3. Environmental Management and Reservation Activities

Much of the work done under the DOE Oak Ridge Operations 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 (see Sect. 2.2.4) requires that all DOE facilities manage and dispose of mixed waste in accordance with their respective site treatment plans. The Bechtel Jacobs Waste Disposition Project was established in part to address the storage, transportation, treatment, disposal, and recycling of legacy and newly generated waste from the ORR. The Bechtel Jacobs Waste Operations Project manages the Toxic Substances Control Act 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 part of the EM work conducted at ORR is done according to the requirements of CERCLA, which is implemented by the 1991 Federal Facility Agreement. The Federal Facility Agreement, signed by DOE, 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 over 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 the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Federal Facility Compliance Agreement made in accordance with the Federal Facility Compliance Act (see Sect. 2.2.4), 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 program also operates and maintains waste treatment, storage, disposal, and recycling facilities at each of the three Oak Ridge sites (ETTP, ORNL, and Y-12). 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 Oak Ridge Operations (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 2001 and some related activities carried out to ensure good stewardship of the reservation.

3.2 SITE TREATMENT PLAN

The Site Treatment Plan, prepared under the 1992 Federal Facility Compliance Agreement, in accordance with the Federal Facility Compliance Act, includes schedules, milestones, and target dates for appropriately dispositioning legacy

mixed low-level waste (MLLW) stored at any of the three Oak Ridge facilities. The Site Treatment Plan is updated annually according to the ongoing needs of DOE-ORO and the character and nature of waste remaining to be dispositioned. Another waste type, transuranic waste, is currently being addressed as an additional effort of the Legacy Waste program. transuranic waste is waste contaminated with radioactive isotopes that have atomic numbers higher than 92.

3.3 WASTE DISPOSITION PROJECT

The two objectives of the Waste Disposition Project are disposition of the inventory of legacy waste stored on the ORR and management and disposition of newly generated waste from the various DOE programs. The overall goal is to get waste generation on the ORR in a "steady state" condition; that is, the only waste present on the site will be the inventory required to accumulate volumes sufficient for their economic disposition, with most waste disposed within one year of generation.

Accomplishments of the Waste Disposition Project in 2001 included

- achieving two Site Treatment Plan milestones and reducing the inventory of MLLW by 2,047 m^3,
- achieving the third Site Treatment Plan milestone one year ahead of schedule by disposing of the remaining inventory of 1,699 m^3 of unstabilized pond sludge,
- obtaining Nevada Test Site certification for the DOE-ORR low-level waste (LLW) program,
- reducing the LLW inventory by 1,568 m^3, including 35 monoliths,
- reducing the amount of floor space used for the storage of legacy waste by over 619,000 ft^2 and tank storage by 297,000 gal, and
- closing 32 Resource Conservation and Recovery Act (RCRA)-permitted storage units, which eliminated the need for 2 RCRA permits.

3.3.1 Hazardous Waste Subproject

The Hazardous Waste subproject manages nonradioactive waste. The nonradioactive status of the waste is based on criteria of the facilities designated to receive the waste and on the rules and regulations of the states where those facilities are located. Hazardous waste can be regulated by RCRA or TSCA; it can also be industrial chemical waste that cannot be managed at ORR facilities.

The objective of the Hazardous Waste subproject is to manage hazardous waste so that at least 80% of it is moved directly from the point of generation to an off-site commercial treatment, storage, disposal, or recycle facility. A related objective is that no more than 20% of the waste is moved into storage on the ORR. The overlying goal of this objective is to minimize the amount of storage space and waste volume stored on the ORR.

The activities conducted by the Hazardous Waste subproject include the following:

- review and verification of generator waste documentation against acceptance criteria;
- transportation of hazardous waste to commercial treatment, recycle, and disposal facilities;
- collection and short-term storage of waste that can be shipped off-site immediately;
- maintenance and operation of the Chemical Detonation Facility, and
- deactivation of as-found, potentially shock-sensitive chemicals at all three sites.

3.3.2 Mixed Low-Level Waste Subproject

The MLLW subproject comprises three activities: legacy MLLW disposition, unstabilized pond waste, and newly generated MLLW disposition. Each activity is discussed in the following sections.

3.3.2.1 Legacy MLLW Disposition

The objective of the Legacy MLLW Disposition activity is to facilitate disposal of MLLW at approved commercial facilities. If any savings are realized from selecting a facility that has lower

costs than those planned, the extra money is applied to additional waste characterization and/or disposition activities.

3.3.2.2 Unstabilized Pond Waste

This activity was completed in CY 2001, one year ahead of schedule. The activity consisted of staging, transporting, treating, and disposing of the approximately 1627 m^3 of unstabilized pond waste that remained stored in 21st Century™ containers, poly-overpacks, and various metal containers. The waste inventory included soft-centered "reject" drums previously processed at the decommissioned K-1419 Batch Plant that failed certification as "stabilized." The activity also included repackaging 449 metal containers of raw, unstabilized pond waste into 21st Century™ containers; transporting, treating, and disposing of the material; and the compliant disposition of the containers.

3.3.2.3 Newly Generated MLLW Disposition

Newly generated MLLW is waste that was received from generators after September 30, 2000. For newly generated waste that is in a "steady state" waste stream category under the Site Treatment Plan, the waste is stored only long enough to accumulate a sufficient quantity to cost-effectively disposition the waste by treatment, disposal, or recycle. Newly generated waste that is in a "non-steady state" legacy waste stream category will be stored until disposition with the legacy waste in that category.

3.3.3 Low-Level/Industrial Waste Subproject

The objective of the Low-Level/Industrial Waste subproject is to support elimination of the current inventory of low-level/industrial waste on the reservation that was put into storage before September 30, 2000. The goal is to reach a point when only newly generated low-level/industrial waste is available and is placed in storage for the sole purpose of accumulating sufficient quantities to cost-effectively treat or dispose of it.

This subproject includes the following activities:

- solid LLW disposition,
- LLW process residues disposition,
- LLW "special case" waste disposition,
- newly generated LLW disposition, and
- legacy industrial waste disposition.

The LLW special case waste disposition activity includes establishing agreements with disposal facilities for waste that has technical disposal difficulties, performance assessment or administrative limitations at disposition facilities, "as low as reasonably achievable" considerations, repackaging constraints, contemporary program scope limitations, or other challenges.

Newly generated LLW must be characterized and packaged by the generator to meet the waste acceptance criteria of the identified treatment or disposal facility to which it will be shipped. The subproject includes verifying the characterization of 10% of all newly generated waste.

The legacy industrial waste disposition activity includes identification, characterization, and treatment and disposal for the nonregulated industrial chemicals.

3.3.4 Transuranic Waste Subproject

Disposition of transuranic waste on the ORR includes treatment and disposal of solids and sludges. Solid transuranic waste disposition includes transporting the stored legacy contact-handled and remote-handled transuranic solid waste containers in inventory and a portion of the Solid-Waste Storage Area (SWSA) 5N remote-handled transuranic casks to the transuranic Waste Remediation Facility for processing. transuranic sludge disposition includes mixing and transferring remote-handled transuranic sludge from Tank W-35 at ORNL to the Melton Valley Storage Tanks to facilitate treatment and packaging at the Transuranic Waste Remediation Facility in the Melton Valley area of the ORNL.

3.3.5 Waste Disposition Storage Project

The Waste Disposition Storage Project includes storing LLW, MLLW, hazardous wastes, and transuranic wastes. It provides safe, compliant, and cost-effective storage of these wastes in facilities located at the ETTP, the Y-12 Complex, and ORNL. These wastes are contaminated with radiological constituents as a result of past weapons development or research operations at these sites and have been accumulated for treatment and disposal pending development of appropriate technologies, availability of disposal sites, and/or availability of funding. The scope of this subproject also includes closure of storage facilities and waste inventory tracking activities. Storage of transuranic waste is now managed under the transuranic Subproject as of FY 2002.

3.3.6 Reindustrialization

The Waste Disposition Project provides waste disposal support to reindustrialization activities at the ETTP being undertaken by Decontamination and Recovery Services at K-1420. Only minimal quantities of waste, primarily personnel protective equipment, were generated as a result of limited surveillance and maintenance in CY 2001. The project team provides guidance on characterizing, packaging, and certifying wastes in accordance with the ORR Waste Certification Program.

3.4 WASTE OPERATIONS PROJECT

The Waste Operations Project consists of operating and maintaining several facilities throughout the ORR that treat, store, dispose of, or recycle waste generated from any of the ongoing DOE facility operations. The project also addresses some of the waste from past operations in accordance with the Site Treatment Plan. In addition to optimizing each facility's operating capability, a large part of this work entails ensuring that all applicable permit requirements and other environmental requirements are met for each facility.

3.4.1 Y-12 Waste Operations

Facilities operated and maintained at Y-12 by the Waste Operations Project include

- the West End Treatment Facility, including the West Tank Farm and Environmental Support Facility;
- the Groundwater Treatment Facility, including the Liquid Storage facility;
- the Uranium Chip Oxidation Facility;
- the Central Pollution Control Facility, including the Central Mercury Treatment System;
- the East End Mercury Treatment Facility;
- the East End Volatile Organic Compound Plume Treatment System; and
- two industrial landfills and two construction/demolition landfills (see Sect. 2.2.1.3).

In 2001,Y-12 Waste Treatment Operations has accomplished the following project highlights:

- processed nearly 25 million gal of water,
- shipped over 1.2 million kg of sludge from the West End Treatment Facility to Envirocare of Utah, and
- disposed of over 85,000 yd^3 of sanitary and construction/demolition waste at the ORR landfills.

The 2002 work is expected to include the following:

- treatment of 786,000 gal of water at the West End Treatment Facility,
- treatment of 1.8 million gal of water at the Groundwater Treatment Facility/Liquid Storage Facility,
- treatment of 4.9 million gal of water at the Central Pollution Control Facility,
- treatment of 4.5 million gal of water at the Central Mercury Treatment System,
- treatment of 12.7 million gal of water at the East End Volatile Organic Compound Plume Treatment system,
- closure treatment of 145,000 gal of water at the Central Pollution Control Facility, and
- closure of Construction/Demolition Landfill VI.

Landfill operations at Y-12 include disposal at Industrial Landfills IV and V, a Spoil Area at Landfill V, Construction Demolition Landfill VI, Construction/Demolition Landfill VII activities, and postclosure activities at Landfill II. All of these operations were conducted in 2001 with no environmental permit noncompliances or accidents. All waste brought to any of these facilities must be non-RCRA hazardous, meet applicable treatment standards, and meet each facility's waste acceptance criteria.

3.4.2 ORNL Waste Operations

The Waste Operations facilities at ORNL include the Process Wastewater Treatment Complex, the Low-Level Liquid Waste Evaporation Facilities, and the Off-Gas Collection and Treatment Facility. In addition to operating these facilities, Waste Operations supports EM projects by providing waste management and disposition services to cleanup projects. Among the services provided was the transfer of approximately 640,000 gal of liquid low-level waste (LLLW) from on-site generators to the Evaporator Facility in 2001.

The Process Wastewater Treatment Complex treated approximately 164 million gal of process wastewater from ORNL during 2001. The Gaseous Waste Project supports gaseous waste collection and treatment generated from ongoing research and development programs at ORNL. The Interim Waste Management Facility operations are located on the southwest border of the SWSA 6 and are designed to dispose of low volumes of high-activity, short-half-life LLW. The Interim Waste Management Facility began operations in 1991 and has disposed of approximately 3,600 m^3 of waste to date.

3.4.3 ETTP Waste Operations

Waste Operations facilities at ETTP include the following:

- the TSCA Incinerator,
- the Central Neutralization Facility, and
- the Transportable Compressed Gas Recontainerization System.

The TSCA Incinerator treated approximately 1.2 million lb of wastes in 2001. About 202,000 lb (including container weight) of residual waste were sent to Envirocare. A trial burn was conducted in May 2001 to support renewal of the Incinerator RCRA Permit and the EPA approval for polychlorinated biphenyl (PCB) disposal. In July 2001, a request was submitted to TDEC to add three permitted hazardous waste storage units. This request was subsequently approved in January 2002.

The Central Neutralization Facility is a hazardous wastewater treatment facility that treats approximately 35–40 million gal of wastewater each year. The secondary waste sludge generated as a result of the wastewater treatment operations at the Central Neutralization Facility and the TSCA Incinerator is shipped to Envirocare of Utah for final disposal. Waste carbon from the carbon adsorption columns at the Central Neutralization Facility is treated at the TSCA Incinerator.

The Transportable Compressed Gas Recontainerization System analyzes and treats the contents of gas cylinders located throughout the ORR. Treatment operations may include neutralization or flaring. Cylinders with inert or nonhazardous gases are vented. In 2001, approximately 1150 cylinders were recycled, and 1000 cylinders were dispositioned at the recontainerization system.

3.5 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

The sequential steps in a CERCLA project are assessment, investigation, feasibility studies, and remedial actions. To implement CERCLA requirements in Oak Ridge, the EM Program adopted a watershed approach for assessing and investigating areas to determine the best methods for protecting and restoring ecosystems and protecting human health. The basic concept of the watershed approach is that environmental problems in industrial areas are best solved at the watershed level rather than at individual contamination sites. The watershed approach requires consideration of all environmental concerns,

including needs to protect public health as well as critical habitats (such as wetlands), biological integrity, and surface water and groundwater. The watershed approach allows better management strategies for investigations and remediation, thereby maximizing the use of scarce resources. In addition to the information presented here, DOE publishes three annual reports that detail the progress of CERCLA actions in the ORR: *Remediation Effectiveness Report* (DOE 2002b); *Federal Facility Agreement Annual Progress Report* (DOE 2002c), and *Cleanup Progress* (DOE 2002d).

3.6 OAK RIDGE Y-12 COMPLEX

EM projects involving the Y-12 Complex are located in one of three hydrogeologic regimes: Bear Creek Valley, Upper East Fork Poplar Creek, and the Chestnut Ridge hydrogeologic regimes. Bear Creek Valley extends from the west end of the Y-12 Complex approximately 10.2 miles to the Clinch River. A 2-mile section of Bear Creek Valley immediately west of the Y-12 Complex contains numerous waste disposal sites that have been used since 1943. Of these, the three main disposal areas are as follows: (1) the S-3 Ponds, (2) the Oil Landfarm/Bone Yard/Burn Yard area, and (3) the Bear Creek Burial Grounds. Several auxiliary areas were used for the disposal of various liquid and solid wastes contaminated with both radionuclides and chemicals. The major contaminants to surface water and groundwater in Bear Creek Valley are uranium and nitrate with lower concentrations of cadmium and technetium-99.

The Environmental Management Waste Management Facility (EMWMF) is being constructed in Bear Creek Valley. This facility will enable disposition of waste generated as a result of CERCLA activities on the ORR.

The Upper East Fork Poplar Creek Hydrogeologic Regime begins in the western portion of the Y-12 Complex as an underground storm drain system that collects groundwater and storm water. Upper East Fork Poplar Creek encompasses the developed Y-12 Complex industrial area, including certain solid waste management units included in the RCRA Hazardous and Solid Waste Amendments permit and other dispersed areas of contamination resulting from past operations. Water in the storm drain system surfaces in the south-central area of the complex, initially flowing northeast along the southern boundary of the complex, then turning to the northwest as it passes through a gap in Pine Ridge, exiting Upper East Fork Poplar Creek as Lower East Fork Poplar Creek. Upper East Fork Poplar Creek is bounded by the base of Pine Ridge to the north, the base of Chestnut Ridge to the south, and Bear Creek Valley to the west. To the east, Upper East Fork Poplar Creek extends to the ORR boundary at Scarboro Road and includes a contaminated groundwater plume, the East End Volatile Organic Compound Plume, which extends eastward past the boundary to a spring at the intersection of Union Valley Road and Illinois Avenue. The creek drains portions of the ORR and privately held lands to the northeast.

The Chestnut Ridge Hydrogeologic Regime extends from the Upper East Fork Poplar Creek regime southward to Bethel Valley Road and includes soil waste piles, closed disposal units, and abandoned quarries.

3.6.1 Bear Creek Valley S-3 Site Tributary Interception Removal Action

The S-3 Ponds, closed in 1988 and capped with a RCRA cap, are now under RCRA post-closure care and monitoring. Capping of the old ponds has reduced the impacts of contamination; however, groundwater downgradient of the S-3 Ponds has been contaminated. The contaminated groundwater acts as a secondary source of contamination as it discharges into Bear Creek and associated tributaries. The primary contaminants in the surface water are uranium, nitrate, cadmium, and technetium-99. The S-3 Site currently contributes approximately 26% of the risk at the Bear Creek Valley Watershed Integration Point through uranium releases. In addition, discharges of contaminated groundwater to surface water at the S-3 Site are the primary causes of current impacts on the aquatic ecology of Bear Creek.

Because the S-3 Ponds were located on a shallow groundwater and surface water divide, contaminated groundwater plumes emanate from the site and extend both easterly and westerly. This subproject addresses the western plume and

includes the design and implementation of treatment systems for contaminated shallow groundwater discharging to Bear Creek and its tributaries.

The western plume consists of three primary pathways of groundwater flow. Two (Pathways 1 and 2) are shallow-flow regimes that discharge to the main stem of Bear Creek. Both pathways are contaminated, primarily with uranium.

In 2001, the project completed modifications to the Pathway 1 and Pathway 2 systems to improve performance and eliminated system problems that prevented efficient operation. The modifications allow the water to be conveyed from Pathway 1 to the Pathway 2 extraction well. A pump and approximately 1300 ft of discharge line connect Pathway 1 to Pathway 2. The commingled water is then pumped from the Pathway 2 extraction well to the existing treatment boxes at the end of the discharge siphon. Continuous operation of the modified system began on December 22, 2000. During FY 2001, more than 2 M gal of contaminated groundwater were treated by the system.

3.6.2 Bear Creek Valley Phase I Record of Decision

This subproject captures actions that crosscut Bear Creek Valley, including the S-3 Site (Pathway 3), the Oil Landfarm, and the Bear Creek Valley Disposal Area Remedial Action Solid Storage Facility, all discussed in following sections.

Additionally, CERCLA actions in the Bear Creek Valley Burial Grounds and groundwater were delayed to a Phase 2 Bear Creek Valley Record of Decision. Part of the decision to delay actions in the Bear Creek Valley Burial Grounds was based on the need for a cost-effective technology to manage the waste if it is left in place.

3.6.2.1 S-3 Site (Pathway 3)

Pathway 3 is deeper and travels through the bedrock along a strike, discharging nitrate- and cadmium-contaminated groundwater to two tributaries of Bear Creek (NT-1 and NT-2).

The objective of this subproject is to capture and treat contaminated groundwater so that risk to human health and the environment may be reduced to levels consistent with the goals of the Bear Creek Valley Phase I Record of Decision.

In 2001, the collection of data from the Pathway 3 predesign study system was completed. The predesign system consisted of collection trenches filled with limestone and a treatment cell of apatite (a calcium phosphate mineral). This system is being evaluated as an alternative to the zero-valent iron used at Pathways 1 and 2. Also in 2001, preparation was begun to meet the June 21 milestone for the remedial design report/remedial action work plan for a groundwater interception trench filled with reactive media for Pathway 3; however, it was agreed to extend this milestone to April 6, 2002, so that the results of the predesign study and performance data could be incorporated into it.

3.6.2.2 Bear Creek Valley Oil Landfarm Area

There are two release sites associated with the Oil Landfarm Area: (1) the Bone Yard/Burn Yard, including Bear Creek Tributary 3 Floodplain Soils and the Hazardous Chemical Disposal Area (part of The Bone Yard/Burn Yard); and (2) the Oil Landfarm Soils Containment Pad. Combustible wastes at the Bone Yard/Burn Yard, including uranium turnings, were placed either on the surface or in trenches and set on fire. The area also was used for abandoned equipment laydown, which resulted in surface contamination. This waste is now leaching to shallow groundwater that discharges to surface water. This site is the major contributor to risk levels in the valley. Disposals at the Bone Yard/Burn Yard took place from 1943 to 1970.

The Hazardous Chemical Disposal Area was used from 1975 to 1981 to dispose of chemicals deemed hazardous to plant workers, including acids, bases, and miscellaneous liquids. The area was capped with a RCRA-like cap in the 1980s. This site is located on the Bone Yard/Burn Yard.

The Oil Landfarm Soils Containment Pad is a below-grade storage pad covered with a Rubb temporary structure. The pad contained 570 yd^3 of PCB-contaminated soils excavated during the

RCRA closure of the Oil Landfarm. The structure and soils have been removed and disposed of.

The objective for the Bone Yard/Burn Yard remedial action was to implement a series of hydraulic isolation measures designed to substantially reduce the uranium flux entering Bear Creek from this site and to "dry" the site out in preparation for excavating the waste in FY 2001. Additionally, the objective for the Oil Landfarm Soil Containment Pad remedial action involves final disposition of the soils stored at the facility and demolition of the temporary storage building and concrete pad. Work being conducted is divided into three phases:

- Phase I: remedial design,
- Phase II: hydraulic isolation at the Bone Yard/Burn Yard and removal/disposal of Oil Landfarm Soils Containment Pad, and
- Phase III: excavation and disposal of the Bone Yard/Burn Yard waste.

The following actions were taken during 2001.

- The Bear Creek Valley Bone Yard/Burn Yard Phase II remedial action, which included clearing and grubbing, hydraulic control, borrow area operation and maintenance, and site restoration, was completed.
- Remedial action of the Oil Landfarm Soils Containment Pad, which included demolition of the structure and excavation and off-site disposal of the soils, was performed.
- The D1 Oil Landfarm Soils Containment Pad phase construction and completion report was submitted to EPA and TDEC on February 6, 2001, for review and comment. Approval of the D1 phase construction and completion report was received from TDEC on July 13, 2001, and from EPA on July 16, 2001.
- The D1 Bone Yard/Burn Yard sampling and analysis plan was submitted to EPA and TDEC on July 25, 2001, for review and comment.
- Field sampling for waste acceptance criteria for disposal in EMWMF was completed.
- Start-up of excavation at the Bone Yard/Burn Yard was delayed because of the delayed opening of the EMWMF.

3.6.3 Environmental Management Waste Management Facility

The purpose of the EMWMF project is to build a CERCLA mixed-waste disposal facility for the ORR. Waste generated from cleanup of waste sites on the ORR and sites off the ORR that have been impacted by past operations is to be disposed of in the EMWMF pending compliance with the waste acceptance criteria. The decision for on-site waste disposal from the CERCLA cleanup of ORR is documented in the record of decision for this project, which was approved by EPA, TDEC, and DOE on November 2, 1999. The EMWMF project involves designing, constructing, operating, closing, and conducting post-closure activities for a mixed hazardous waste and LLW disposal facility. This facility is compliant with requirements of RCRA, TSCA, and DOE orders for LLW disposal and has been upgraded to accept DOE classified waste. The detailed design and construction phase is nearly complete, with operations to begin in late May 2002.

The RCRA-compliant liner consists of a leachate collection system above the primary liner and a leak detection system between the primary liner and secondary liner. The leachate collection system is designed to collect leachate from accumulating on the primary liner; the leak detection system is designed to detect leachate moving through the primary liner. A three feet thick compacted clay liner is the final component of the multilayer liner system that prevents waste contained in the disposal facility from migrating into or contacting groundwater. Additionally, surface water will be rerouted away from the disposal facility area, storm water controls are in place to prevent erosion and impacts to the surface water, and a groundwater monitoring program has been installed to monitor groundwater quality beneath the facility. Phase 1 of the project is nearing completion, that is design, construction, and operation of a 400,000-yd^3 facility.

Operations of the EMWMF include receiving wastes that have been certified to meet the waste acceptance criteria. When received by the EMWMF for final disposal, the waste is placed in one of two initial cells of the disposal facility, filling one cell at a time. Trucks carrying waste

arrive at the EMWMF with waste receipt documentation detailing information such as the waste lot, waste characterization, and volume. After each load of waste is weighed, and the waste receipt documentation is in order, the load is cleared to enter the disposal facility. The truck proceeds directly to the disposal cell and backs into the workface area on a clean dump ramp, where the waste is offloaded. Each truck is surveyed by a radiation control technician at the workface before departing the area. If the truck is found to be contaminated, it is decontaminated and rechecked for contamination before leaving the cell area. Waste placed in the active disposal cell is assigned a grid location, and the geoglobal positioning system is used to measure the depth, which is recorded with the waste receipt documentation. A layer of clean soil obtained from a borrow area is placed over each compacted waste layer or large item of waste. Decontamination water, leachate, or contact water is spread over the waste to facilitate compaction, and cover soil or a soil fixative agent is applied as needed to ensure that airborne contaminants do not escape the cell as dust. When a cell is filled, a temporary cap for that portion of the disposal cell is put into place. During operations, a detection monitoring system is to be employed to ensure that the facility does not release contaminants to the environment.

The record of decision included expansion of the facility to nominally 1.3 million yd^3, which is based on the waste generation forecast for the ORR. During operations, a separate procurement process is used to complete the facility expansion (Phase 2) to the maximum site capacity. After revising the current design, construction of the expansion, likely to begin in FY 2004, is to occur without impact to Phase 1 operations of the EMWMF.

The following actions took place during 2001:

- four quarters of baseline groundwater data were collected;
- more than 75% of the EMWMF construction was completed;
- development of the D3 EMWMF Waste Acceptance Criteria Attainment Plan continued; and
- the project was delayed four months (November 2001 to March 2002) because of the request of a regulator to add a geobuffer and because of a stand-down due to a fire.

The baseline monitoring report, which contains threshold values for post-operations monitoring of groundwater, was issued in May 2002.

3.6.4 EMWMF/Transuranic Stream Restoration

Construction activities at a number of sites throughout the reservation will impact streams. These impacts will be mitigated on a reservation basis, as opposed to mitigation during each individual construction activity. This subproject will design and construct stream restoration mitigation activities associated with CERCLA actions throughout the reservation.

The following actions were taken during 2001.

- Potential on-site and off-site locations were evaluated for obtaining necessary stream mitigation credits. The Royal Blue Wildlife Management Area and Great Smoky Mountains National Park were tentatively selected as the candidate sites to address stream impacts caused by EMWMF construction.
- Stream reconnaissance and surveys were conducted as initial steps in the development of the conceptual plan.

3.6.5 East End Volatile Organic Compound Plume

The purpose of this project is to complete the non-time-critical removal action by implementing a cost-effective, near-term action for mitigating off-site migration of the Y-12 East End Volatile Organic Compound Plume as defined in the approved action memorandum. The project scope includes installation of the treatment system, preparation of the removal action report, and start-up of the treatment system.

The D1 treatability study work plan for the deployment of a pilot-scale bioremediation system for the East End Volatile Organic Compound Plume was submitted to EPA and TDEC on June 11, 2001, for review and comment.

3.6.6 Upper East Fork Poplar Creek Record of Decision—Phase 1

The objective of this project is to complete remedy selection and documentation of the selected remedy pursuant to CERCLA for Phase 1 remedial actions in the Upper East Fork Poplar Creek Characterization Area. The Phase 1 record of decision focuses on interim source control actions for remediation of mercury-contaminated surface water. Subsequent records of decision address soil remedial actions for worker protection, additional surface water actions as necessary, building decontamination and decommissioning, and groundwater actions.

The following actions were taken in 2001.

- The D3 feasibility study addendum was submitted to EPA and TDEC on December 18, 2000, for approval. Approval was received from TDEC and EPA on January 8, 2001.
- The D2 proposed plan was submitted to EPA and TDEC on December 18, 2000, for approval.
- The D3 proposed plan was submitted to EPA and TDEC on February 6, 2001, for approval. Approval was received from TDEC on January 8, 2001, and from EPA on February 8, 2001.The proposed plan was issued for public comment on January 25, 2001, and a public meeting was held on February 22, 2001.
- The D1 record of decision was submitted to EPA and TDEC on June 25, 2001, for review and comment.
- The D2 record of decision was submitted to EPA and TDEC on September 26, 2001, for approval.

There have been numerous extensions to the milestone submittal dates for the proposed plan, the record of decision, and the subsequent remedial design work plan to accommodate resolution of issues. A D3 proposed plan was required by the regulators.

3.6.7 Mercury Treatability and Abatement Studies

This project is designed to comply with mercury-concentration limits in Upper East Fork Poplar Creek required by the Y-12 Plant National Pollutant Discharge Elimination System permit. Specifically, it seeks to eliminate or mitigate mercury-contaminated effluent or to capture it for treatment. The two specific actions currently identified address mercury in soils and bank stabilization. This project includes three treatability study work plans that will be used to support future CERCLA decisions.

The technical objectives of this project include completion of the noninvasive characterization technology demonstration and verification sampling and analysis plan, completion of bank stabilization and verification sampling, continuation of monthly and quarterly sampling, and the preparation of the annual Mercury Abatement Report.

The following actions were taken in 2001.

- The FY 2001 Mercury Abatement Report was completed.
- Verification sampling and evaluation of the noninvasive characterization technology was completed.
- An evaluation was completed of the hydraulic connectivity for Upper East Fork Poplar Creek to support future remedial decisions for the Building 81-10 area and for the 9201-2/Outfall 51 area.
- The in situ grouting treatability study for mercury in soils was begun.
- The treatability study for evaluating alternatives to low-temperature thermal desorption for mercury in soils was begun.

3.7 EAST TENNESSEE TECHNOLOGY PARK

The CERCLA projects at ETTP can be divided into two broad categories: remedial action and decontamination and decommissioning projects. Remedial action projects address contaminant releases to the environment by cleaning or treating contaminated soil, water, sediment, or biota. Decontamination and decommissioning

projects address contamination in facilities and structures. Both kinds of projects address hazardous and radioactive contamination and compliance issues resulting from implementation of the projects.

3.7.1 Remedial Actions

3.7.1.1 K-1070-A Contaminated Burial Ground

The K-1070-A Burial Ground, located in the northwest corner of ETTP, was used for the disposal of several types of waste from the 1950s through the mid-1980s. The burial ground contains primarily uranium-contaminated waste from ETTP and other operations buried in unlined trenches and pits. Thorium-contaminated and pyrophoric waste and uranium hexafluoride (UF_6) cylinders are also included in burial records at the site. Investigations have concluded that groundwater underlying the burial ground is contaminated and that the plume is migrating southward toward the K-901-A Holding Pond.

This project includes the excavation of the waste deposited in the trenches and pits. Groundwater and adjacent soils will be addressed under future CERCLA decisions.

The following actions were taken in 2001.

- TDEC approved the D2 remedial design report/remedial action work plan on August 22, 2001.
- A waste media characterization plan was submitted to EPA and TDEC to aid in the review of the remedial design report/remedial action work plan.
- Waste media characterization sampling was completed; 230 samples were collected from the source and from surrounding areas in the fall of 2001.
- Limited site mobilization and preparation work was completed.

3.7.1.2 K-1070-C/D G-Pit and K-1071 Concrete Pad Remedial Action

The K-1070-C/D Classified Burial Ground is located on the eastern side of ETTP. The burial ground is composed of several disposal areas: large trenches, small pits, three earthen dike areas, a land farm, and a concrete pad. Both low-level radioactive and nonradioactive, nonhazardous waste materials and equipment were buried in the large trenches. The small pits were used for the disposal of segregated liquid and glass wastes, including some hazardous and radioactive wastes. One of the pits, G-Pit, is considered to be a continuing source of contamination to groundwater. The K-1071 Concrete Pad was used to compact metal drums before burial and has been identified as a source of radiological contamination. Contaminants of concern at the burial ground are volatile and semivolatile organics, uranium-contaminated scrap metal, uranium compounds, lead, and other metals.

A remedial investigation/feasibility study was performed for the K-1070-C/D area. Results indicated the need for remediating two sites in the K-1070-C/D Classified Burial Ground: the K-1071 Concrete Pad and the G-Pit.

The record of decision for the K-1070-C/D Operable Unit was approved in January 1998. It mandated the excavation and temporary storage of wastes from the G-Pit at ETTP and the placement of a soil cover over the concrete pad area. The G-Pit project was divided into two phases: Phase I was the excavation of approximately 230 yd^3 of soil; Phase II consists of thermal desorption and disposal of excavated soil. Phase I was completed in 2000.

The following actions were taken in 2001.

- Low-temperature thermal desorption treatment was completed of approximately 230 yd^3 of contaminated soil excavated during Phase 1.
- A special waste request was prepared and was submitted to TDEC for disposal of the treated soil in the ORR Industrial Landfill.
- A risk assessment to address the option of spreading the treated soil in the K-1070-C/D Area was prepared and was submitted to EPA and TDEC. The results indicate no unacceptable risk to future industrial workers from this soil material.
- The D1 remedial action report was submitted to EPA and TDEC on July 16, 2001, for review and comment.

Final disposition of the treated soils has been delayed due to the presence of ^{99}Tc. The TDEC review special waste request was delayed while DOE discussed the topic of acceptable radioactivity levels in soil with several TDEC divisions: Radiological Health, Solid/Hazardous Waste Management, and DOE Oversight. TDEC has now resumed review of the request.

3.7.1.3 Phase I K-1085 Old Firehouse Burn Area Drum Burial Site Removal Action

The K-1085 Old Firehouse Burn Area Drum Burial Site (Drum Burial Site) is located outside the ETTP perimeter fence within an area bounded by State Highway 58, Bear Creek Road, and Powerhouse Road. The Drum Burial Site consisted of five locations that were identified using geophysical investigation results and a sixth area identified during Tennessee Department of Transportation construction activities. The scope of the time-critical removal action consists of excavation of all drums, including drum fragments; excavation of waste that has escaped from ruptured or deteriorated drums; and excavation of discolored soil to a depth of approximately 7 ft below grade or until all drums, drum fragments, and discolored soil have been removed from the six areas. In addition, the scope includes disposition of the associated waste streams.

The following actions were taken in 2001.

- A time-critical removal action memorandum was submitted on March 28, 2001.
- All wastes were excavated, characterized, and placed into proper storage containers located in a secured area within the area of concern, and the excavation areas were restored. Waste characterization indicated that part of the material is a mixed waste that will require treatment prior to disposal. The remainder of the waste is LLW that will not require treatment.
- Final disposition of the waste was delayed pending receipt of funding for treatment of mixed waste.
- All excavated areas were restored, allowing the state highway project to proceed.

3.7.1.4 ETTP Zone 1 Record of Decision

This project addresses an area of approximately 1400 acres located outside of the ETTP main fence and surrounding the former main plant production area.

The following actions were taken during 2001.

- A proposed plan and a record of decision were developed for Zone 1 based on information available in the draft site-wide remedial investigation/feasibility study, which will not be finalized.
- An agreement was reached on soil remediation levels for Zone 1.
- TDEC approval of the D3 proposed plan was received on July 6, 2001; EPA approval was received on August 8, 2001. The plan was submitted for public comment on August 15, 2001.
- A public meeting was held to receive public comments on the D3 proposed plan on September 6, 2001.
- Work began on the record of decision.
- Submittal of the D1 record of decision was delayed from April to October 31, 2001, due to a D3 proposed plan being required for approval instead of approval on the D1 proposed plan as originally planned.

3.7.2 Decontamination and Decommissioning

3.7.2.1 K-25 Auxiliary Facilities Area Demolition Group I Building Demolition Removal Action

The five facilities included in the K-25 Auxiliary Facilities area Demolition Group I Building Demolition are K-724, K-725, K-1031, K-1131, and K-1410.

Decontamination and decommissioning of these facilities was performed as a CERCLA non-time-critical removal action under the guidelines of the May 22, 1995, joint DOE and EPA *Policy on Decommissioning of Department of Energy Facilities under CERCLA* (DOE-EPA 1995).The engineering evaluation/cost analysis was sub-

mitted in April 1996, the D1 action memorandum was submitted in September 1996, and the D2 action memorandum was approved in January 1997. All buildings had been demolished to ground level by June 1999.

After demolition, the building concrete slabs were scabbled in an attempt to remove fixed contamination. The K-724 slab and a large portion of the K-725 slab were successfully cleaned to unrestricted-use levels. After two passes with scabbling equipment, contamination was still present on the K-1031, K-1131, and K-1410 concrete slabs. The exposed concrete slabs from K-1031, K-1131, and K-1410 had the potential to weather and create mobile, transferable contamination in close proximity to surface waters and storm drains. A 2-in. layer of asphalt was applied to cover the concrete slabs, thereby stopping the weathering of the fixed contamination and helping to reduce the potential spread of radioactive contamination. Because the Group I Auxiliary Facilities removal action is an interim action, future CERCLA decisions will determine the final remedy for the contaminated slabs, soils, and below-grade structures. Remaining activities for this project are debris removal.

In 2001, the project:

- Completed the disposition of 945 ft^3 of industrial waste to the ORR Industrial Landfill Facility.
- Delayed disposition of 5800 ft^3 of low-level radioactive waste (LLW) to take advantage of cost savings of approximately $250,000 by disposing of this waste in the EMWMF instead of the Environcare facility in Utah.

3.7.2.2 K-25 Auxiliary Facilities, Group II Buildings Demolition, Main Plant Buildings

The CERCLA buildings included in the K-25 Auxiliary Facilities, Main Plant Buildings Demolition project are K-1300, K-1301, K-1302, K-1303, K-1405, K-1407, K-1413, and their associated appurtenances. A broad-scope engineering evaluation/cost analysis for the K-25 Auxiliary Facilities Group II buildings was issued in February 2000. The main plant buildings are within its scope. An action memorandum for the K-25 Auxiliary Facilities Demolition Project Main Plant Buildings was approved in August 2000.

The decontamination and decommissioning of these facilities are being performed as a CERCLA non-time-critical removal action. The facilities will be demolished to grade; the concrete floor slabs will remain in place. The slabs will either be decontaminated to unrestricted levels to remove fixed contamination, removed, or covered with asphalt to prevent the potential for the spread of radioactive contamination. Because the Group II Auxiliary Facilities removal action is an interim action, further CERCLA decisions will determine the final remedy for the contaminated slabs, soils, and below-grade structures.

In 2001, three buildings were demolished under CERCLA—K-1301, K-1405, and K-1407. In addition, three Federal Facility Agreement buildings were demolished under the National Environmental Policy Act of 1969 (NEPA)—K-1045A, K-1404, and K-1408.

The project completion was extended to accommodate the time required for safe demolition and disposal of overhead vent lines. Characterization data obtained during the removal action confirmed the presence of radiological material in the overhead lines. A nondestructive assay was used to evaluate the overhead vent lines; the assay confirmed the presence of radiological deposits. Fissile material controls that were not addressed in the original removal action schedule must be executed in the demolition and disposition of the overhead lines.

3.7.2.3 K-25/K-27 Buildings

The scope of this project is to disposition the radiologically contaminated K-25 and K-27 buildings under a non-time-critical removal action. The K-25 Building "footprint" covers approximately 1.6M ft^2. The K-25 Building contains approximately 3000 stages of gaseous diffusion process equipment and associated auxiliary systems, which will be removed and disposed as part of the decontamination and decommissioning process. Each stage consists of a converter, two compressors, two compressor motors, and associated piping. The K-27 Building footprint covers approximately 383,000 ft^2. The K-27 Building contains approximately 540 stages

of gaseous diffusion equipment and associated auxiliary equipment.

The scope of this project includes the following:

- preparation of CERCLA documents;
- hazardous material abatement;
- equipment dismantling and removal;
- demolition of buildings, structures, and appurtenances; and
- disposal of waste at appropriate disposal facilities.

The following actions were taken in 2001.

- The D1 engineering evaluation/cost analysis was submitted to EPA and TDEC on May 12, 2001, for review and comment. The D2 engineering evaluation/cost analysis was submitted on June 4, 2001. The D3 engineering analysis/cost analysis was submitted on July 3, 2001. Approval of the D3 engineering evaluation/cost analysis was received from TDEC on July 13, 2001, and from EPA on August 3, 2001.
- A public information session on the D3 engineering evaluation/cost analysis was held on August 16, 2001.
- The Phase I Hazardous Materials Abatement subcontract was awarded.

The submittal of the D1 action memorandum was delayed from September to October 2001 to accommodate a D3 version of the engineering evaluation/cost analysis and an extension of the public comment period for it. The extension of the public comment period was in response to a request.

3.7.2.4 K-29, K-31, and K-33 Equipment Removal and Building Decontamination

The scope of this project is to remove and disposition all radiologically and nonradiologically contaminated process and process-support equipment from the gaseous diffusion process buildings (K-29, K-31, and K-33) and to decontaminate the interior of the buildings to a specified endpoint criterion under a non-time-critical removal action. The purpose of the project is to clean out the three buildings so that they are available for reuse without radiological and other (nonradiological) concerns. The three buildings contain 4.89M ft^2 of space under roof and 136,000 tons of contaminated or potentially contaminated material. The material is made up of approximately 1800 stages of gaseous diffusion process equipment and associated auxiliary systems, which will be removed and disposed of as part of the dismantlement and disassembly process. Each stage consists of a converter, compressor, compressor motor, associated piping and valves, and electrical support components. The scope also includes the dismantlement and removal of the K-31 and K-33 Switchyard equipment and packaging, transportation, and disposal of 20,000-plus drums of stabilized pond and Portsmouth soils waste from Buildings K-31 and K-33.

The project is a DOE fixed-price prime contract with BNFL, Inc. BNFL, Inc. decontaminates and recycles the materials and equipment where economically feasible and disposes of all nonrecyclable project waste at regulated facilities (i.e., Envirocare of Utah and the Nevada Test Site). To date, BNFL has dispositioned 68,775 tons of metal from the K-33 Building, either as LLW or as recycled metal.

The following actions were taken in 2001.

- The project reached 54% total completion.
- Building K-33 reached 90% completion.
- A total of 35,775 tons of metal was dispositioned from Building K-33.
- An additional 12,250 tons of metal was dismantled within Building K-33. This material is awaiting disposition through supercompactor, classified and/or unclassified controlled nuclear information material disposal, or recycling.
- An on-site supercompactor for compacting the LLW to reduce disposal volume started full operation on March 2, 2001.
- The first classified LLW shipment to the Nevada Test Site was made on April 12, 2001.
- K-31 operation and cell floor dismantlement and disposal started in March and April, 2001, respectively.

- Dismantlement and disposal of five of the eight cascade units in the K-33 Building were completed.
- Closure of waste pile units in Buildings K-31 and K-33 was completed as partial closure of Permit TNHW-056.

Certain critical-path dismantlement items (i.e., converters) continue behind schedule, but BNFL and DOE are working to perform some activities in parallel to recover the overall project schedule by January 2003. Building K-33 will be completed approximately 9 months behind schedule.

The secretary of energy's moratorium on release of volumetrically contaminated nickel and suspension of the release of surface-contaminated material into commerce has impacted the project. DOE and BNFL are working to resolve these impacts on both cost and schedule.

Fissile material operations were suspended November 1, 2001. Both DOE and BNFL are working on resolution of problems and full resumption, but this issue will have a negative impact on the progress of the project.

3.8 OAK RIDGE NATIONAL LABORATORY

As at the Y-12 Complex, ORNL CERCLA activities can be grouped into remedial action and decontamination and decommissioning projects with definitions similar to those at ETTP. Additionally, ORNL hosts a Nuclear Material Facility Stabilization program that is addressing radioactive contamination in abandoned reactors before they become candidates for decontamination and decommissioning.

3.8.1 Remedial Actions

Remedial actions at ORNL are being addressed in two watersheds: Bethel Valley (the main area of ORNL) and Melton Valley, which is south of the ORNL main plant area and where most of the historic waste disposal operations took place.

3.8.1.1 Melton Valley Remedial Actions

Melton Valley Watershed Record of Decision for Interim Actions Project

CERCLA areas located in the Melton Valley Watershed at ORNL are addressed under this project. The project used existing data, supplemented by a small amount of new data, to prepare a record of decision for interim actions for the watershed. Source units in the watershed were evaluated as a single entity to ensure that (1) a consistent approach to remediation was implemented across the valley and (2) remedial actions at specific sites were prioritized to achieve the greatest risk reduction. Selection of the preferred alternative for the remediation of the Melton Valley watershed led to the establishment of remediation goals and the identification of the sequence of actions to be taken during watershed remediation. The record of decision was signed by the Federal Facility Agreement parties in September 2000. Tasks under this project following the record of decision include approval of the remedial design work plan, approval of the land use control implementation plan, submittal of an engineering evaluation of the feasibility of removing transuranic waste from some trenches in SWSA 5 North and South, submittal of a sampling and analysis plan for ecological monitoring, and submittal of a monitoring plan to collect data needed to determine the effectiveness of remedial actions. In 2001, all of these documents were submitted to the regulators.

Solid Waste Storage Area 4 Capping/ Intermediate Holding Pond Remediation Project

The first major remedial action resulting from the Melton Valley Watershed Record of Decision is remediation of the Intermediate Holding Pond and installation of approximately 30 acres of a multilayer engineered cap over SWSA 4, along with upgradient and downgradient groundwater interception trenches to isolate the SWSA 4 buried wastes from groundwater. Sediments will be excavated from the Intermediate Holding Pond and will be disposed of in the EMWMF. The Remedial Design Report/Remedial Action Work

Plan was submitted, and development of the borrow area and upgrading of the haul road were completed in 2001.

3.8.1.2 Bethel Valley Remedial Actions

Bethel Valley Watershed Record of Decision

A record of decision is being developed for the Bethel Valley Watershed. The remedial investigation/feasibility report in support of the record of decision was approved by the regulators in August 1999. In 2000, the proposed plan was approved, and a draft record of decision was submitted to the regulators. Negotiations on the record of decision neared completion in 2001.

Gunite and Associated Tanks Project

The Gunite and Associated Tanks (GAAT) project consists of the eight underground gunite tanks associated with two tank farms located in the center of the ORNL main plant area. Tanks W-3 and W-4 are in the North Tank Farm; W-5, W-6, W-7, W-8, W-9, and W-10 are located in the South Tank Farm. These inactive tanks, installed in 1943 to store liquid wastes, were used as the main holding tanks for the LLLW system at ORNL. The GAAT project is separated into three components: (1) removal of residual sludge in the tanks as part of an interim action record of decision, (2) stabilization of the tanks under an action memorandum, and (3) final site closure under the Bethel Valley Record of Decision.

Removal of tank contents was completed in September 2000. In 2001, the tanks were stabilized by filling them with grout, and an asphalt cover was placed over the South Tank Farm for soil stabilization.

ORNL Main Plant Surface Impoundments

The Main Plant Surface Impoundments, originally consisting of four surface impoundments located in the south-central portion of the ORNL main plant area, were used to collect, mix, or store untreated wastewaters. Transfer of the sediment and underlying soil from the two smaller impoundments, C & D (3539 and 3540), to Impoundment B (3513) was completed in 1998. Transfer of the sediment and underlying soil from Impoundment A (3524) to B and backfilling of Impoundment A were completed in 2000. A treatment facility for the consolidated sludge and subimpoundment soil from Impoundment B was completed, and sludge removal and treatment began in 2001. The final waste forms are being staged for shipment and disposal at an approved facility.

Prior to remediation of Impoundment B, inactive discharge pipes were sealed to prevent seepage through the impoundment berm. The berm is routinely inspected for signs of seepage or erosion, and corrective actions are taken as required.

Bethel Valley Main Plant LLLW Tanks Removal Action

ORNL has nearly completed a comprehensive program to upgrade the LLLW system to meet the Federal Facility Agreement requirements. Tank systems that do not meet these requirements have been removed from service, characterized, and remediated. As of the end of 1998, all LLLW tanks that did not meet the Federal Facility Agreement requirements for active service had been removed from service. The inactive tanks are being remediated within the CERCLA framework. Tanks with little associated risk were remediated as maintenance actions with regulatory concurrence. Tanks with more associated risk were remediated based upon an approved engineering evaluation/cost analysis and an action memorandum. Final decisions on the tanks will be documented in the Bethel Valley Record of Decision.

An action memorandum was approved in May 1999 for removal of waste from 11 inactive LLLW tanks and was modified in September 1999 to include the remaining 16 inactive tanks. In 2001, three tanks containing residual sludge mixed with resin (T-1, T-2, and HFIR) were deleted from the scope of the removal action because of the difficulties associated with converting the sludge to a form that can be disposed of. Remediation of these tanks will be addressed under the Bethel Valley Record of Decision. Removal of residual sludge and filling with grout was completed for the remaining 24 tanks.

Core Hole 8 (Tank W-1A) Plume Source Removal

The liquid radioactive waste collection/storage Tank W-1A was commissioned in 1951 and remained in service for 35 years, until 1986. Tank W-1A was used as a storage tank for wastes from the high-radiation analytical facilities (Buildings 2026 and 3019) and the isotope separation building (3019B). During rock-coring activities in 1991, high concentrations of radiological contamination were detected in groundwater in the central main plant area of ORNL at a location designated as Core Hole 8. Subsequent groundwater sampling in 1995 indicated significant gross beta and alpha contamination in the vicinity of Tank W-1A in the North Tank Farm. Actions have been taken to intercept and treat the contaminated groundwater.

The plume source removal project is focused on the removal of Tank W-1A and the surrounding soils suspected of being a primary source of contamination to groundwater. A remedial action work plan was approved by the regulators in March 1999, and field work began in August 1999. Additional soil analyses performed in 1999 indicated higher-than-expected levels of some radionuclides, requiring modification of plans for excavation and disposal of the soil. Tank contents were removed in November 2000, and 90% of the contaminated soil was excavated. Unexpectedly high concentrations of transuranic contaminants were encountered while excavating soils immediately surrounding the tank. Excavation of this material was not within the approved scope of the removal action. The tank and approximately 100 yd^3 of highly contaminated soil were left in place to be addressed by a future CERCLA action, and the excavated area was backfilled to protect ORNL workers and to minimize contaminant migration.

3.8.2 Decontamination and Decommissioning

3.8.2.1 Molten Salt Reactor Experiment

The Molten Salt Reactor Experiment facility was an experimental reactor fueled by molten uranium tetrafluoride salt and cooled by molten salts of lithium and beryllium. It operated from 1965 to 1969. After being shut down, the reactor was mothballed. The fuel was solidified in tanks for long-term storage, and surveillance and maintenance programs were initiated.

In subsequent years, a number of potential problems were found in the facility. Samples of off-gas revealed that fluorine and uranium hexafluoride gas were being emitted, leading to the discovery of a 15-kg deposit of uranium in a charcoal-bed off-gas filter. Because the charcoal bed was within a water-filled chamber, it raised a concern that a nuclear criticality was possible. In addition, the fluorine had reacted with the charcoal to form chemically unstable compounds. These discoveries led to the initiation of remedial actions, which began in 1994, to reduce or eliminate three potential risks: a nuclear criticality accident, an explosive release of radioactive material, and a release of reactive and/or radioactive gases.

Removal of reactive uranium hexafluoride gas began in 1996 and was completed in 1999, resulting in the removal of approximately 22.6 kg of uranium.

In 1996, an action memorandum for removal of uranium deposits from the charcoal bed was issued. A remedial action work plan was approved in 1999, but examination of the charcoal revealed that it is nongranular rather than granular, as had been assumed. Consequently, a revised approach and remedial action work plan were submitted to the regulators and were approved in 2000. Installation of equipment and removal of the uranium deposits were completed in 2001.

A record of decision for removal of fuel and flush salts was signed in 1998. The remedial design report/remedial action work plan was approved by the regulators in 1999. Installation of fuel and flush salt removal equipment was completed in 2001.

3.8.2.2 Metal Recovery Facility

The Metal Recovery Facility is a one-story, metal-sided building that was used as a pilot and small-scale nuclear fuel reprocessing plant between 1952 and 1960. Associated with the Metal Recovery Facility are an exterior concrete canal, a small storage facility, and, interior to the

facility, a dissolver pit and seven hot cells. The facility was used primarily to recover fuel and other nuclear materials. The fuel reprocessing occurred in the hot cells; fission products were also separated out. Demolition of above-grade structures was completed in 2001. Also in 2001, the dissolver pit was drained and the subsurface structures of the canal and dissolver pit were filled with a low-strength cement and gravel mixture. The waste generated by this project was disposed of at an approved facility.

3.8.2.3 Old Hydrofracture Facility

Between 1964 and 1980, waste liquid and suspended solids from the ORNL main plant LLLW system were decanted and pumped to five tanks at the Old Hydrofracture Facility, from which the radioactive liquid was mixed with grout and injected deep into shale bedrock. The Old Hydrofracture Facility Impoundment was a riprap-lined pond used between 1965 and 1979 to receive various types of wastes from the facility operations. Remediation of the tanks and impoundment was completed in 2000.

The CERCLA remedial action, which is part of the Melton Valley Record of Decision, addresses the decontamination and decommissioning of the Old Hydrofracture Facility structures and equipment, which must be completed before installation of a cap on SWSA 5. Inactive buildings, surplus aboveground structures, and equipment items at the site will be removed to ground level. Subsurface structures will be filled with concrete or other inert and stable material. Structures and equipment to be addressed include the Old Hydrofracture Facility Building, pumphouse and valve pits, the above-grade portion of Waste Pit T-4, abandoned tank remediation equipment, and miscellaneous debris.

Demolition of the aboveground structures began in 2001.

3.8.2.4 SWSA 4 Small Facilities

Prior to installation of the SWSA 4 cap, described in Sect. 3.8.1.1, existing facilities and equipment within the cap footprint must be demolished to slab. The facilities and equipment to be demolished as part of this project include the Alpha Greenhouse Facility, Decontamination Facility, Pilot Pits Building, Solid Waste Leaching Lysimeters, and five shielded transfer tanks adjacent to the Decontamination Facility.

The shielded transfer tanks were transferred to a storage location, and demolition of the remaining facilities was completed in 2001.

3.8.2.5 New Hydrofracture Facility

The New Hydrofracture Facility was constructed in 1980, following the closure of the Old Hydrofracture Facility, to serve as the operational hydrofracture waste disposal facility for ORNL. The facility performed 13 operational injections, averaging approximately 220,000 gal of waste/grout mixture per injection, between June 1982 and January 1984. The New Hydrofracture Facility CERCLA action addresses decontamination and decommissioning of surface structures and equipment. Above-grade structures (e.g., Building 7860, bulk storage bins) will be demolished to 2 ft below grade; the remaining below-grade structure and equipment (e.g., piping, valves, pumps) will be grouted in place. The contents of underground tank T-13 will be removed, and the tank shell will be grouted in place. In 2001, the remedial design report and remedial action work plan were submitted to the regulators for review and comment.

3.8.2.6 Hydrofracture Wells Plugging and Abandonment

Between the 1960s and mid-1980s, the process of deep injection of waste was used at ORNL to dispose of radioactive liquids and sludges in mixtures of waste with portland-cement-based grout and various additives. Two experimental injection wells, called HF-1 and HF-2, were constructed, along with boreholes and wells, to observe the behavior of the injected grout in the bedrock. Small quantities of radionuclides were added to the injected grout to make the grout sheet detectable with instrumentation. The third and fourth injection wells, called the Old Hydrofracture Facility and the New Hydrofracture Facility, along with numerous observation and monitoring wells and boreholes, were constructed for large-scale radioactive waste disposal. The waste disposals were generally at depths greater than 780 ft. The injection and monitoring

wells and boreholes provided potential pathways for migration of radionuclide contamination. To prevent this migration, the four injection wells and about 100 associated monitoring wells and boreholes will be plugged and abandoned, as specified in the Melton Valley Record of Decision.

The remedial action work plan for this project was approved, and 33 monitoring wells were plugged and abandoned in 2001.

3.8.3 Spent Nuclear Fuel Program

The purpose of the Spent Nuclear Fuel Program is to place spent nuclear fuel at ORNL in a safe and stable condition as quickly as possible. Spent nuclear fuel at ORNL is being retrieved from underground storage wells, repackaged, certified, and placed in interim storage until it can be shipped to INEEL. Retrieval of spent nuclear fuel began in 1996 and was completed in 2001. Most of it has been repackaged and placed in interim storage. Shipment of spent nuclear fuel to INEEL is expected to begin in 2002.

3.9 TECHNOLOGY DEVELOPMENT: DEPLOYMENTS, DEMONSTRATIONS, AND TREATABILITY EVALUATIONS

3.9.1 ORNL Technology: Modular Evaporator and Ion Exchange Systems for Waste Reduction in Tanks and Waste Tanks Pretreatment

State-of-the-art evaporators remove excess water from liquid waste before solidification by processing sluice water generated during the retrieval of sludges and/or treatment of secondary wastes generated during treatment operations. Removal of cesium and strontium is being implemented to minimize the volume of high-activity waste, thus reducing costs for construction and operation of waste treatment facilities, waste form transportation, and disposal. A solid/liquid separation system is used to manage the excess liquids generated during sluicing of sludges between tank farms and/or to maintain desired feed composition for subsequent treatment operations. Technologies deployed for processing wastes from the Melton Valley Storage Tanks W-29 and W-30 include a single-stage, sub-atmospheric evaporator, a highly selective crystalline silicotitanate ion-exchange system, and a cross-flow filtration system.

3.9.2 ETTP Technology: Toxic Substances Control Act Incinerator Test Bed for Continuous Emissions Monitors

A national test bed has been established at the TSCA Incinerator in Oak Ridge to evaluate promising continuous emissions-monitoring technologies. The TSCA Incinerator—a full-scale, mixed-waste treatment facility—is being used to conduct field tests of emerging continuous emissions-monitors in a real-world operating environment. This test bed facilitates passing continuous emissions monitoring technology from the engineering development phase to the demonstration phase. Testing of continuous emissions monitors is also enhancing public and regulatory acceptance of thermal treatment technologies for treatment of DOE mixed wastes. The trial burn, a rigorous test to make sure the TSCA Incinerator is meeting its permit requirements, was completed in 2001.

3.9.3 Y-12 Site Technology

3.9.3.1 Bench-Scale Tests Under CERCLA Treatability Study

In October 2000, a CERCLA treatability study was initiated to evaluate in situ stabilization of a mercury-contaminated source area (Building 81-10 area) to limit releases of mercury to Upper East Fork Poplar Creek. This innovative approach is potentially an order of magnitude less expen-

sive than the baseline cost of excavation, treatment, and disposal. This study will be followed by a CERCLA-focused feasibility study and amendment of the Upper East Fork Poplar Creek Phase 1 Record of Decision so that the action can be performed as planned within the Y-12 Lifecycle baseline. DOE and regulators could not agree on the action due to data limitations and decided to eliminate it from the record of decision; this approach allows a remedial decision per the baseline. During 2001, a treatability study work plan was prepared and was submitted to the regulators. Phase 1, bench-scale testing, was also initiated. Soil from the 81-10 site was shipped to MSE Technology Applications for the bench-scale testing, and thirteen grouting formulations were identified to be tested. Completion of the bench-scale testing and initiation of Phase II, a field demonstration, are planned for 2002.

In October 2000, a CERCLA treatability study was initiated to evaluate alternative treatments for characteristic RCRA mercury-contaminated soils at Y-12. The current life-cycle baseline estimates that up to 50,000 yd^3 of contaminated soils will require thermal treatment costing more than $50 M to meet EMWMF waste-acceptance criteria. The treatability study is evaluating alternatives to thermal treatment with the potential to lower costs by an order of magnitude. Results from the study will be evaluated in a focused feasibility study, and the Upper East Fork Poplar Creek Phase 1 Record of Decision will be amended. Results will also be used in other records of decision and in the evaluation of centralized treatment facilities for the EMWMF. During 2001, a treatability study work plan was prepared and was submitted to the regulators. DOE awarded subcontracts to three vendors to bench-scale test their alternative technologies. Y-12 mercury-contaminated soils were provided to the three vendors for the bench-scale testing. During 2002, the bench-scale tests will be completed and a field demonstration will be performed of one or more of the technologies.

3.9.3.2 Reactive Barriers Performance Monitoring and Verification

Technologies are needed to evaluate and maximize the effectiveness of permeable reactive barriers. The colloidal borescope is an instrument capable of directly observing the movement of colloidal-size particles within boreholes to quantify groundwater flow rate and direction. The instrument was used at the two reactive barriers installed at the Y-12 Bear Creek Valley S-3 Pond area to monitor the performance of the treatment system.

3.10 POLLUTION PREVENTION

During FY 2001, the Oak Ridge sites continued to implement a substantial number of pollution prevention projects. Specifically, a total of 84 projects (excluding wastewater and ongoing source reduction and segregation projects) were reported during FY 2001. These 84 projects reduced approximately 21,300 m^3 of waste and saved or avoided spending approximately $15.9 million.

The ORR Pollution Prevention Programs are driven by federal and state laws and regulations; executive orders; and DOE policies, notices, and orders. During FY 2001, in addition to supporting the implementation of pollution prevention projects, the ORR facilities performed activities to ensure that the requirements of the new drivers established in FY 2000 were addressed as well as all other existing requirements. The ORR facilities must complete pollution-prevention-related requirements such as planning and reporting to comply with many regulatory requirements, including RCRA, the Tennessee Hazardous Waste Reduction Act, and the Emergency Preparedness and Community Right-to-Know Act/Pollution Prevention Act. The ORR facilities must also comply with DOE requirements, including reporting of pollution prevention project and program activities. The *Annual Report on Waste Generation and Pollution Prevention Progress as Required by DOE Order 5400.1*, the annual Affirmative Procurement report required by Executive Order 13101 and RCRA Section 6002, and pollution prevention project reporting completed by each site are designed to provide data

used to measure progress toward DOE's FY 2005 and 2010 pollution prevention goals.

Additionally, each site's data are included in DOE's complex-wide *Annual Report on Waste Generation and Pollution Prevention Progress*. Elements of DOE's annual report are extracted and included in DOE's Central Internet Database, which provides national-level DOE waste management and cleanup data to the public, as required by the December 1998 settlement agreement between DOE and the Natural Resources Defense Council, Inc.

To support future pollution prevention implementation, compliance, and goal achievement, the ORR sites' pollution prevention programs continue to pursue site projects where possible, perform required activities, and complete required reporting.

3.11 EM-SUPPORTED ENVIRONMENTAL MONITORING ON THE ORR

The Water Resources Restoration Program was established by DOE-EM to implement a comprehensive and integrated environmental-monitoring and assessment program for the ORR and to minimize duplication of field, analytical, and reporting efforts. The Water Resources Restoration Program and associated site-specific water quality programs are successors to the Integrated Water Quality Program that was established in 1996. The DOE is under a regulatory requirement from the Federal Facility Agreement to conduct postremedial action monitoring. The Federal Facility Agreement requires the evaluation and annual reporting on the effectiveness of completed remedial actions. Specific monitoring requirements are typically included in documents supporting CERCLA records of decision, action memoranda, or remediation/removal action reports. Additional monitoring includes baseline water quality, pre-record-of-decision monitoring to support watershed management decisions.

There are water quality projects (WQPs) for each of the three sites on the ORR: the XWQP is responsible for monitoring activities within the Bethel Valley and Melton Valley administrative watersheds at ORNL, the EWQP is responsible for monitoring at ETTP, and the YWQP is responsible for monitoring within Bear Creek Valley and Upper East Fork Poplar Creek administrative watersheds at Y-12 and at selected non-ORR localities. The Water Resources Restoration Program provides a central administrative and reporting function that integrates and coordinates the activities of the watershed-specific projects. It also provides coordination and integration among the respective WQPs for the development and implementation of long-term monitoring strategies and plans to support future groundwater remediation decisions.

The annual *Remediation Effectiveness Report* (DOE 2002b), a Federal Facility Agreement primary document, provides analytical results and evaluations of performance assessment monitoring, as required by CERCLA decision documents and/or the project-specific remedial action work plans or remedial action reports. The *Remedial Effectiveness Report* will provide any recommendations for changes to the facility WQP monitoring plan for the subsequent year. Additionally, the report includes a summary of stewardship activities for completed CERCLA remedial actions that, together with the performance assessment monitoring data, support the completion of a CERCLA 5-year review. A CERCLA 5-year review was performed as part of the *Remedial Effectiveness Report* starting with FY 2001, and subsequent reports will contain all required information to support future reviews.

3.12 PUBLIC INVOLVEMENT

The public is entitled to participate in decisions and information exchange regarding remediation of contaminated areas on the ORR. DOE-ORO encourages such participation by actively seeking and considering the views of its stakeholders, thereby providing the opportunity to influence decisions. Stakeholders include individuals, groups, host communities, and other entities in the public and private sectors that are interested in or affected by DOE CERCLA activities and decisions.

Specific efforts by DOE to provide information to the public and to solicit input from stakeholders have made the following sources available.

- Information is available at the DOE web site (http://www.energy.gov/), the DOE Oak Ridge Operations web site (http://www.oakridge.doe.gov), and the DOE environmental management web site (http://www.em.doe.gov/index4.html).
- The Oak Ridge Site Specific Advisory Board, a federally appointed citizen panel, provides advice and recommendations to DOE on environmental management activities (http://www.oro.doe.gov/em/ssab).
- TDEC [http://www.state.tn.us/environment] contracts with the surrounding counties and the city of Oak Ridge through the Local Oversight Committee (http://www.local-oversight.org) to provide independent public oversight of DOE-ORO and DOE-EM activities.
- Public meetings serve as forums for DOE to present project information to the public and to allow citizens to voice their concerns. The schedule for upcoming public meetings is available at http://www.oro.doe.gov/meetings.html.
- DOE Information Center (phone: 865-241-4582) (http://www.oro.doe.gov/foia/doe_public_reading_room.htm) provides newsletters, reports, and tapes and transcripts of public meetings.
- City of Oak Ridge Environmental Quality Advisory Board, an appointed advisory board of the Oak Ridge City Council, provides environmental leadership to the city government on environmental matters (http://orserv01.ci.oak-ridge.tn.us/ComDev-html/EQAB.htm).
- NEPA requires federal agencies to provide the public with environmental information for proposed major federal actions that could affect environmental quality. Announcements on pending NEPA actions are available at http://tis-nt.eh.doe.gov/nepa.
- Advocates for the Oak Ridge Reservation is an educational and scientific organization supporting the continued preservation and protection of the ORR for science, conservation, education, health and safety, hunting and other forms of recreation, and cultural values (http://www.korrnet.org/aforr/).
- The *DOE Public Involvement Plan for CERCLA Activities at the U.S. Department of Energy Oak Ridge Reservation* and the monthly DOE publication *Public Involvement News*, are available by calling 865-576-0885. Additional information on public involvement opportunities may be found at http://www.ornl.gov/emef/facts/public.htm.
- The Oak Ridge Health Agreement Steering Panel, funded by DOE and administered through the Tennessee Department of Health, looks at historical contaminant releases from the ORR and their potential impact on the health of nearby residents. Steering Panel meetings and information sessions are open to the public. For information contact the Tennessee Department of Health at http://www.state.tn.us/health/.
- Information on each of the Oak Ridge environmental management projects is available at http://www.bechteljacobs.com/facts/facts-or.htm.
- The Roane County Environmental Review Board advises the county government on environmental matters and monitors cleanup and waste transportation activities on the ORR. Members are appointed by the county executive and are confirmed by the County Commission. For information call 865-376-5287.
- The *Comprehensive Integrated Plan for the Oak Ridge Reservation* (http://www.ornl.gov/~dmsi/cip/cip.htm) is a planning reference that identifies primary issues regarding major changes in land and facility use for three of the DOE-ORO sites: the ORR; the Paducah Gaseous Diffusion Plant in Paducah, Kentucky; and the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio.

3.13 LAND USE PLANNING

DOE programs in Oak Ridge depend not only on the facilities at ORNL, ETTP, and the Y-12 Complex, but also on the land base of the ORR. UT-Battelle, LLC, has the management and planning responsibility for most of the ORR's undeveloped land area. This responsibility includes planning for approximately 18,000 acres of undeveloped and developed land. The *2002 Oak Ridge National Laboratory Land and Facilities Plan* has been prepared to assist DOE and contractor personnel in implementing

ORNL's land and facility responsibilities for management and planning. The plan is available at http://www. ornl.gov/~dmsi/landUse/.

The ORR includes multiple, overlapping reservation land uses. Details on the various uses are discussed in Sect. 2 of the *2002 Oak Ridge National Laboratory Land and Facilities Plan*. With major changes in mission at ETTP and at the Y-12 National Security Complex, demonstrating current land use and planning for future land use needs by DOE and ORNL are critical. Decisions on how to use the land area have an effect not only at local and regional levels but also on the national and international levels.

The ORR is a unique and irreplaceable resource for DOE to use for its national science and technology missions. The DOE ORR vision, as stated in the *ORR Comprehensive Integrated Plan* (September 1999), emphasizes that the ORR serves as an integrated science, education, industrial, and technology complex managed by DOE in partnership with the private sector—supporting a dynamic regional and national economy. Future use is to include a mixture of activities that are compatible with and contribute to ongoing and anticipated DOE missions. According to current plans, the reservation will be used to support many of the same programs it currently supports while adapting to changing national goals and interests and reduced federal budgets. Portions of the reservation will be used to promote the development of private-sector enterprises in ways that are consistent with and complementary to DOE missions. DOE's environmental management and reindustrialization initiative is highlighted at the ETTP; defense support, manufacturing, and storage is highlighted at the Y-12 National Security Complex; R&D is highlighted at ORNL.

A set of possible land use scenarios have been developed for portions of the ORR that may in the future no longer be needed for mission purposes. These land use scenarios will help guide DOE decisions. Public input through a Land Use Planning Process Focus Group, public workshops, and other communications has been a critical component of the process. DOE program needs for current and future land uses have been reviewed. Most of the ORR land, except for the northwest portion of the reservation around ETTP, will be needed for future DOE missions during the next 5 to 20 years. Planning is taking into consideration existing resources and interests, including historic and preservation sites, wetlands and other sensitive habitats, research and monitoring, leased areas, and ongoing environmental remediation. Technical analyses of land use are being done for each of the scenarios. Site-specific and reservation-wide consequences are being considered for both individual and cumulative effects. The planning process, which began the end of August 2001, will reach closure the end of September 2002. The results will be incorporated into the *ORR Comprehensive Integrated Plan*.