

**The Waste Factory at the East Tennessee Technology Park —  
17424**

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**ABSTRACT**

To successfully support the U.S. DOE Oak Ridge Office of Environmental Management (OREM) in its cleanup at the East Tennessee Technology Park (ETTP), URS | CH2M Oak Ridge LLC (UCOR) recognized the need for the timely disposition of large amounts of waste.

To achieve cleanup goals, UCOR implemented the “Waste Factory” concept. The Waste Factory requires a centralized waste management program, waste management-deployed staff, and numerous outlets for the various waste streams that move the waste from generation to disposition in a timely, compliant manner.

Because no waste can be double handled or stored, characterization has to be sound, the disposition path selected based on the characterization, packaging determined, the Waste Acceptance Criteria (WAC) evaluated for the selected repository, and the waste shipped immediately upon generation.

Since inception of the UCOR contract, a total of 509,703.24 m<sup>3</sup> (18 million ft<sup>3</sup>) have been dispositioned, totaling more than 60,000 waste loads and 6.5 million safe kilometers (4 million safe miles) driven (Fig. 1). The generated waste has been dispositioned onsite and offsite based on the waste characterization and the UCOR waste management hierarchy.



Fig. 1. Six-and-a-half-million safe kilometers (four million safe miles) is equivalent to circling the globe 160 times.

Without the timely disposition of the large amounts of waste generated from a massive cleanup project like ETTP, the project could not have achieved the aggressive schedule and performance that has been accomplished to date.

The Waste Factory concept can serve as a model for waste management operations across the DOE complex and in other industries where significant quantities of waste must be disposed of. Without the availability of secure, onsite disposal, UCOR would have been forced to send hundreds of millions of pounds of waste by truck to repositories around the country, increasing risks and costs and slowing the overall progress of cleanup.

## **INTRODUCTION**

At ETTP, UCOR is responsible for the demolition of 603,869.7 m<sup>2</sup> (6.5 million ft<sup>2</sup>) of buildings and structures once used to produce the “nuclear fuel” for weapons and reactors.

The volume of waste generated during the cleanup process is immense. By contract end, UCOR will have disposed of 594,653.7 m<sup>3</sup> (21 million ft<sup>3</sup>) of equipment, soils and construction debris, enough to fill 320 Olympic size pools (50 m long x 25 m wide x 2 m deep, or 164 feet long x 82 feet wide x 6.5 feet deep).

Waste management risks are magnified by the deteriorated state of unused facilities on the Oak Ridge Reservation (ORR). Many buildings are laced with radioactive materials, and years of unregulated waste disposal practices have polluted the soil and groundwater. In many cases, the extent of contamination was not fully known.

The complexity of the task is further amplified by state and federal regulatory requirements for treatment or disposal. Close, continual scrutiny is provided by the Tennessee Department of Environment and Conservation (TDEC) and the U.S. Environmental Protection Agency (EPA).

## **THE WASTE FACTORY**

UCOR’s waste factory provides a preplanned, methodical approach for assembling waste products with the precision of consumer manufacturing.

Imagine that the waste becomes the raw material for a series of highly regulated, meticulously scrutinized “products.” As the waste travels along the imaginary production line, it is examined—or characterized—to determine the types and quantities of radioactive and chemical contamination left behind in equipment, concrete, steel, soil, and piping.

Characterization usually involves a combination of methods, particularly if the waste is radioactively contaminated. The waste may be sampled, analyzed and undergo nondestructive assay, or NDA, where in-depth measurements and

assessments of the waste are taken using various tools, then captured in a database for greater analysis.

NDA relies on detectors to measure neutrons being emitted from the waste in the container. A special software program uses this information to conservatively determine the total number of grams of uranium including "uncertainty" in the container. Based on these findings, distinct "product lines"—or waste streams—begin to form, and waste specialists begin to match waste types with compatible treatment and disposal sites.

The "haul road" between ETPP and the onsite disposal facility—the Environmental Management Waste Management Facility (EMWMF)—eliminates truck traffic on public highways, which reduces the risk to the general public, removes complex logistics requirements, and shortens travel time.

Despite the high percentage of waste disposed of at EMWMF, the waste accounts for only 15 percent of the total radioactive content. EMWMF has operated since 2002 with no violations.

Prior to UCOR's arrival at ETPP in August 2011, acres of demolition debris accumulated before shipping began. The debris field left waste exposed to wind and rain for extended periods of time, increasing the potential for contaminant release to the surrounding environment. UCOR instituted a "pack as you go" waste-handling approach; waste is hauled as it is generated, resulting in lower life-cycle costs, schedule efficiency, and reduced risk of environmental issues associated with aging waste exposed to the elements.

UCOR uses 35 different container types to dispose of ETPP waste. Often, the waste type dictates a type of container, especially if the waste is shipped on public highways to offsite treatment or disposal facilities. As waste containers are typically buried with their contents, packaging is a very costly aspect of the disposal process.

When challenged to find cost-effective options for the offsite shipment of contaminated compressor parts once used in the enrichment process, UCOR waste disposition experts teamed with the deactivation and demolition (D&D) and Engineering organizations to design and fabricate reusable containers, resulting in significant cost savings (Fig. 2).



Fig. 2. Innovative solutions for waste packaging in reusable containers offered significant cost savings.

## WASTE MANAGEMENT PROGRAM

UCOR's waste management program reflects DOE's emphasis on implementing the waste hierarchy, which guides the disposal toward strategically preferred options. The *UCOR Waste Management Program Plan* (PPD-WM-2400) [1] requires evaluation of waste disposition options in the following sequence, while considering impacts to cost and schedule. Considerations include:

- Can the waste be recycled or reused?
- Is the waste a candidate for the ORR Industrial Landfill or onsite disposition?
- If Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), waste, can it be dispositioned at the EMWMF?
- Can the waste be disposed at another DOE facility?

Figure 3 illustrates the UCOR waste hierarchy that is followed in determining the proper disposition path for the waste generated from ETP cleanup and closure.



Fig. 3. ORR Waste Management Program overview.

UCOR's Waste Management Organization (WMO) supports the cleanup and closure of ETPP by providing waste transportation, treatment, and disposal services, utilizing both onsite and offsite facilities. Because the Waste Management facilities support other generators in addition to ETPP, such as the Y-12 National Laboratory Security Complex (Y-12) and the Oak Ridge National Laboratory (ORNL), these facilities will remain in operation beyond ETPP closure.

## MAJOR DISPOSAL FACILITIES FOR ETPP WASTE

### Onsite Disposal

WMO manages various landfills for disposal of wastes at ORR (Fig. 4). The EMWMF receives CERCLA-listed waste, including low-level waste (LLW), RCRA hazardous waste, the Toxic Substances Control Act (TSCA) waste, and mixed waste. The ORR Landfills (ORRLF) receive sanitary and construction debris waste, including classified waste.



Fig. 4. Waste shipments for onsite disposal meet rigorous standards.

### **Environmental Management Waste Management Facility**

EMWMF is a land disposal facility authorized by EPA and TDEC for disposal of wastes generated by environmental restoration activities being conducted at DOE's ORR. Low-level radioactive wastes (LLRWs), hazardous wastes defined in Subtitle C of RCRA, and wastes defined by TSCA, are approved for disposal in the EMWMF. Combinations of these waste types ("mixed wastes") are also disposed in the EMWMF.

Based on the survey performed in March 2016, the total volume of constructed airspace at EMWMF is 1,665,200.4807 m<sup>3</sup> (2,178,000 yd<sup>3</sup>). The total volume of airspace that has been used is 1,177,414.4813 m<sup>3</sup> (1,540,000 yd<sup>3</sup>). Therefore, the remaining available capacity as of March 2016 is 487,785.99939 m<sup>3</sup> (638,000 yd<sup>3</sup>).

### **ORR Landfills (ORRLF)**

UCOR operates three additional landfills on the ORR. Each of the landfills has a total permitted area, and the space within this permitted area is constructed and readied for waste receipt in large parcels prior to needing the additional disposal area. The volumes listed for the landfills are based on April 2015 survey data.

#### ***Landfill IV***

Landfill IV is the classified landfill. It is a 1.7-ha (4.2-acre) site (68414.6 m<sup>3</sup> or 89,483 yd<sup>3</sup>) that opened in 1989. The remaining constructed airspace is 10,206.8 m<sup>3</sup> (13,350 yd<sup>3</sup>).

Historically, the volume of waste being disposed of at Landfill IV was very small. However, utilizing the waste hierarchy, the equipment from Building K-1037 has been determined to be acceptable for disposal in Landfill IV instead of the

previously assumed EMWMF. This change has increased the projected waste receipts drastically, and the remaining permitted capacity is being constructed. After completion, the constructed available capacity will be 57,876.8 m<sup>3</sup> (75,700 yd<sup>3</sup>).

### **Landfill V**

Landfill V is the sanitary landfill. It is a 10.5-ha (25.9-acre) site that opened in 1994. Landfill V has a total permitted capacity of 1,660,330.3 m<sup>3</sup> (2,171,630 yd<sup>3</sup>). Approximately 626,934.9 m<sup>3</sup> (820,000 yd<sup>3</sup>) has been used, and the remaining permitted airspace is 1,035,054.3 m<sup>3</sup> (1,353,800 yd<sup>3</sup>). However, only a portion has been constructed to date. The available constructed capacity is approximately 359,340.7 m<sup>3</sup> (470,000 yd<sup>3</sup>).

### **Landfill VII**

Landfill VII is the construction/demolition landfill, which was opened in 2001. Landfill VII has a permitted capacity of approximately 1,590,274.1 m<sup>3</sup> (2,080,000 yd<sup>3</sup>). The currently developed and available space in Landfill VII is approximately 87,770.9 m<sup>3</sup> (114,800 yd<sup>3</sup>).

### **Offsite Disposal**

For waste that does not meet the acceptance criteria for onsite facilities, WMO establishes contracts for commercial treatment and/or disposal.

UCOR and DOE will continue to maintain outlets for waste that do not meet the ORRLF or EMWMF WAC. These outlets include the Nevada National Security Site (NNSS), and numerous commercial Treatment, Storage, Disposal, and Recycle Facilities (TSDRFs). Typically, higher activity LLW is sent to the NNSS for disposal, and mixed low-level waste (MLLW), or recyclable materials, are sent to various TSDRFs. UCOR and DOE will maintain contracts with the various commercial TSDRFs for approved profiles. The commercial TSDRFs are routinely evaluated to verify they meet legal requirements and are fully compliant. In addition, UCOR will maintain its NNSS-approved program to allow for continued shipments to the NNSS.

### **CONCLUSIONS**

Driven by stringent standards, reinforced by reliable onsite disposal, and enhanced by worker innovations, UCOR's Waste Factory has safely disposed of more than 509,703.2 m<sup>3</sup> (18 million ft<sup>3</sup>) of ETTP cleanup waste since August 2011 while traveling over 6.5 million safe kilometers (4 million safe miles).

### **REFERENCES**

1. UCOR procedure, *UCOR Waste Management Program Plan*, PPD-WM-2400, URS | CH2M Oak Ridge LLC, Oak Ridge, TN (2016).