

# Oak Ridge National Laboratory



## Background

The U.S. Department of Energy's (DOE) Oak Ridge Reservation includes several contaminated areas that are a result of years of operation at Oak Ridge National Laboratory (ORNL). To better address the restoration of ORNL, the Environmental Management program has divided ORNL into two major areas: Bethel Valley and Melton Valley. The Bethel Valley area includes the principal research facilities. The Melton Valley Area was used for reactors and waste management. Remediation of these areas is under way.

## Bethel Valley

Bethel Valley is a challenging site for remediation for many reasons. It is an active operational research center, having dealt with a multitude of chemical elements, compounds, and radioactive materials. Cleanup must be performed on a schedule that does not interfere with current research activities. Along with the active Surveillance and Maintenance program at the site,

cleanup activities are being initiated by Removal Actions and Remediation efforts approved in the Bethel Valley Record of Decision (ROD).

## Tank W-1A Removal Action Project

In January 2012, DOE contractor URS | CH2M Oak Ridge LLC (UCOR) removed Tank W-1A at the central campus of the Oak Ridge National Laboratory (ORNL). The 4,000-gallon tank, commissioned in 1951, and the surrounding contaminated soil are considered the largest source of groundwater contamination in Bethel Valley at ORNL.

The stainless steel tank collected and stored liquid wastes from radiochemical separations and high-radiation analytical facilities at ORNL. The tank was removed from service and emptied in 1986 when significant levels of soil and groundwater contamination were traced to the area surrounding the vessel.

Field work began at Tank W-1A in September 2011, shortly after UCOR assumed the cleanup contract on Aug. 1. The project was originally assigned under another scope, but UCOR accepted the task during the transition period.

The remediation process included excavating, packaging, and transporting contaminated soil for disposal, as well as removing, cutting up, containerizing, and transporting the concrete pad, tank supports, and tank shell for disposal.



*Tank W-1A being removed from the ground*



# Oak Ridge National Laboratory (continued)

## Building 3026 Hot Cells Facility

The 3026 hot cells facility at ORNL has been downgraded from a Hazard Category 3 nuclear facility to a radiological facility. Previously, three of the facility's five hot cells were demolished. However, due to unanticipated conditions, the remaining hot cells were downgraded and placed into surveillance and maintenance. This downgrade makes the facility less costly to maintain.

UCOR, at the request of DOE, took over the 3026 hot cells project as part of the Surveillance and Maintenance Program. UCOR conducted stabilization activities to achieve the downgrade, such as installing permanent electrical equipment, sealing all openings, reinforcing site boundaries, and containerizing residual waste and debris.

In FY 2011, the 3026-C "Counting Room" and "Tritium Lab" were decontaminated. In FY 2012, 3026-C "Cell Bank 1" and

"Cell Bank 2" and 3026-D "Storage/Sorting Cell" were decontaminated. In FY 2012, 3026-C was demolished and the waste was disposed.

In FY 2013, preparation for demolition of 3026-D was halted because higher levels of contamination than anticipated were found. The available funding allowed 3026-D to be left in a safe configuration for surveillance and maintenance but did not allow for demolition. A report documenting work completed and work remaining was submitted to the Environmental Protection Agency and the Tennessee Department of Environment and Conservation.

## Non-Reactor Facilities Removal Action

Legacy material removal and demolition activities have been completed at several ORNL facilities. These contaminated non-reactor facilities are surplus buildings, some dating from the original Manhattan Project, that were no longer needed.



*A concrete berm is being poured as part of the 3026 stabilization activities*



# Oak Ridge National Laboratory (continued)

As part of the 34 Buildings D&D Project, legacy material was removed from more than 32,000 ft<sup>2</sup> of facility space, and a total of 115,600 ft<sup>2</sup> of building space was demolished and the demolition debris disposed. The 34 buildings, located in the busy central campus portion of ORNL, were safely and successfully demolished without impacting adjacent laboratory facilities. This project has eliminated the risk associated with these unused facilities and will allow re-use of the area to support ORNL's ongoing and future research activities.



*The 3085 tanks were among the non-reactor facilities that were demolished*

## 2000 Complex D&D Project

Eight facilities associated with the 2000 Complex at ORNL have been demolished.

The complex, located in the northwest corner of the ORNL central campus, encompassed approximately 58,000 ft<sup>2</sup>.

The facilities were constructed in the late 1940s to support various ORNL research projects. They were in severe disrepair and had been vacant for approximately six years. DOE determined that the resulting risks warranted implementing a time-critical Removal Action.

In FY 2010, demolition of the first phase (six buildings with a combined area of approximately 35,000 ft<sup>2</sup>) was completed. Demolition of the second phase was completed in FY 2011 with the removal of Buildings 2000 and 2034, a combined area of 23,200 ft<sup>2</sup>.

The specific hazards encountered in this facility complex included the extremely poor physical condition of the structures, constant flaking of PCB-containing paint, extensive quantities of friable and non-friable asbestos in restricted attic areas, and radiologically contaminated ductwork and fume hoods.

## Bethel Valley Burial Grounds Project

Workers have completed the Bethel Valley Burial Grounds Remediation Project, which included capping of two solid waste storage areas (SWSAs): SWSA 1 in Central Bethel Valley and SWSA 3 in West Bethel Valley. Remediation of contaminated soil hot spots and five landfills near the two SWSAs were also part of the project.

Capping of SWSA 1 was completed in 2010, and the SWSA 3 cap was completed in August 2011. Two areas of soil contamination and the former Closed Scrap Metal Area were also covered by the SWSA 3 cap. A gravel road that crosses the capped area was rebuilt on top of the cap. Both caps are constructed of several layers of impermeable cap material placed to prevent migration of contaminants. This process is called hydrologic isolation, which also involves various other methods to keep water

from infiltrating the buried waste. The SWSA 3 cap included two upgradient French drains and surface water ditches that will divert shallow groundwater and rain water away from the capped area, further enhancing the hydrologic isolation of the waste.

SWSAs 1 and 3 and the associated remediated areas will be inspected periodically and maintained to ensure that they remain in good condition, and that damage, if any, is quickly repaired. Groundwater and surface water sampling and analyses will be performed and reported annually in the Remediation Effectiveness Report.

## Bethel Valley Soils and Sediment Project

The Bethel Valley Soils and Sediment Project is responsible for removing selected slabs and remediating contaminated soils at ORNL.

The Remedial Action Work Plan for the project provides the approach that will be followed to characterize and evaluate soils and sediments, ensuring that the soil cleanup requirements for Bethel Valley are met. The Work Plan was submitted to the regulators in 2008 and was approved in early FY 2010. The cleanup strategy includes a series of workshops to identify sampling needs in specific portions of Bethel Valley. More than 20 workshops have been conducted, and field sampling activities, which focused on the northwest corner of the ORNL main campus, have been completed with sampling results received. This effort has resulted in more than 487 acres being identified as requiring no action.

Additional workshops and field characterization activities on the remaining areas are continuing.

## U-233 Material Downblending and Disposition

Oak Ridge has a significant inventory of uranium-233 (U-233) stored in Building 3019A at ORNL. U-233 is a special nuclear material that requires strict safeguards and security controls to protect against access. The U-233 Project was initiated to address safeguards and security requirements, eliminate safety and nuclear criticality concerns, and safely dispose of the material.

Treating the U-233 inventory as expeditiously as possible will reduce the substantial annual costs associated with safeguards and security requirements, eliminate the risk of a nuclear criticality event, and avoid the need for future facility upgrades to Building 3019A to ensure safe storage of the inventory. Constructed in the 1940s, Building 3019 is the oldest continually operating nuclear facility in the DOE complex.

In FY 2014, work continued with the State of Nevada to address their concerns with the planned disposition of the Consolidated Edison Uranium Solidification Project (CEUSP) material at the Nevada National Security Site. CEUSP originated from a 1960s research and development test of thorium and uranium fuel at Consolidate Edison's Indian Point 1 nuclear plant in New York State. Following completion of the test, the fuel was processed by Nuclear Fuel Services in West Valley, New York. Approximately 8,000 liters of liquid uranium nitrate were shipped to ORNL for storage in anticipation of future reuse. With no near-term future use identified, the material was solidified in the 1980s and placed in 403 sealed stainless steel canisters for storage.

In parallel with ongoing discussions with the State of Nevada concerning CEUSP, 17 canisters of high purity material have been transferred to ORNL for reuse.

Preparations for the processing campaign also continued in FY 2014. The processing campaign will focus on the material that cannot be directly disposed. The conceptual design work is in progress and is expected to be completed in late 2015. Building 2026 located at ORNL will be used for this processing work. Initial preparations in Building 2026 continued in FY 2014 including clean out of the existing hot cells and cell access areas.

## Building 3550 Slab Excavated

Building 3550 is one of 34 buildings recently demolished in the Central Campus area of ORNL. Since this slab is the largest in the area and the only one located along Central Avenue, it was selected for excavation. In FY 2013, the concrete slab was excavated, along with contaminated soil beneath the slab to a depth of up to two feet, and the area was

graded and seeded with grass.

A completion report documenting the work performed was prepared and submitted to the Environmental Protection Agency and Tennessee Department of Environmental Conservation.

## Building 3038

Building 3038 is a 7,773-square-foot nuclear facility located in the ORNL Central Campus area. Building 3038 was used for packaging, inspecting, and shipping activities for radioisotopes. All operations ceased in 1994.

During FY2014, a report documenting completion of demolition of Building 3038 was approved by the Environmental Protection Agency and the Tennessee Department of Environment and Conservation. In the previous fiscal year, in order to prepare the building for demolition, all waste was removed from the building and disposed, stabilization activities were completed, the local ventilation system was re-started and air-monitoring equipment was placed on-line.

## 4500 Gaseous Waste System Completed

The objective of the 4500 Area gaseous waste system upgrades project was to deactivate one of the five cell ventilation system branches and remove several facilities from the central hot off-gas system.

The ventilation system branches and off-gas system are part of the central gaseous waste system at ORNL that vent through the 3039 Central Stack. The project provides localized ventilation systems to the 4501, 4505, 4500N, and 4507 facilities; stabilizes the hot cells in Building 4507; cleans out filter pits



*A worker in 3038 uses a glove box to package and dispose of waste.*



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3106 and 4556; and stabilizes hundreds of feet of deactivated underground ductwork.

Demolition, removal of existing equipment, and fabrication and installation of the replacement ventilation system for the 4501, 4505, and 4500N facilities were completed in January of 2013.

In September of 2013, characterization of the underground ductwork, stabilization of the underground ductwork, and clean-out of the 3106 and 4556 filter pits were completed.

Design, fabrication, installation, and operation of the local ventilation system for Building 4507 had previously been completed in FY 2012, along with stabilization of the 4507 hot cells.

## Final Bethel Valley ROD

Following the completion of the Bethel Valley Interim ROD remediation activities, the Remedial Action Report will document the surface water and groundwater monitoring necessary to track the effectiveness of the source control remediation activities. Once this data is captured and contamination trends to the surface water and groundwater are known, a final ROD will be developed to address remaining sources, if any, and determine the necessary remediation required to address the ecology and groundwater in the Bethel Valley area.

## Melton Valley

Contamination source remediation activities were completed under the Melton Valley Interim ROD. A fact sheet is available that details these activities. Remaining at this site to be addressed are some inactive, excess reactors (and soils surrounding these facilities), the watershed area ecology, sediment, and groundwater.

Another ROD will be developed to address the reactors, and then a final ROD will be developed for the entire Melton Valley area.

## Molten Salt Reactor Experiment

The Molten Salt Reactor Experiment (MSRE) facility was a graphite-moderated, liquid-fueled reactor that operated from June 1965 through December 1969. Since reactor shutdown, several studies and removal actions have been performed to address the contaminated fuel and flush salts in the facility. In 1998, a Record of Decision for an interim action to remove fuel and flush salts was approved. The approved action included the following steps:

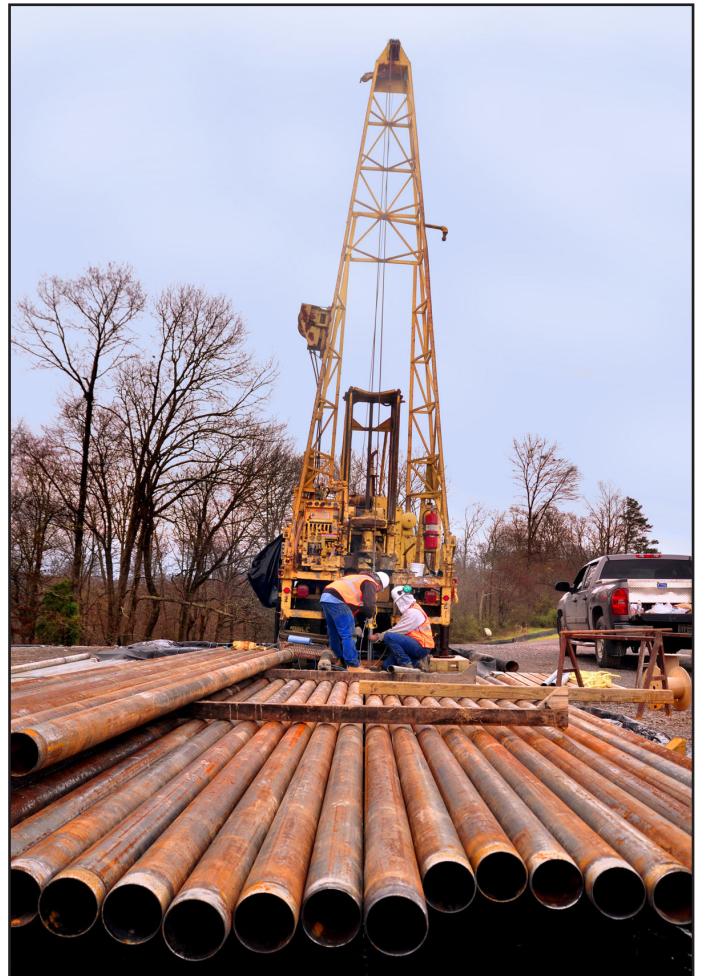
- Melt and chemically treat the salts.
- Fluorinate the salt to remove uranium.
- Trap the uranium on cold traps and transfer the uranium to chemical traps.
- Ship the uranium-loaded traps to ORNL Building 3019A for storage.

- Transfer residual salts to shield canisters designed for transportation and storage.
- Ship shielded salt canisters to ORNL Solid Waste Storage Area 5 for interim storage.

The first four steps were completed between 2004 and 2008. The remaining steps were deferred pending an engineering study to examine the approach for salt removal, which is addressed in the MSRE Remediation Strategy Plan prepared in FY 2012. The preferred alternative for the salt disposition is removal of the defueled salt by thermal means, transfer to shipping containers, and disposal at the Waste Isolation Pilot Plant in New Mexico.

In FY 2013, comments on the MSRE Remediation Strategy Plan were received from the Environmental Protection Agency and the Tennessee Department of Environment and Conservation, and a revised plan was prepared and submitted.

Also in FY 2013, additional waste from the defueling performed in 2006 was identified. An inventory of the waste and a waste disposition plan were prepared and submitted to the Envi-



*Monitoring well drilling in the Melton Valley area*

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Environmental Protection Agency and the Tennessee Department of Environment and Conservation.

## Monitoring Wells

DOE has completed installation of monitoring wells opposite the Oak Ridge Reservation side of the Clinch River to monitor for potential ORNL site-related contaminants.

The Melton Valley Off-site Monitoring Well project installed 16 new monitoring wells that are constructed to depths equivalent to monitoring zones on the DOE side of the river. The new wells were drilled to depths from 250 to 650 feet deep. Geophysical logging and in situ permeability testing was conducted on each of the wells. Two of the proposed well sites adjacent to the river utilized previously operated drinking water wells to install multiple zoned wells in the open borehole.

The driller was demobilized and the well sites were restored in August 2010. Field work was completed with repairs to Jones Road and Upper Jones Road. The new wells are now included in the Melton Valley monitoring network and incorporated into the recently proposed Melton Valley Monitoring Plan. The 16 new wells and 5 nearby residential wells are being sampled quarterly.

## Final Melton Valley ROD

With the completion of the Melton Valley Interim ROD, the monitoring data necessary to address both White Oak Creek and White Oak Lake is being captured and tracked to determine the effectiveness of the remediation work performed.

Another Interim ROD will be developed to address the removal of inactive reactors and ancillary reactor facilities within this area. With the removal of the Melton Valley Reactors and soil remediation, the final Melton Valley ROD will address any impacted ecology within Melton Valley, groundwater, White Oak surface waters (Bethel Valley and Melton Valley), and lake sediments.

## Surveillance and Maintenance

Surveillance and Maintenance (S&M) activities involve maintaining facilities in a safe and compliant condition until sites are remediated or facilities are demolished through EM cleanup projects. The project is responsible for safekeeping of contaminated structures and equipment, radiological sources and other reactive chemicals inventory. The main objective of the S&M project is to not only keep site personnel and the public safe, but also to prevent any impacts to the environment.

The S&M scope covers former experimental land areas/sites, and surplus process buildings. The S&M project oversees 100 facilities and 273 sites. These facilities and sites include nuclear, radiological, or other industrial facilities.

Routine S&M includes numerous activities, such as characterization of hazards, material inventory, facility/site inspections; maintenance of property and key inventory, leachate collection and transport for treatment, fence and sign maintenance, and radiological surveys.

## ORNL Water Quality Program

The ORNL Water Quality Program conducts surface water and groundwater monitoring to measure the performance of remedial actions in Melton Valley and Bethel Valley. The Program also supports elements of the Biological Monitoring and Abatement Program in monitoring the recovery of aquatic ecosystems in areas of the ORNL site where the CERCLA Program has the lead responsibility for environmental compliance.

The ORNL Water Quality Program monitoring is dovetailed with UT-Battelle's ORNL site environmental compliance monitoring activities through data sharing agreements.