3. Environmental Management and Reservation Activities

Much of the work accomplished by the DOE Oak Ridge Office of Environmental Management (EM) on the ORR is performed as a result of the requirements of the Federal Facility Compliance Act and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The 1992 Federal Facility Compliance Agreement requires that all DOE facilities manage and dispose of mixed waste in accordance with their respective site treatment plans. Bechtel Jacobs Company LLC has established programs to address the storage, transportation, treatment, disposal, and recycling of legacy and newly generated waste from the ORR. Bechtel Jacobs LLC manages the Toxic Substances Control Act (TSCA) Incinerator, wastewater treatment facilities, landfill operations, and certain other treatment and recycle facilities that also contribute to meeting the requirements of the Federal Facility Compliance Agreement and other EM milestones.

Another large portion of the EM work conducted at ORR is performed according to the requirements of CERCLA, which is implemented by the 1991 Federal Facility Agreement. The Federal Facility Agreement, signed by DOE, Tennessee Department of Environment and Conservation (TDEC), and EPA, addresses contamination resulting from past activities of DOE operations that remain in structures, buildings, facilities, soil, groundwater, surface water, or other environmental media.

3.1 Introduction

For more than half a century, one of the primary missions of DOE and its predecessor agencies was the production of nuclear weapons for the nation's defense. Production of materials for nuclear weapons, which began in 1943, produced hazardous and radioactive waste and resulted in contamination of facilities, structures, and environmental media. Two laws passed by Congress included requirements to address these problems. These two laws are the Federal Facility Compliance Act and CERCLA. The Federal Facility Compliance Agreement, made in accordance with the Federal Facility Compliance Act, requires that all DOE facilities manage and dispose of waste in accordance with their respective site treatment plans. The Waste Disposition and Waste Operations projects address waste stored, treated, disposed of, or recycled on the ORR in accordance with the Site Treatment Plan. The DOE Environmental Management (EM) program also operates and maintains waste treatment, storage, disposal, and recycling facilities at each of the three Oak Ridge sites (ETTP, ORNL, and the Y-12 Complex). These activities are included in the Waste Operations Project.

CERCLA addresses any environmental contamination resulting from past industrial operations, not just those performed at federal facilities. CERCLA requires that sites requiring cleanup actions be placed on the National Priorities List. Once on the list, the responsible entities are required to investigate and remedy abandoned or uncontrolled hazardous waste sites where a release has occurred or may occur. The ORR was placed on the National Priorities List in 1989. In 1990, DOE Headquarters (DOE-HQ) established the Office of Environmental Management (EM), making DOE-ORO responsible for cleanup of the reservation. CERCLA also requires public involvement to ensure that citizens will be informed of cleanup decisions that may affect them or the area in which they live.

The following sections highlight some of the EM activities for 2005 and some related activities carried out to ensure good stewardship of the reservation.

3.2 East Tennessee Technology Park

3.2.1 Decontamination and Decommissioning

3.2.1.1 K-29, K-31, and K-33 Project Completed

In August 1997, DOE signed an action memorandum (AM) to decontaminate and remove equipment from the K-29, K-31, and K-33 gaseous diffusion buildings. The contractor,

BNG America, under a fixed-price contract with DOE awarded in August 1997, completed the work in fiscal year (FY) 2005. K-31 and K-33 Buildings were 98% and 85%, respectively, decontaminated to specified radiological end-point criteria. DOE plans to complete the decontamination of the K-31 Building utilizing another contractor and will pursue making Building K-31 available for reuse. Building K-33 decontamination will not be completed until a reuse has been identified and a decision on the final disposition is made prior to December 2007. Building K-29 has been determined to not be in satisfactory condition for reuse and will be demolished as part of the Remaining Facilities Removal Action. A total of 159,000 tons of material has been dismantled, removed, and dispositioned as waste or recycle material for the entire project. DOE will submit the Removal Action Report to the regulators in FY 2006.

- More than 75% of waste from the K-29, K-31, and K-33 buildings was shipped to either Envirocare of Utah or the Nevada Test Site.
- The original estimate of metal that would have to be dispositioned from the buildings was 126,000 tons, but the project dispositioned almost 160,000 tons.
- More than 463 miles of piping were removed from the buildings.

3.2.1.2 K-25/K-27 Facilities Decontamination and Decommissioning

The three-story, U-shaped K-25 Building was built during the Manhattan Project and contained 3,018 stages of gaseous diffusion process equipment and associated auxiliary systems. Each stage consists of a converter, compressors, motors, and associated piping. The K-27 Building covers 383,000 ft^2 and contains 540 stages of gaseous diffusion equipment and associated auxiliary equipment.

An AM for the demolition of the K-25 and K-27 Buildings was signed in February 2002. The AM stipulates that the buildings be demolished to the slab and that the associated waste be disposed of. The first phase of the demolition, hazardous materials removal, started in December 2001 and was completed in June 2005. Hazardous materials removal primarily included the removal of asbestos-containing building material, such as transite panels and insulation, from inside the K-25 and K-27 Buildings. During the 3.5-year period, a total of 944 waste shipments, comprising approximately 621,000 ft^3 of waste, were transported to the Environmental Management Waste Management Facility (EMWMF), a CERCLA disposal facility located near the Y-12 National Security Complex.

Process equipment removal is under way with the shipment of 115 loose converters to the Nevada Test Site (NTS) and EMWMF for disposal, 75 of which were shipped in 2005. Excess materials are also being removed from the buildings. Excess materials consist of nonprocess items, such as laboratory equipment, laboratory samples, office equipment, tools, wooden pallets and crates, and drums of chemicals. In 2005, a total of 465 waste shipments, containing approximately 339,000 ft^3 of waste, were transported to the EMWMF for disposal.

At the end of 2005, removal of fixed process equipment was awaiting completion of the Operational Readiness Review and transmittal of the Notice to Proceed from DOE Headquarters. Approximately 1,500 stages in the K-25 Building have been purged of residual process gas in preparation for fixed, process equipment removal.

K-25 Building demolition continued in 2005 with the removal of approximately 117,000 ft^2 of transite panels from the exterior of the building, demolition of 72 of the 114 filter houses, and removal of transite enclosures from about half of the 150 interior stairways. The building demolition waste-handling plan was approved in FY 2005.

The memorandum of agreement (MOA) regarding historical preservation of the K-25 Building was ratified on March 28, 2005. This MOA allows the east and west wings of the U-shaped K-25 Building to be demolished, but retains the north wing for historic preservation purposes. The MOA also allows the placement of concrete rubble within the vaults of the east and west wings. The vault walls of the east and west wings along the interior of the "U" will be preserved. Filling and grading of the vault areas will leave the upper portion of the wall available for use by others to portray the history of Oak Ridge (e.g., murals). The footprint of the K-25 Building will be preserved and nominated as an historic landmark.

3.2.1.3 Group II Buildings, Phase II Buildings (K-1064 Peninsula)

DOE signed an AM in July 2002 for the demolition of facilities and the removal of scrap material located in the K-1064 peninsula area. During 2004 and 2005, 17 of the 19 facilities were demolished. Demolition of the remaining facilities and removal of the scrap are planned to be completed in 2006.

3.2.1.4 Remaining Facilities

In September 2003, DOE signed an AM to demolish the approximately 500 remaining facilities. In 2005, 45 predominantly uncontaminated facilities, 19 low-risk/low-complexity facilities, and 9 facilities in a grouping called "Balance of Site - Laboratories Group" were demolished, transferred, or sold; characterization and utility deactivation continued in preparation for demolition work in 2006; removal of universal waste was started in the K-29 Building; and waste-handling plans were approved for K-1401, K-1420, K-29, and Centrifuge Equipment Removal.

3.2.1.5 Zone 2 Record of Decision Developed

The focused feasibility study, focused feasibility study addendum, and proposed plan for cleanup of the Zone 2 portion of ETTP were approved in 2004 by the Federal Facility Agreement parties (DOE, EPA, and TDEC). These documents detail the options and selected remedy for remediation of the site. A public meeting was held on August 24, 2004, to discuss the Zone 2 Proposed Plan.

Zone 2 includes the area within the main fence of the plant (approximately 324 hectares). Zone 1 is the area surrounding ETTP outside the fence. These documents address soil, slab, subsurface structure, and burial ground contamination. Remedial action objectives have been set to provide for protection of a future industrial work force and to protect underlying groundwater. The Zone 2 Record of Decision (ROD) was signed by DOE, the state of Tennessee, and EPA in 2005.

3.2.1.6 ETTP Soil Remediation

The soil at ETTP will be remediated to protect a future industrial work force and to protect underlying groundwater. Two RODs have been signed that address soil, slabs, subsurface structures, and burial grounds.

The Zone 1 ROD was signed by DOE, the TDEC, and the EPA in November 2002. Zone 1 is the 567-hectare area surrounding ETTP outside the fence. The Zone 2 ROD was signed by DOE, TDEC, and EPA in April 2005. Zone 2 includes the area within the main fence of ETTP (approximately 324 hectares). The Remedial Design Report/Removal Action Work Plan for Soils, Slabs, and Subsurface Structures was approved by EPA and TDEC in September 2005.

Work associated with the K-901 and Duct Island areas was completed in 2005, and the Phased Construction Completion Report was submitted to the EPA and TDEC for approval. Schedules associated with this work are contained in the Federal Facility Agreement, Appendix E, on the web at www.bechteljacobs.com/pdf/ffa/appendices/appendex.pdf.

3.2.1.7 ETTP Site-Wide ROD Project Under Way

The ETTP site-wide ROD addresses contamination in groundwater, surface water, and sediment for the protection of human health and the environment. In addition, it will determine whether additional soil action is necessary to protect the environment. The geographic areas included in this decision are Zone 1 (outside the main plant) and Zone 2 (inside the plant fencing).

After a series of data-quality-objective workshops focusing on groundwater, surface water, sediment, and soil actions were held, a work plan for additional investigations was developed and was submitted to EPA and TDEC for approval. Fish sampling and aquatic community surveys were conducted as stated in the work plan. Additionally, the three Federal Facility Agreement parties developed a detailed schedule of the ensuing activities to allow for signature of the ROD in early 2007.

3.2.1.8 ETTP Scrap Removal Project

The ETTP Scrap Removal Project began shipping contaminated scrap from the K-770 Scrap Yard to the EMWMF on July 26, 2004. Almost 22,000 tons of contaminated scrap metal were disposed at EMWMF during 2005 under the ETTP Scrap Removal Project. This project is responsible for disposing of approximately 47,000 tons of scrap metal from the K-770 Scrap Yard, K-1131 Area, K-1064 Scrap Yard, K-1300 Area, and K-1066-G Maintenance Yard. Remediation of contaminated soil at these sites is planned for 2007.

3.2.1.9 ETTP Outdoor Legacy Waste

The ETTP Outdoor Legacy Waste is composed of 6209 containers of low-level waste that were the result of past operations at the site. This waste has been characterized to support disposal and shipment to the EMWMF, which is in progress.

3.2.1.10 UF_6 Cylinders Being Shipped Off Site

More than 6000 cylinders containing uranium hexafluoride (UF_6) are being shipped to the Portsmouth Site for disposition. Most contain depleted UF_6. These steel cylinders hold approximately 10 to 14 tons of depleted UF_6. They are stored in storage yards in aisles and are stacked two high. 2,747 cylinders of depleted UF_6, and 429 cylinders of uranium compounds other than depleted UF_6 were shipped in 2005.

Natural uranium in the form of UF_6 was used as feed material during the gaseous diffusion process to enrich uranium at the former K-25 Site. The percentage of uranium-235 was increased from the original feed material in the process (i.e., enriched). The remaining material is depleted UF_6. It is stored as a white, crystalline solid that is slightly less radioactive than natural uranium.

3.2.1.11 Blair Quarry Remediation Completed

More than 15,000 tons of contaminated soil and debris have been removed from Blair Quarry, a former waste disposal site adjacent to ETTP, and site restoration is complete.

The remediation project kicked off in mid-November 2004 and was completed in early 2005 with no recordable injuries, first aid cases, or transportation incidents. The material was disposed of at EMWMF.

Blair Quarry was created in the early 1940s by excavating into McKinney Ridge, forming a U-shaped amphitheater with exposed rock on three sides. The rock material was used to support construction of the K-25 Site. It operated as a quarry until 1945 and was then used for open burning of trash and debris through the late 1950s.

Several investigations of the type and extent of contamination at Blair Quarry were conducted before the remediation project began. The project served as a pilot for the strategy that was developed and approved for the characterization and verification of Zone 1 and Zone 2 areas at ETTP. Additional contaminants of lesser concern included polychlorinated biphenyls (PCBs) and low levels of radionuclides and metals. Based on these investigations, only 0.4 hectare of the initial 27-hectare area required remediation.

3.2.1.12 TSCA Incinerator Hazardous Waste Treatment

The TSCA Incinerator, located at ETTP, treated 325,520 lb of liquid waste and 167,482 lb of solid waste in 2005. Plans are in place to increase the throughput at the incinerator to ensure cost-effective operations in support of the DOE complex's cleanup mission. The TSCA Incinerator plays a key role in treatment of radioactive PCB and hazardous wastes (mixed wastes) from the ORR as well as other facilities across the DOE complex, thus facilitating compliance with regulatory and site closure milestones.

3.2.1.13 Central Neutralization Facility

The Central Neutralization Facility (CNF) is ETTP's primary wastewater treatment facility and processes both hazardous and nonhazardous waste streams arising from multiple waste treatment facilities and remediation projects. The facility removes heavy metals and suspended solids from the wastewater, adjusts pH, and discharges the treated effluent in accordance

with NPDES requirements into the Clinch River. Sludge from the treatment facility is treated, packaged, and disposed of off-site. The CNF treated approximately 28 million gallons of wastewater in 2005.

3.3 Oak Ridge National Laboratory

3.3.1 Melton Valley Remedial Actions

The Federal Facility Agreement parties signed the Melton Valley ROD in September 2000. The Melton Valley ROD presents the selected remedy for environmental remediation of various burial grounds and other contaminated waste units within the ORNL Melton Valley area. Remediation will be accomplished through a combination of responses that includes containment, stabilization, removal, treatment, monitoring, and interim land-use controls.

Regulators approved a remedial design work plan in May 2001, with the approval of the land use control implementation plan still outstanding. The plan specifies what actions must be taken to implement and maintain the required land use controls. Remediation work mandated by the Melton Valley ROD has been ongoing and will continue through 2006. Individual actions completed before 2004 include remediation of both the Process Waste Sludge Basin and the Old Hydrofracture Facility, demolition of various surface structures in Melton Valley, and excavation and disposal of contaminated soil from the Intermediate Holding Pond.

During 2005, construction of 11 caps covering about 42.1 hectares of solid waste storage areas (SWSAs) 5 and 6, and Seepage Pits and Trenches, continued. Collection and treatment of groundwater from the Seepage Pits and Trench 7 began and continued in 2005.

3.3.2 Hydrofracture Wells Plugging and Abandonment

Between the 1960s and mid-1980s, the process of deep waste injection was used at ORNL to dispose of radioactive liquids and sludge in mixtures of waste with cement-based grout and various additives. Two test injection wells were constructed, along with boreholes and wells, so that the behavior of the injected grout in the injection zone bedrock could be observed. At these two test sites, small quantities of radionuclides were added to the injected grout to make the grout sheets detectable by gamma detectors. The third and fourth injection wells, located within the Old Hydrofracture Facility and New Hydrofracture Facility, respectively, were constructed for large-scale waste disposal. More than 5 million gal of liquid waste-grout mix, containing approximately 1.4 million Ci of activity, were injected into artificially induced fractures in a shale formation at depths of 300 to 1000 ft. All large-scale disposals were at depths greater than 780 ft. Contamination levels in hydrofracture monitoring wells have been reported as high as 97 million pCi/L gross beta.

These surplus wells are potential pathways for the migration of contaminated fluids from the grout sheets and from deep groundwater to shallower groundwater zones. To prevent this migration, a remedial action was initiated in 2001 to plug and abandon 111 wells consisting of 4 injection wells and 107 monitoring wells. Plugging and abandonment of the last well (injection well 1968), which was located within the New Hydrofracture Facility, were completed in March 2004. The Phased Construction Completion Report was drafted, and comments were received in 2005. Approval of the final report is expected in 2006.

3.3.3 New Hydrofracture Facility Decontamination and Decommissioning

The New Hydrofracture Facility was built at ORNL between 1979 and 1982 and operated from 1982 to 1984. It replaced the Old Hydrofracture Facility, which operated between the late 1950s to the mid-1970s. The New Hydrofracture Facility was designed to facilitate the injection of a mixture of radioactive waste solutions and grout into an impermeable shale formation at depths between 700 and 1000 ft below grade. The hydrofracture process is essentially a batch process in which the waste/grout mixture is pumped down a tubing string in the injection well and out into the shale formation. The high injection pressure of approximately 3000 psi fractures the subsurface shale and forces the waste/grout mixture into the fractures, where it hardens into “grout sheets.”

The objective of the decontamination and decommissioning of the New Hydrofracture Facility is the removal and disposition of the main and ancillary facilities, including some subsurface structures. The majority of the New Hydrofracture Facility has been demolished. Only three rooms, or cells, of the main structure remain. All process equipment and piping have been removed from these cells in preparation for demolition of the cell structures, scheduled to be completed in 2006.

3.3.4 SWSA 4 Hydrologic Isolation

Work on the SWSA 4 project includes the hydrologic isolation of the SWSA 4 burial ground, Liquid Waste Disposal Pit 1, the Pilot Pits Area, and the 7819 Decontamination Area, as well as the excavation of the Intermediate Holding Pond. Hydrologic isolation includes the installation of a multilayer cap, upgradient storm-flow diversion trenches, and downgradient collection trenches. To facilitate cap installation, this project also included plugging and abandonment of unneeded, shallow, non-hydrofracture wells within the cap boundary; developing a borrow area and associated haul roads; and relocating Lagoon Road.

From 1951 to 1959, DOE used SWSA 4 for disposing various liquid and solid radioactively contaminated wastes in unlined trenches and auger holes. SWSA 4 contains approximately 20,000 Ci of radioactive wastes and contributes approximately 27% of the total risk in surface water to a hypothetical resident at White Oak Dam.

Pit 1 was constructed in 1951 to test the feasibility of disposing liquid waste in pits excavated in the natural clays in Melton Valley. Pit 1 received liquid waste from August to October 1951. In 1981 Pit 1 was backfilled and covered with an asphalt cap. In 1991 a portion of the wastes disposed of in Pit 1 was stabilized as part of an in situ vitrification technology demonstration. In situ vitrification is a process that uses electrical power to heat and melt contaminated soil, fusing the soil and waste into a glasslike solid.

Construction of an approximately 12-hectare cap, upgradient and downgradient groundwater interception trenches, and a groundwater treatment unit were completed in 2004. Groundwater collection and treatment began at SWSA 4 and continued in 2005.

3.3.5 Homogeneous Reactor Experiment Ancillary Facilities

The Homogeneous Reactor Experiment (HRE) ancillary facilities consist of 11 separate structures external to the HRE reactor building, which provided support capabilities (waste management, storage, etc.) during reactor operation. The ancillary facilities include a liquid waste evaporator, a charcoal absorber that cleaned up gaseous effluents prior to discharge to the atmosphere, a decontamination pad and storage shed, an office building, and other miscellaneous structures. Decontamination and decommissioning (D&D) of three of the ancillary facilities was completed in 2005. Planning and characterization of the remaining facilities was performed. D&D is scheduled to be completed in 2006.

3.3.6 Molten Salt Reactor Experiment Fuel and Flush Salts Removal

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.

A CERCLA action to remove the fuel and flush salt is under way. Testing of fuel and flush salt removal equipment and a cold trap system was successfully completed in 2003. Operating procedures were developed based on results of the testing, and training of operators was completed. Melting of the salt in preparation for removal began in December 2004, and processing of the initial flush salt tank was completed in 2005. Completion of salt removal is scheduled for late 2006.

3.3.7 22-Trench Area TRU Waste Retrieval

During the 1970s, packages of transuranic (TRU) waste were retrievably stored in the 22-Trench. Since the 1980s, packages of newly generated TRU waste have been stored in constructed facilities. Radionuclides in the TRU

waste containers represent some of the most toxic and longest-lived radioisotopes stored on the ORR. In a consent agreement signed in September 2000, DOE committed to the state of Tennessee to retrieve the TRU waste from the 22-Trench Area under DOE's Atomic Energy Act authority.

A request for proposals for the 22-Trench Area retrieval project was issued for bid early in 2003. The proposals were evaluated, and a subcontract was awarded. The scope of work consists of retrieving the TRU waste packages, placing the waste packages in overpacks, and staging the waste in appropriate areas pending transport to the TRU Waste Processing Facility when directed by DOE. There the wastes will be repackaged to meet the acceptance criteria for off-site disposal facilities and then shipped off site for disposal. Soil exceeding remediation levels in the Melton Valley ROD and debris waste associated with the excavation will be disposed of at the EMWMF or other appropriate facility. Retrieval of waste packages began in December 2004. As of the end of 2005, 191 of the anticipated 204 packages had been retrieved, overpacked, and staged.

3.3.8 Melton Valley Hydrologic Isolation

In addition to the SWSA 4 cap, the Melton Valley ROD calls for construction of caps on several other waste disposal areas (SWSA 5, SWSA 6, and selected pits and trenches). Approximately 40 hectares of multilayer caps, several groundwater interception trenches, and a groundwater treatment unit will be constructed. Cap construction at SWSA 5 South and SWSA 6 began in 2004 and continued through 2005. Downgradient groundwater interception trenches were completed at Seepage Pits 2, 3, and 4 and SWSA 5. Groundwater collection and treatment has begun at the Seepage Pits, Trench 7, and Seep D.

3.3.9 T-1, T-2, and HFIR Tanks Remediation

The T-1, T-2, and High Flux Isotope Reactor (HFIR) tanks were the last inactive liquid low-level radioactive waste (LLLW) tanks at ORNL to be remediated. The HFIR Tank was stabilized in 2004 by being filled with grout. The residual sludge in Tanks T-1 and T-2 was to have been treated to destroy organic resins; however, it was determined that the quantity of resins in the sludge would not adversely impact the LLLW system. Therefore, the sludge was transferred directly to the active LLLW system in 2004, and Tanks T-1 and T-2 were stabilized with grout. The phased construction completion report documenting completion of the tanks' remediation in accordance with the ROD was approved during 2005, completing the tanks' remediation activities.

3.3.10 Soils and Sediments Remediation

Several inactive waste ponds and areas of soil with radioactive contamination above criteria established in the Melton Valley ROD require excavation. In CY 2005 four inactive ponds and associated contaminated soil at the HFIR were excavated and disposed of, as was the former HRE Pond and lesser-contaminated soil surrounding the pond. Remediation efforts at the HFIR facility entailed the shipment of more than 600 truckloads of contaminated sediment and soil to EMWMF, comprising approximately 6,200 yd^3. At HRE, 578 truckloads containing an estimated 5,000 yd^3 of contaminated soil were shipped to EMWMF for disposal. Contaminated soil removed from areas adjacent to the HRE Pond, 1,374 truckloads containing about 13,000 yd^3 of contaminated soil were transported to one of the Melton Valley Hydrologic Isolation capping sites for beneficial reuse as contour fill.

In addition, five contaminated soil sites in Melton Valley were remediated, resulting in the removal of approximately 4,500 yd^3 of contaminated soil. The soil from these sites, primarily derived from previous leaks from the ORNL low-level radioactive waste (LLW) system, was also dispositioned as contour fill beneath one of the MVHI caps. Gamma walkover surveys and soil sampling across Melton Valley identified 20 small hot spots that were also remediated, entailing the excavation and transport of approximately 15 yd^3 of contaminated soil (also placed beneath an MVHI cap as contour fill).

Pipeline remediation activities began in the summer of 2005 and continued through the end of the calendar year, at which point approxi-

mately 20,000 linear feet of inactive LLLW and process waste lines had been grouted.

3.3.11 Decontamination and Decommissioning Projects

A number of structures and facilities, including ancillary HRE facilities, the 7841 Equipment Storage Area, and Shielded Transfer Tanks, will undergo D&D. The remedial design report/remedial action work plans for these activities were approved by the regulators in 2004. Field mobilization was completed, and processing of material from the 7841 Equipment Storage Area began during 2005. Decontamination and decommissioning of five of the HRE ancillary facilities was completed in 2005. The HRE ancillary facilities consist of 11 separate structures external to the HRE reactor building, which provided support capabilities (waste management, storage, etc.) during reactor operation. The ancillary facilities include a liquid waste evaporator, a charcoal absorber that cleaned up gaseous effluents prior to discharge to the atmosphere, a decontamination pad and storage shed, an office building, and other miscellaneous structures. Planning and characterization of the remaining facilities was performed. D&D is scheduled to be completed in 2006.

3.3.12 In Situ Grouting of Trenches 5 and 7

The selected remedial action for Seepage Trenches 5 and 7 in the Melton Valley ROD was in situ vitrification. During 2003, a predesign field investigation and a procurement for design and construction services were conducted in preparation for performing in situ vitrification. New information resulted from these activities and prompted a reassessment. The new information included the presence of standing water in the trenches and a much higher cost for performing the in situ vitrification than was expected. After further evaluation, DOE proposed in an amendment to the ROD that an alternative treatment, in situ grouting, be substituted for in situ vitrification for Trenches 5 and 7. This remedy change and the associated ROD amendment were approved in 2004 by the regulatory agencies.

The requirements decision record/remedial action work plan for the in situ grouting of the trenches was approved in September 2004. The trenches will be treated by the permeation grouting method, utilizing portland-cement-based grouts injected under low pressure into the crushed limestone trench material. The grout will form a solid mass with the crushed limestone and the finer sediments, greatly reducing the permeability of the trench materials. The soil adjacent to the trench walls will be treated with a solution grout (e.g., polyacrylamide) to reduce migration of contaminants away from the trench by sealing off seepage pathways. Nuclear safety and overall safety considerations during actual grouting prompted extension of the schedule for completion to 2006.

3.3.13 Bethel Valley Remediation

The Bethel Valley ROD, signed by the Federal Facility Agreement parties in May 2002, presents the remedy selected for environmental remediation of various contaminated areas within the ORNL Bethel Valley area. Higher-risk sites will be addressed first. Remediation work mandated by the Bethel Valley ROD will continue through FY 2014. The first three projects to be performed under the ROD are the Bethel Valley Groundwater Engineering Study; remediation of the T-1, T-2, and HFIR Tanks; and partial remediation of the Hot Storage Garden.

3.3.14 Bethel Valley Groundwater Engineering Study

The Bethel Valley ROD specified that a groundwater engineering study be conducted to satisfy data needs for the design of several remedial actions related to groundwater, including (1) deep groundwater extraction at the Corehole 8 plume, (2) in situ biodegradation at the East Bethel Valley volatile organic compound (VOC) plume, (3) groundwater monitoring in West Bethel Valley, and (4) soil excavation at known leak sites to minimize impacts to groundwater. Planning for the groundwater engineering study was summarized in the *Engineering Study Work Plan for Groundwater Actions in Bethel Valley*, issued as a final document in 2003. The work plan includes an evaluation of existing, relevant data from previous characterization activities and defines the scope of work to be performed to design groundwater and soil remedial actions

under the record of decision. The engineering study data have been collected, and a report summarizing the results has been issued.

In CY 2005, the Bethel Valley Groundwater Engineering Study completed the components of the required fieldwork. Two hundred and eighty-three soil push probes were completed to obtain soil and groundwater samples. The soil gas installations were completed, and the data were acquired and analyzed. Based upon the soil gas monitoring, seven groundwater monitoring wells were installed to provide additional data about the VOC plume. All of the surface water, groundwater, process waste system, storm sewer, and outfall sampling has been completed. Additional groundwater monitoring wells were installed and sampled to obtain radiological data about the Corehole 8 plume and leak sites. The data from the Engineering Study was evaluated and summarized in the *Bethel Valley Groundwater Engineering Report*. This report has been approved by regulatory agencies.

3.3.15 Hot Storage Garden

Beginning in the mid-1950s, the Hot Storage Garden supported research at ORNL by storing radioactive material, including spent fuel rods, in the below-grade wells and in a partially above-grade, water-filled canal. All the fuel was transferred for storage to a solid waste storage area in the mid-1980s. The facility was then placed in the surveillance and maintenance program.

In 2003, some additional funding was made available to perform D&D on a facility currently in the surveillance and maintenance program. The Hot Storage Garden was selected because it was a small facility that could be decontaminated and decommissioned with the available funding, and existing documentation indicated that the source material had been removed with no indication of residual contamination. Additional characterization data were obtained by analyzing radiological smears from the below-grade canal, residual well water, and wells. However, smears of the removable well sleeves were only obtained to approximately one-half the well depth.

The project started in the summer of 2004. All the surface structures were removed, and 5 of the 14 well sleeves were removed and cut. High concentrations of removable alpha-emitting contamination were found near the bottom of one of the well sleeves. Each of the sleeves had been cut in half using a reciprocating saw. The vibration caused by the reciprocating saw is believed to have caused the contaminants to become airborne. As a result, four workers received an unexpected dose of less than 500 millirem, or 10% of the maximum annual dose allowed by nuclear regulations.

The project was immediately stopped, and the area was secured. The project performed additional characterization on the five removed well sleeves. The characterization included sampling and analysis to ensure that all the residual radionuclides on the well sleeves are identified and quantified. The sampling was performed in a negative-air enclosure to minimize the chance of creating airborne contamination. After sampling, a fixative was applied to the interior and exterior of the well sleeves. The analytical data were reviewed to determine the appropriate approach to containerization and disposition. Based upon the review of the data, the removed well sleeves were containerized and transported to the EMWMF disposal facility. The remaining nine wells will remain sealed until a final cleanup effort begins in 2009.

3.4 Y-12 National Security Complex

3.4.1 Upper East Fork Poplar Creek

Remediation of the Upper East Fork Poplar Creek (UEFPC) Watershed is being conducted in stages using a phased approach. Phase 1 addresses interim actions for remediation of mercury-contaminated soil, sediment, and groundwater discharges that contribute contamination to surface water. The focus of the second phase is remediation of the balance of contaminated soil, scrap, and buried materials within the Y-12 Complex, the major contaminated area in the UEFPC Watershed. Decisions regarding final land use and final goals for surface water, groundwater, and soils will be addressed in future decision documents.

During FY 2005, regulators provided comments on the draft proposed plan for Phase 2 interim remedial actions for accessible soil, buried waste, or subsurface structures that contribute significantly to contamination above

acceptable risk levels in UEFPC. The proposed plan was finalized, and a public meeting was held in March 2005. Comments from the public meeting and from members of the public were addressed in the Responsiveness Summary portion of the draft ROD. Regulator comments on the draft ROD were received at the end of FY 2005. The Phase 2 ROD is anticipated to be finalized and approved in FY 2006.

3.4.2 Big Spring Water Treatment System

To mitigate the mercury being released into UEFPC, the Big Spring Water Treatment System was designed and constructed as the first action of the approved ROD for Phase 1 Interim Source Control Actions in the UEFPC Characterization Area.

The 300-gal/min water treatment system uses a series of granular activated carbon columns to reduce the mercury concentrations in the system effluent to levels of 200 ppt or less. The system influent will include the outfall 51 discharge and 9201-2 sump water. The existing East End Mercury Treatment System will be removed. Construction of the new water treatment system began in March 2004 and was completed on March 2005. Initial operations began August 4, 2005.

3.5 Off-Reservation Activities

3.5.1 David Witherspoon Inc. 901 Site Cleanup

The David Witherspoon, Inc. (DWI) 901 Site, located on Maryville Pike in Knoxville, Tenn., consists of a 3.4-hectare parcel formerly owned and operated as the DWI Recycling Center and a 0.2-hectare parcel owned by CSX Transportation, Inc. A 1993 court order forced cessation of DWI operations at the site, and the Tennessee Division of Superfund took control of the property. The objective of this off-site project is to perform interim actions and to complete the supporting documentation, resulting in a ROD at the DWI 901 Site.

The scope of the project is to decontaminate and demolish the main building, a metal office building, the incinerator, the magnet house, the compactor house, the control house, the scale house and scale, the bailer house, and the breaker house. Contaminated soils will be excavated and disposed of in the EMWMF as radioactive PCB mixed waste. The contaminated soils will be excavated and treated to meet land disposal restrictions.

The interim action for D&D and debris removal started in April 2004. During April of 2005 all 10 buildings had been demolished, all site debris had been shipped. Approximately 1400 yd^3 of building material and debris had been sent to the Y-12 Landfill, approximately 6400 yd^3 of site debris were shipped to the EMWMF, and five loads of universal waste were shipped for off-site disposal.

During 2005, the soil removal interim action work plan was completed, and excavation of soil began. Presently 56,000 yd^3 of soils have been excavated and shipped to the EMWMF. This phase of the Witherspoon work is scheduled to be completed in the Fall of 2006.

3.5.2 DWI 1630 Site Cleanup

The DWI 1630 Site consists of five separate tracts of land located at 1630 Maryville Pike in Knoxville, Tennessee. The 19-hectare site includes a closed 2-hectare landfill plus roughly 8 hectares of dismantled vehicles, equipment, scrap metal, drums, large containers, transformers, ferrous and nonferrous materials, soil-like debris, miscellaneous trash, and other surficial debris from the DWI business operation.

The DWI 1630 Site operated as an unregulated industrial landfill in the early 1950s until its closure in 1974. The area surrounding the landfill was also used by DWI for storage, treatment, and disposal of scrap metal and equipment, including contaminated items. Contaminants include metals (e.g., lead, chromium, and cadmium); volatile organic analytes; semivolatile organic analytes; PCBs; pesticides; dioxins/furans; and radionuclides, including various isotopes of uranium, thorium, and associated radioactive decay products.

DOE has agreed to undertake remedial actions at the site as specified under a Consent Order with the state of Tennessee (Consent Order No. 90-3443, April 4, 1991) and as further delineated by a Memorandum of Understanding (MOU) between DOE and the state of Tennessee (MOU Regarding Implementation of Consent Orders, October 6, 1994).

The objective of this off-site project is to perform interim actions and complete the supporting documentation, resulting in a ROD for the DWI 1630 Site. The scope of the project is to (1) remove contaminated equipment, debris, and soil and (2) repair the landfill cap. Essentially all of the contaminated waste will be disposed of in the EMWMF.

The schedule currently calls for starting additional field investigation in the spring of 2006, starting on-site interim action in November 2006, completing removal of waste in July 2008, and completing landfill cap repair and site restoration in August 2008. This phase of the Witherspoon work is scheduled to be completed by September 2008.

3.6 Waste Treatment and Disposal

3.6.1 Tons of Wastes Placed in the EMWMF and Other Landfills

The EMWMF, located in East Bear Creek Valley near the Y-12 Complex, is an on-site waste facility that is being used to contain the wastes generated during cleanup of the ORR and associated sites in Tennessee. The EMWMF accepted its first waste shipment in May 2002. Since then, projects from all over the ORR have shipped waste to EMWMF for disposal. In FY 2005, 82,436 tons of waste were disposed of at the EMWMF. The operations also effectively controlled site erosion and sediments, resulting in an 80% reduction in total suspended solids measured in surface waters during the year.

DOE also operates solid waste disposal facilities located near the Y-12 Complex, called the ORR Sanitary Landfills. In FY 2005, 136,000 yd^3 of industrial, construction/demolition, classified, and spoil material waste were disposed of at this facility.

3.6.2 EMWMF Upgrades

3.6.2.1 Build-Out to Add to Disposal Capability

Another notable construction project was completed at the EMWMF in 2005. A build-out to add 800,000 yd^3 of disposal capacity kicked off in June. Cells 3 and 4 were added to the two cells that were completed in 2002. Waste disposal operations in the new cells can commence upon approval of the construction completion report by EPA and TDEC. The construction completion report is the compilation of all of the quality control and quality assurance testing and monitoring that was performed to ensure that the build-out was constructed in accordance with the approved design.

3.6.2.2 Haul Road Completed

It became apparent in early 2004 that removing shipments of ETTP waste bound for the EMWMF from public roads would better serve project and public interests. Conceptual design work to identify feasible routes to construct a haul road between ETTP and the EMWMF was initiated in early summer. The road enhances public safety by eliminating the hazards presented by large trucks mixing with passenger vehicles on public roads. It also reduces cleanup costs by decreasing the cycle time for each load of ETTP waste that is disposed at the EMWMF. Construction started in 2005, and was completed in 2006 just in time for the start of the intensive waste-hauling campaign from the ETTP cleanup.

3.6.3 Millions of Gallons of Wastewater Treated in FY 2005

During 2005, the EM Program treated 24 million gal (~ 91 million L) of contaminated groundwater at the Groundwater Treatment Facility, East End Mercury Treatment System, Central Mercury Treatment System, and East End VOC System.

The West End Treatment Facility and the Central Pollution Control Facility at the Y-12 Complex processed wastewater, primarily in support of National Nuclear Security Administration (NNSA) operational activities. This wastewater included hazardous materials such as PCBs, cyanide, mercury, cadmium, chromium, and uranium. The hazardous materials end up in the sludge that results from wastewater treatment. In fall 2005, construction was completed on a 300-gal/min water treatment facility near Building 9201-2, identified as the "Big Springs West Treatment System." The system uses a series of granular activated carbon columns to reduce mercury concentrations in the system

effluent to 200 ppt or less. The system influent will include the outfall 51 discharge and 9201-2 sump water. The existing East End Mercury Treatment System will be removed.

At ORNL, 153 million gal of wastewater was treated and released at the Process Waste Treatment Complex. New zeolite columns and associated transfer equipment (pumps, piping, valve) were installed in 2005 that allowed all of the wastewater processed at Building 3544 to be treated for cesium removal (up to 300 gal/min). The system used prior to this upgrade had a throughput limited to 100 gal/min. The LLLW evaporator at ORNL also treated 143,500 gal of waste. Gaseous waste was also treated at the ORNL 3039 Stack Facility. These important waste treatment activities supported both EM and Office of Science mission activities in a safe and compliant manner.

3.6.4 Transuranic, Low-Level, and Mixed Waste Operations

Operations at the ORR produce wastes that frequently contain radionuclides. Such wastes are characterized as either LLW or TRU wastes. Mixed low-level wastes (MLLWs) are those that contain materials deemed hazardous and are regulated under Resource Conservation and Recovery Act (RCRA).

TRU wastes from throughout the DOE complex are to be disposed of at the Waste Isolation Pilot Plant (WIPP), near Carlsbad, New Mexico. Before being shipped to the WIPP, however, TRU wastes must be treated, packaged, and certified to meet its waste acceptance criteria.

DOE awarded a contract to Foster Wheeler Environmental Corporation in 1998 to build and operate a TRU waste treatment facility on the ORR. In 2001, an approximately 1,000-ft extension to the access road from White Wing Road (State Route 95) and fencing of the approximately 8-hectare site were completed. Waste processing at the TRU waste treatment facility began in 2004. In 2005, preparations were made to begin processing contact handled TRU wastes. Processing of this material is scheduled to begin in 2006.

The ORR has the largest inventory of legacy LLW (i.e., waste from historic reservation operations) in the DOE complex. In addition, active DOE missions at the Y-12 Complex and ORNL produce newly generated LLW that must be managed and disposed of safely and efficiently. In 2004, DOE shipped 40 legacy LLW monoliths (2,161 yd^3) to the Nevada Test Site for disposal. Disposal of the legacy LLW inventory got well under way in 2004. Much of the inventory was shipped for disposal. The ORR also has a large inventory of MLLW, but most of it has been dispositioned since the sewage treatment plant agreement was signed in 1995.

3.7 Public Involvement

3.7.1 Public Input on EM Initiatives

Many projects have moved from the decision-making phase to actual fieldwork. However, DOE is still seeking public involvement in many decisions affecting cleanup of the ORR. Public input was sought in 2005 on a variety of initiatives, including the following:

- Proposed plan for remedial actions in Zone 2 (fenced area) at ETTP;
- Draft management plan for approximately 3,000 acres of the Black Oak Ridge Conservation Area located on the ORR;
- Proposed plan for interim actions for contaminated soils and scrap yard in UEFPC;
- Covenant deferral request to transfer a parcel of vacant land, known as Parcel ED-5 East, to Heritage Center LLC, a subsidiary of the Community Reuse Organization of East Tennessee;
- Interim action work plan for soil removal at the DWI site;
- Construction of the ETTP-to-EMWMF haul road and bridges;
- Covenant deferral request to transfer approximately 1 acre of federal property located at ORNL to the State of Tennessee; and
- Draft environmental assessment for transferring approximately 360 acres, known as Parcel ED-6, to the City of Oak Ridge.

DOE continued distributing its monthly stakeholder newsletter, *Public Involvement News*, to the community and elected officials. Several EM project fact sheets were also revised and combined into three main fact sheets: ETTP, Melton Valley, and Balance of Reservation. The annual report, *Clean Up Progress*, highlighting accomplishments in the ORO Environmental

Management Program, was also issued. The DOE ORO Information Center, a one-stop shop for information on cleanup activities, had 2,503 visitors in 2005 and received 1,164 requests for information.

3.7.2 Oak Ridge Site Specific Advisory Board

The Oak Ridge Site Specific Advisory Board (ORSSAB) posted several accomplishments in 2005 in its mission to provide informed advice and recommendations to DOE on its Oak Ridge EM Program and to involve the public in environmental decision-making. ORSSAB is an independent, volunteer, federally appointed citizens' panel formed in 1995.

The board generated eight recommendations this year on a variety of EM topics, including

- Recommendations on the natural resources damage assessment process;
- EM SSAB recommendations on waste disposition issues;
- Recommendations for long-term stewardship of contaminated areas on the ORR;
- Recommendation for standardized language submitted to land record authorities of land with notices of contamination;
- EM SSAB recommendation on establishing local advisory boards and establishing mechanisms for national meetings;
- Comments and recommendations on the public health assessment for the TSCA Incinerator;
- EM SSAB recommendation that DOE sponsor a national waste disposition workshop; and
- Comments on the Proposed Plan for Interim Actions for Contaminated Soils and Scrapyard in Upper East Fork Poplar Creek (DOE/OR/01-2173&D2).

3.7.3 Annotated Outline for a Long-Term Stewardship Implementation Plan

Stewardship of contaminated areas of the ORR following cleanup has long been an ORSSAB priority. So when DOE signed the Long-Term Stewardship Strategic Plan for the Oak Ridge Reservation in March 2004, the board's Stewardship Committee took the next logical step by producing an Annotated Outline for a Long-Term Stewardship Implementation Plan.

The outline is specifically tailored to the known contaminated areas of the reservation with the hope that this approach will result in an implementation plan that provides detailed functional specifications. A solid implementation plan will enable the design and execution of an ORR-specific stewardship system that meets both current and future needs and also has the acceptance of local stakeholders.

The Annotated Outline is available on the Board's web site at www.oakridge.doe.gov/em/ssab/recommendations/FY2004/R7-14-04.8.pdf.

3.7.4 Student Summary of ORR Stakeholder Report on Stewardship

In 1999, ORSSAB published the second volume of its two-volume *Oak Ridge Reservation Stakeholder Report on Stewardship* (ORSSAB 1999). As time passed, though, it became apparent that the report was too detailed for some audiences—notably the high school students whom the board was trying to reach through its public outreach program.

To address the problem, the ORSSAB Stewardship Committee asked advance-placement science classes at Oak Ridge and Roane County high schools to summarize the report. The resulting *Student Summary of the Oak Ridge Reservation Stakeholder Report on Stewardship* (ORSSAB 2004) was published in May 2004 and does an outstanding job of distilling the original reports into language easily understood by high school students. The summary is available on the ORSSAB web site, www.oakridge.doe.gov/em/ssab/Publications/StudentSummary.pdf

The student summary was widely distributed to local schools and libraries to help ensure long-term awareness and understanding of the community's responsibility for stewardship of contamination that will remain on the reservation following cleanup.