DOE Oak Ridge Environmental Management Program

Y-12 National Security Complex

Background

The U.S. Department of Energy (DOE) Oak Ridge Reservation includes several contaminated areas that are a result of years of operation at the Y-12 National Security Complex. Remediation of these sites is under way.

Upper East Fork Poplar Creek

Phased Records of Decision

In 1953, the Y-12 National Security Complex began efforts to separate lithium isotopes to develop hydrogen bombs based on fusion. Millions of pounds of mercury were needed to separate the lithium. Three similar processes housed in several buildings were used to perform this task. Flowing at relatively high rates and pressures through numerous pumps, pipes, valves, and seals, the mercury often dripped or spilled. Pump maintenance also allowed mercury to escape, especially during early operating years. An estimated 240,000 pounds of mercury were released from Y-12 directly to Upper East Fork Poplar Creek (UEFPC) from 1950 to 1982. An estimated 2 million pounds of mercury was lost to the environment or not otherwise accounted for, although limited inventory control during that time makes estimating difficult.

The remediation of UEFPC is being conducted in phases. Phase 1 addresses interim actions for remediation of mercury-contaminated soil, sediment, and groundwater discharges that contribute contamination to surface water. The Phase 1 Record of Decision (ROD) was signed in May 2002. The initial Phase 1 action was the design and construction of the Big Springs Water Treatment System, which collects and treats the largest remaining point source of mercury in UEFPC. Post-2009 actions remaining from this ROD include hydraulic isolation of the West End Mercury Area and the removal of contaminated sediments from the UEFPC creek bed and Lake Reality.

The UEFPC Phase II ROD was finalized and approved by regulators in April 2006. It addresses the remediation of the balance of contaminated soil, scrap, and buried materials within the Y-12 Complex. The remediation activities within this ROD were initiated in 2009 with the removal of scrap from the Y-12 Salvage Yard. Decisions regarding final land use controls and final goals for surface water, groundwater, and stream sediment cleanup will be addressed in a future final decision for the upper and lower East Fork Poplar Creek.

Big Springs Water Treatment System

A water treatment system that continuously treats 300 gallons of water a minute has been constructed at the Y-12 Complex.

The Big Springs Water Treatment System, located near Building 9201-2, is mitigating mercury being released into UEFPC.

Past operations at the Y-12 Complex have resulted in mercury contamination of a natural spring called "Big Spring," located on the eastern portion of the site. Water from the spring flows through Outfall 51, a culvert that empties into UEFPC. The system will also treat contaminated groundwater collected in sumps in Building 9201-2.

The Y-12 National Security Complex performs critical roles in strengthening national security and reducing the global threat from weapons of mass destruction.

The treatment system consists of three facilities, including a 15-ft-deep, in-ground wet well to collect the contaminated water; a 70,000-gallon collection tank, where the water is pumped and stored prior to treatment; and the treatment process system, where the water is decontaminated.

The process system uses a series of granular activated carbon columns to reduce the mercury concentration. Construction began in March 2004 and was completed in March 2005. Initial operations began in August 2005.

CERCLA Waste Facility

Wastes generated in the cleanup of the Oak Ridge Reservation are disposed of in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The CERCLA Waste Facility, also known as the Environmental Management Waste Management Facility (EMWMF), was constructed to receive these wastes. It is an above-grade waste disposal facility located in East Bear Creek Valley, just west of the Y-12 Complex.

The facility is authorized to receive low-level radioactive waste (LLRW) as

Y-12 National Security Complex (continued)

CERCLA Waste Facility

well as wastes regulated under the Resource Conservation and Recovery Act and Toxic Substances Control Act from CERCLA-regulated cleanup work. Potential wastes include soil, sludge, sediments, solidified waste forms, stabilized waste, vegetation, building debris, personal protection equipment, and scrap equipment.

In addition to the disposal cells, the CERCLA Waste Facility consists of a leachate collection and transfer facility, support facilities, access roads, stormwater retention basins, and monitoring and security systems.

The latest expansion of the facility, Cell 6, was completed in Spring 2011, bringing the final capacity to 2.2 million yd^3.

American Recovery and Reinvestment Act Projects

Old Salvage Yard Scrap Removal

A total of 21 million pounds of scrap has been removed from the Old Salvage Yard, located at the west end of the Y-12 National Security Complex within and outside the high-security boundary. Of that amount, 8.7 million pounds were shipped to EMWMF and 7 million pounds to the Nevada National Security Site.

The 7-acre site, established in the early 1970s, was used for storing scrap metal and liquid hazardous wastes from Y-12 operations until 1999.

The Old Salvage Yard received scrap into open piles until 1995, when new procedures required that all scrap metal be placed inside containers.

The primary contaminants of concern in the scrap yard include uranium and thorium. Forklifts, an abandoned crane, and other equipment are also being removed.

Contaminated soil was also excavated and removed from the site. The excavated soil was characterized, profiled, and disposed in FY 2012. Approximately 988 yds^3 of contaminated soils and miscellaneous debris were disposed at EMWMF. Site restoration was completed for remediated and non-remediation areas.

The soil characterization data and groundwater modeling indicated soil remediation was required at the former Drum Deheader area.

Y-12 National Security Complex (continued)

A remedial action was taken to remove contaminated soil that could contribute to future groundwater contamination. A 50-ft by 50-ft area was excavated to a depth of five feet to remove sufficient volatile organic compound concentration to mitigate the impact. The excavated area was then backfilled.

Building 9735 has been demolished.

Building 9735 Demolition

Demolition of Building 9735, referred to as the Research Services Laboratory, was completed in July 2010. This building was the last one to be removed from Engineering Row. Demolition of Engineering Row reduced the Y-12 footprint by 92,690 ft^2.

The other six buildings that once comprised Engineering Row were demolished in 2008. Building 9735 was a two-story, masonry (glazed terra cotta tile), wood-truss structure with a slab-on-grade foundation. The south end consisted of a two-story rectangular structure with a former basement that housed a development calutron.

The project involved complete deactivation and demolition of the building as well as the disposition of 2,964 m^3 of material and waste to the Y-12 Sanitary and Industrial Waste landfills and approximately 8 m^3 to the Nevada National Security Site. In addition to eliminating safety risks, this project allowed Y-12 to add an employee parking area and contribute to ARRA goals of creating and saving jobs and stimulating the local economy.

Building 9206 Bag Filter House Removal

The Building 9206 Bag Filter House Removal project at the Y-12 Complex was unlike other ARRA-funded deactivation and demolition projects. Only a section of the building was demolished. The primary furnace chamber, ash removal unit, and its major control equipment were located inside Building 9206. The remaining components of the system were located on the roof and in the south yard exterior to the building. This project also deactivated the recovery furnace exhaust system. The scope required Y-12 operations personnel to characterize, isolate, disassemble, decontaminate, and dispose of all equipment, support equipment, and waste from demolition of the identified Building 9206 Bag Filter House.

Deactivating the recovery furnace exhaust system reduced exposure from potential release of radiological and hazardous materials in out-of-service equipment. Deactivation also eliminated the need for daily monitoring of the process systems and was a key step in preparing the building for D&D. The Building 9206 Filter House project team removed and disposed of a total of 268 m^3 of waste.

Alpha 5 Project

Alpha 5 (Building 9201-5) is the largest building at Y-12, measuring 613,642 ft^2.

Previously completed work scope for the project included removal and disposal of legacy materials from the building (floors 1 through 4). Legacy materials were defined as those being easily removed and involving minimal reconfiguration efforts (e.g., unbolting, unplugging, wire cutting, cold cutting). The building was organized into 82 units, and legacy material was present in 67 of the units located on four floors. The building was completely emptied of its legacy materials, and those materials were appropriately disposed at on-site and off-site facilities. Approximately 464,000 ft^3 of legacy waste was disposed.

In FY 2012, characterization of building materials and equipment that was physically connected to the building was completed. This effort was a critical necessary step in preparation for the eventual deactivation and decommissioning of the building. The final Characterization Report was completed in January 2012.

Beta 3 (9204-3) Legacy Material Disposition Project

The Beta 3 Legacy Material Disposition project work scope included completing the refurbishment of 36 glove boxes, 4 Plexiglas enclosures, and associated ventilation systems to maintain and ensure containment capability within the facility Actinide Lab area.

Debris stored and accumulated within the glove boxes was characterized, removed, packaged, and disposed as either low-level radioactive waste, mixed low-level waste, or transuranic waste. Following removal of the debris, the Hazard Analysis for the facility was re-evaluated, resulting in a revised Hazard Assessment Document and lower hazard category, which will reduce the long-term surveillance and maintenance costs for the facility. A completion report documenting the work performed was prepared, submitted, and approved in FY 2012.

Beta 4 Legacy Material Disposition Project

The Beta 4 Legacy Material Disposition Project consisted of removal and disposal of legacy materials from the second floor and second floor mezzanine of Building 9204-4. This work will prepare the facility for deactivation and demolition as part of the site transformation plan. As with the Alpha 5 Project, legacy materials were defined as those being easily removed with minimal reconfiguration efforts. The second floor and second floor mezzanine were likewise organized into 16 units, and legacy materials not salvaged or reused were managed as waste and characterized, segregated, size-reduced, compacted, and/or treated to meet the waste acceptance criteria for disposal at approved facilities. Approximately 128,000 ft^3 of legacy waste was disposed.

Disposition plans for Beta 4 waste were accelerated with ARRA funding. Results of these efforts were improved site safety and security, reduced operating costs, and reduced environmental risk to site personnel and to the immediate and surrounding areas.

Biology Complex and Building 9769 Deactivation and Demolition Project

The Biology Complex and Building 9769 Deactivation and Demolition Project involved four of the seven buildings in the Biology Complex that were deactivated and demolished. Buildings 9211, 9220, 9224, and 9769 were demolished, and the work took place in six phases: building characterization, utilities deactivation, hazardous material abatement, radiological contaminated surfaces stabilization, building demolition to grade level, and site stabilization.

Support activities such as waste size reduction, waste packaging, and shipping were integrated within the activities of these six major phases. Sanitary and construction/demolition debris that met the facility waste acceptance criteria were disposed at the Y-12 Sanitary Landfill. Radiologically contaminated waste were disposed at the on-site EMWMF. Approximately 32,000 yd^3 of waste were generated and disposed from this project.

The Biology Complex project was part of Y-12's ongoing footprint reduction effort, designed to minimize maintenance and security costs. The project eliminated 135,812 ft^2 of unused building space and the risk associated with the deteriorated facilities. These buildings were vacant since 2003.

Exposure Unit 9

An 11.7-acre Exposure Unit (EU) 9 at the Y-12 National Security Complex was addressed in FY 2012.

This project included characterization of the EU and development of a Remedial Design Report (RDR) that had an FFA milestone of Sept. 30, 2012. The characterization strategy followed the UEFPC Remedial Action Work Plan (RAWP) and included radiation walkover surveys and soil sampling and analyses. The goal was to identify contaminants exceeding industrial worker remediation limits and contaminants that were a threat to surface and groundwater below 2 feet.

Characterization results were presented in a Technical Memorandum and indicated that a remedial action is required in the former 81-10 Area for protection of the industrial work force. The proposed remedial action is excavation of a 45-ft by 70-ft by 2-ft deep area with an estimated volume of 6,300 ft^3 of soil in the remedial action boundary. An RDR detailing the method of accomplishment, waste management, and waste disposition was submitted to EPA and TDEC ahead of the FFA milestone.

Workers prepare a soil sample for containerization at Exposure Unit 9

Mercury Reduction Project

The Mercury Reduction Project was initiated to facilitate reduction and lower mobility of mercury at Y-12. Subprojects under the Mercury Reduction Project included Five Tanks Remediation, Outfall 200 Conceptual Design, Mercury Recovery Trap Installation, Mercury Soils Treatability Study, and Secondary Pathway Remediation. Field activities on the Mercury Reduction Project began in May 2012 and continued into FY 2013.

Five Tanks Remediation Project

A tank removal project was initiated in FY 2012 to dispose of five tanks formerly used for mercury-related activities at Y-12. These tanks were removed from service in the 1980s. Characterization was completed along with the necessary documentation needed for disposal of these tanks.

The tank removal project was completed in FY 2013. Based on characterization results, two tanks were sent to the sanitary landfill at Y-12. Three tanks were transported to Materials and Energy Corporation for residual removal of tank contents and size reduction of the tanks. After size reduction, the tank residuals and debris were disposed. Approximately 650 pounds of mercury was removed and treated. A formal report documenting completion of the project was submitted to the Environmental Protection Agency and Tennessee Department of Environment and Conservation.

Abandoned tanks at the Y-12 Complex

Outfall 200 Mercury Treatment Conceptual Design Project

An outfall is a discharge point of a waste stream into a body of water. Outfall 200 is the point at which the Y-12 storm drain system discharges to Upper East Fork Poplar Creek.

During FY 2012, a treatability study and conceptual design were initiated for a treatment plant to reduce the release of mercury from Outfall 200 into Upper East Fork Poplar Creek. Samples were collected from Outfall 200 A6, Outfall 169, Outfall 163, and Outfall 150. Collected samples of storm water effluent and grit from the bottom of the storm sewers were analyzed for constituents of concern and subjected to treatability analysis for removal of suspended solids and mercury. An alternatives analysis was performed for an Outfall 200 treatment system.

During FY 2013, the Remedial Design Work Plan for the Outfall 200 Mercury Treatment Facility was completed. The work plan described an interim remedial action to reduce the release of mercury into Upper East Fork Poplar Creek with a goal of restoring surface waters. The design of the treatment facility was summarized in the Conceptual Design Report for the Outfall 200 Mercury Treatment Facility.

Mercury Recovery Project

The Mercury Recovery Project designed and installed mercury recovery traps at locations upstream of Outfalls 150, 160, 163, and 169. The traps collect elemental mercury and mercury-contaminated sediment, and Y-12 personnel remove that mercury and sediment from the traps and other storm drain locations.

Y-12 began collecting mercury and sediments from storm drains in FY 2013. Ongoing collection and disposition of elemental mercury and associated contaminated sediments from the storm drain system from the traps will be summarized in the

annual Remediation Effectiveness Report, which details the effectiveness of remediation activities.

In FY 2013, the Mercury Recovery Project installed a decanting facility to separate mercury from co-collected sediment and water, and potential amalgamation of collected elemental mercury for disposal purposes.

Trapping and removing elemental mercury from the storm drain system will be of benefit by removing some mercury before it reaches the Upper East Fork Poplar Creek at Outfall 200.

Mercury Contaminated Soils Treatability Study

A treatability study for mercury-contaminated Y-12 soils started in FY 2012. The treatability study was initiated to define treatment options and available disposal options for Y-12 soils contaminated with mercury.

In FY 2013, the Treatability Study Report for Y-12 Site Mercury Contaminated Soil was prepared, detailing the results of treatability studies and providing treatment and disposal options for the mercury contaminated soils.

Secondary Pathways

In FY 2013, actions to reduce or eliminate secondary mercury infiltration around Alpha 4 (9201-4) and Alpha 5 (9201-5), and identification and confirmation of open drains inside Alpha 5 and Beta 4 (9204-4) were completed. These massive facilities were involved with lithium isotope separation activities, which utilized large quantities of elemental mercury. These activities included modifying some roof drains and drainage systems, installing graded impervious surfaces to ensure rainwater runoff is routed to storm drains to reduce percolation through mercury-contaminated soils, and investigating potential mercury source points inside the facilities. The actions were documented in a completion report. All waste generated was disposed in FY 2013.

Water Resources Restoration Program

The Water Resources Restoration Program (WRRP) coordinates activities for three Oak Ridge Reservation watershed-specific Water Quality Programs, manages data collected by the programs, provides Sample Management Office services, and manages the Oak Ridge Environmental Information System. The WRRP coordinates the development of long-term monitoring strategies to support future groundwater remediation decisions. The program also tracks compliance with long-term stewardship requirements.

The WRRP also monitors the effectiveness of completed remedial actions. It manages performance of post Record of Decision sampling and data analysis.

Summaries of monitoring results and interpretations of data collected by the watershed Water Quality Programs and other related projects are reported in the yearly Remediation Effectiveness Report and every five years in the a more comprehensive Five-Year Review.

Surveillance and Maintenance

Surveillance and Maintenance (S&M) activities involve maintaining 65 surplus sites and facilities covering more than 600,000 ft^2 and approximately 500 acres of land within the Chestnut Ridge, Upper East Fork Poplar Creek, and Bear Creek Valley watersheds and at several offsite locations in a safe and compliant condition until sites are remediated or facilities are demolished through EM cleanup projects. The project is responsible for safe-keeping radiologically and chemically contaminated facilities, structures, equipment, and land parcels. 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 burial grounds, closed waste treatment/disposal facilities and land areas, waste storage vaults, and surplus process buildings, as well as closed storage tanks, diked areas, trailers, storage sheds, etc.

Routine S&M includes numerous activities, such as facility/site inspections required by Federal and State regulations (e.g., CERCLA Records of Decision and RCRA Post-Closure Permits), relevant DOE orders, and other regulations/requirements; characterization of hazards; radiological surveys; routine, corrective, and preventative maintenance of facilities, structures, systems, and components (e.g., roofs, fire protection systems, building steam and ventilation supply, land area caps, access roads, etc.); RCRA cap leachate collection and transport for treatment; and pumping accumulated precipitation from diked areas. S&M also includes one-time activities necessary to reduce facility inventory, remove unneeded utilities and reduce utility costs, perform waste management/recycle activities, and mitigate other risks.