DOE Oak Ridge Environmental Management Program

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 principle 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).

ORNL is a multiprogram science and technology laboratory managed for the U.S. Department of Energy by UT-Battelle, LLC. Scientists and engineers at ORNL conduct basic and applied research and development.

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

Building 3026 Removal Action

Demolition was completed on the wooden superstructure of one of the highest hazard excess facilities at ORNL—the 3026 C&D Radioisotope Development Laboratory. This building, one of the original Manhattan Project facilities, had a footprint of approximately 24,000 ft^2 and contained several hot cells and associated pipes and ducts that were highly contaminated.

The wooden structure in which the hot cells were located had deteriorated significantly over the years due to age and roof leaks. A roof failure in 2007 damaged the fire suppression sprinkler system, requiring it to be deactivated. This deactivation presented potential fire hazards to nearby facilities and the potential for contaminant release if a fire occurred in the facility.

DOE determined that the resulting risks warranted implementing a time-critical Removal Action to remove the 3026 C&D wooden structure and stabilize the hot cells.

The activities required to prepare for final demolition of the wooden superstructure included removal of asbestos-containing materials (floor tile, transite, thermal insulation); removal of certain hazardous materials, such as lead shielding, light bulbs, mercury switches, and oils; and removal of hot cell piping and ductwork. Required pre-demolition abatements were completed in November 2009.

Demolition and stabilization were completed in February 2010. More than 160 shipments of building debris, representing 1.7 million pounds of waste, were sent to the Environmental Management Waste Management Facility (EMWMF). An additional 25 yd^3 of waste was processed and dispositioned via alternative pathways. For personnel safety, a portion of the building had to be demolished with friable asbestos in place. This required the use of supersacks for debris packaging.

As a final step in this phase of the 3026 C&D work, the en-

Remaining 3026 hot cells with polyurea coating

tire remaining hot cell structures and building slab were coated with polyurea. The polyurea's properties of fast reactivity and relative insensitivity to moisture make it useful for large surface area projects, such as secondary containment and manhole and tunnel coatings. With this final stabilization coating in place, the 3026 C&D area was transitioned to DOE's contractor responsible for removing the hot cells for this next phase of work.

A Waste Handling Plan for the 3026 hot cells demolition and waste disposition was approved by the Environmental Protection Agency and the Tennessee Department of Environment and Conservation in FY 2011. The six structures that comprise Building 3026 C&D are in various stages of characterization, planning, decontamination, and demolition in FY 2012. Two structures (3026C "Counting Room" and 3026C "Tritium Lab") were decontaminated in FY 2011. Three additional structures (3026C "Cell Bank 1", 3026C "Cell Bank 2", and 3026D "Storage/Sorting Cell") were decontaminated in FY 2012. This work included removal of internal equipment, the final step to make these structures ready for demolition. The four 3026C structures were also demolished and disposed of in FY 2012.

Preparation for demolition of the two remaining structures (3026D Storage/Sorting Cell and 3026D Cell A and B) is under way. In March 2011, higher levels of contamination than anticipated were found in the 3026D structures while performing initial characterization. The project's revised technical approach for hot cell clean-out was approved in FY 2012, the Operational Readiness Review was completed in July 2012, and demolition will be completed in FY 2013.

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

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.

As part of the 34 Buildings D&D Project, legacy material was removed from more than 32,000 ft^2 of facility space, and a total of 115,600 ft^2 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.

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^2.

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^2) 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^2.

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, has 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 is 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 ship the material to an approved disposal site.

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. DOE commissioned a review of alternatives for dispositioning the U-233 inventory. Phase I of the Alternatives Analysis, which screened and identified potential alternatives, was completed in January 2011. The Deputy Secretary of Energy endorsed the review recommendations in April 2011, and the team began executing the two-part direct disposition campaign on Jan. 1, 2012.

Workers install a French drain at SWSA 3 to divert groundwater and rain away from the capped areas.

By October 2012, 126 items were dispositioned to the Nevada National Security Site, and 10 items were safely and securely transferred to ORNL for programmatic re-use.

Phase II of the Alternatives Analysis, which provided a more detailed evaluation of processing options for the inventory unable to be directly dispositioned, was approved by DOE's EM and Science Offices and endorsed by the Secretary of Energy in July 2012.

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 operated from 1965 to 1969 to test the molten salt concept. Unlike most current commercial reactors that have fuel confined to fuel rods, the MSRE was fueled by molten salt that flowed through the reactor chamber, where the nuclear chain reaction produced heat.

When the reactor was shut down, the molten salt was drained into two fuel salt storage tanks, where it solidified. A flush salt, similar to the fuel salt but without the uranium, was re-circulated through the reactor and drained into a third storage tank and solidified. The storage tanks are located in an underground, concrete-shielded drain tank cell adjacent to the reactor cell.

In 1998, DOE signed a ROD for interim action to remove the fuel and flush salts to address the presence of fluorine and uranium fluoride gas. The selected remedy includes separation of the uranium from the fuel and flush salts, removal of the fuel and flush salts from the drain tanks, storage of the uranium material as a more stable form, stabilization/repackaging of the residual salt, and placement of the residual salt in interim storage until final disposition.

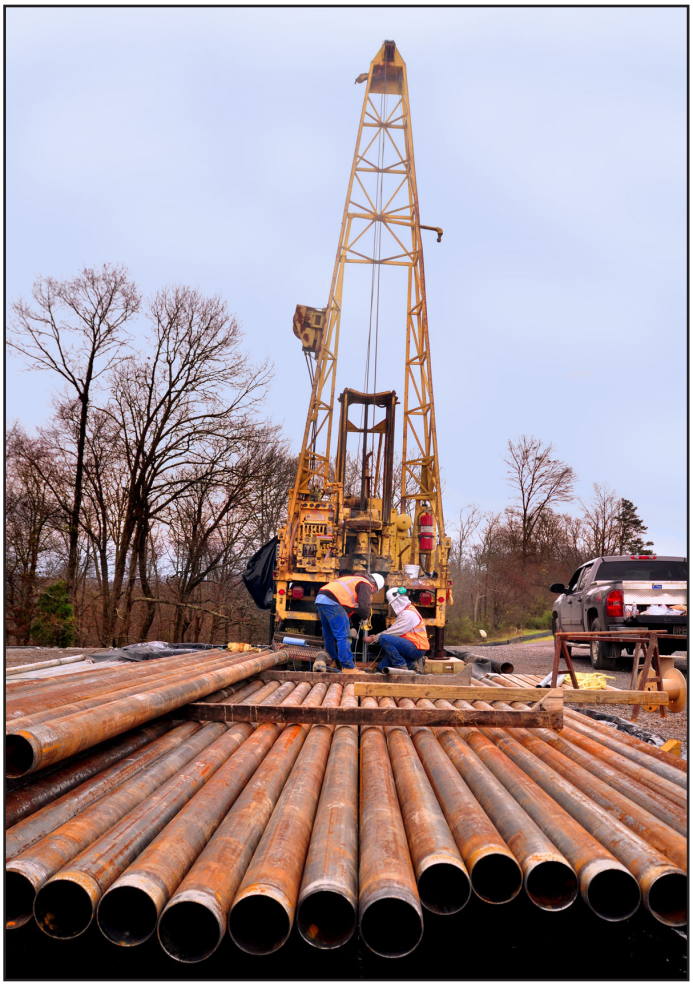
Processing of the initial flush salt tank at the MSRE was initiated in December 2004 and completed in June 2005, with recovered uranium transported to an on-site storage facility. However, a salt plug blockage in a small pipe prevented removal of the flush salts from the flush salt tank. An alternate method of salt removal was designed to allow flush salt removal after completion of the two fuel salt drain tanks.

Fuel removal from the fuel salt drain tanks was completed in April 2008. Salt removal from the two tanks will be performed.

An engineering study of the selected method of salt removal is being performed to determine feasible methods of removing the salt without heating the tanks. This study will be completed before this action is attempted again.

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.



Monitoring well drilling in the Melton Valley area

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 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 will be sampled quarterly.

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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 (4 Nuclear, 156 Radiological, and 213 Other Industrial).

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.