CHAPTER 2: OPERATIONS OVERVIEW OF Y-12 NATIONAL SECURITY COMPLEX

This chapter provides an overview of the Y-12 National Security Complex (Y-12) operations, programs, and facilities. It begins with a brief history of Y-12 and its operations, followed by a discussion of programs supported by Y-12. Further details of the Y-12 programs may be found in Appendix A.

2.0 OVERVIEW OF Y-12

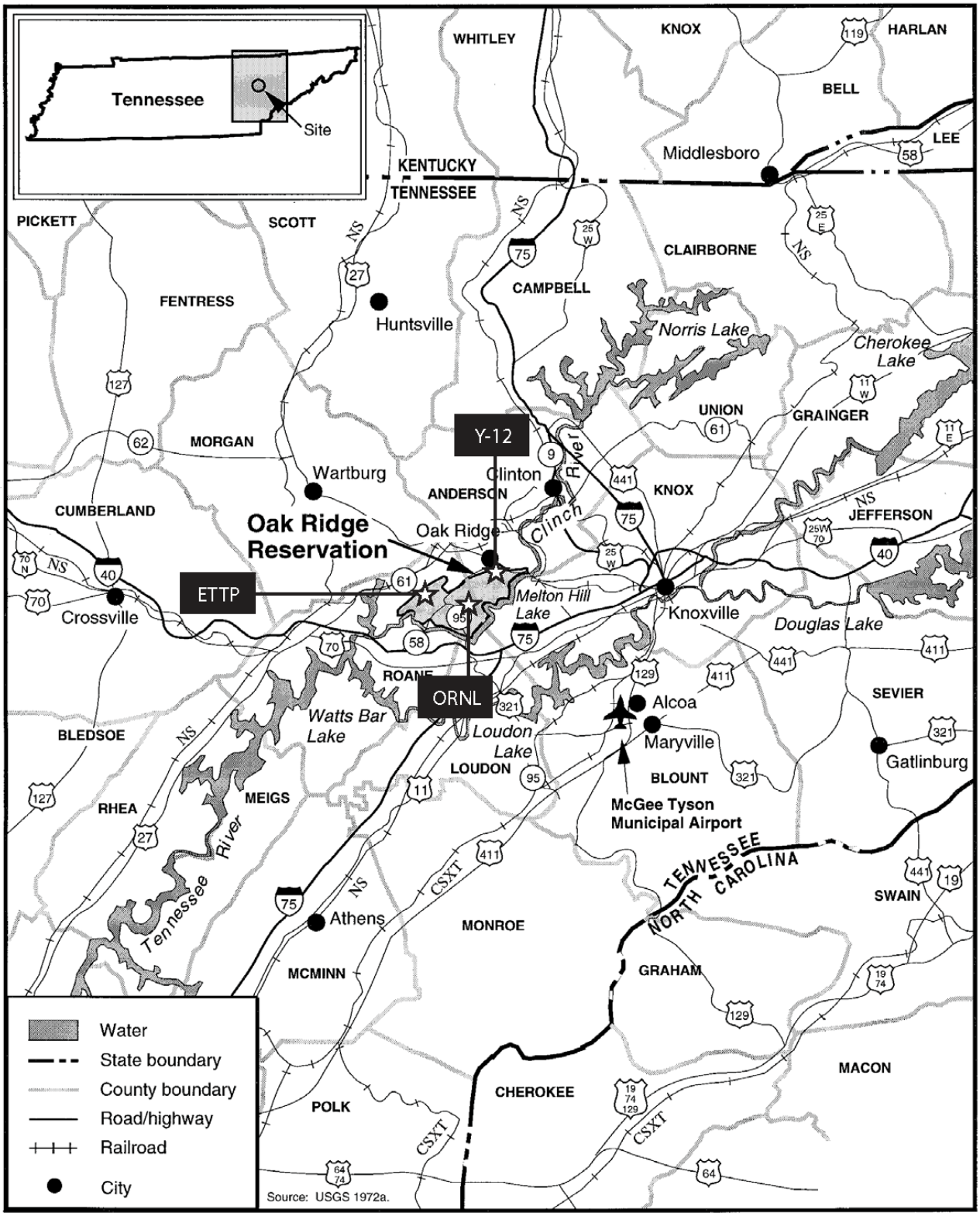
Y-12 is located on the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR), which covers approximately 35,000 acres. Most of ORR lies within the corporate limits of the city of Oak Ridge, Tennessee. The ORR is bordered on the north and east by the city of Oak Ridge and on the south and west by the Clinch River/Melton Hill Lake impoundment. ORR is approximately 15 miles west of Knoxville, Tennessee.

Y-12 is one of three primary DOE/National Nuclear Security Administration (NNSA) installations on ORR. Figure 2-1 shows the location of ORR. The other installations are the Oak Ridge National Laboratory (ORNL) and the East Tennessee Technology Park (ETTP). Construction of Y-12 was started in 1943 as part of the World War II Manhattan Project. The early missions of the site included the separation of U-235 from natural uranium by the electromagnetic separation process and the manufacture of weapons components from uranium and lithium.

As one of the NNSA major production facilities, Y-12 has been the primary site for enriched uranium (EU) processing and storage, and one of the primary manufacturing facilities for maintaining the U.S. nuclear weapons stockpile. Other activities at Y-12 are not defense-related, and include environmental monitoring, remediation, and decontamination and decommissioning (D&D) activities of DOE's Environmental Management (EM) Program; management of waste materials from past and current operations; support of other Federal agencies through the Work for Others Program and the National Prototyping Center; and the transfer of highly specialized technologies to support the capabilities of the U.S. industrial base (NNSA 2007).

NNSA is the Y-12 site landlord and is responsible for approximately 74 percent of the floorspace (approximately 5.3 million square feet today[1]) and approximately 390 facilities. Buildings and facility types include large production, light and heavy laboratory, sophisticated and standard warehousing and a mix of new and World War II vintage technical and administrative office structures. Y-12 is a diverse site that supports NNSA through Defense Program Missions (Section 2.1.1) and National Security Programs (Section 2.1.2). Y-12 also supports non-NNSA

[1] The 5.3 million square feet figure does not include approximately 550,000 square feet associated with the Jack Case and New Hope Centers which were completed in July 2007 and are leased by Babcock & Wilcox Technical Services Y-12, LLC (B&W).



Source DOE 2001a.

Figure 2-1. Location of Oak Ridge Reservation, Principal Facilities, and Surrounding Area.

programs (Section 2.2). The following sections describe the major NNSA missions/work performed at Y-12; as well as complementary work performed for other Federal, state, and local entities, and private sector companies.

These descriptions are based upon information contained in the Y-12 Ten-Year Site Plan (TYSP) for 2009-2018 (NNSA 2008a). The descriptions are meant to be informative and illustrative of the major missions and the breadth/scope of work that is performed at Y-12; the descriptions are not intended to represent a detailed breakdown of all the missions/work performed, nor are they intended to illustrate day-to-day or building-by-building work performed. A map of the current Y-12 programmatic responsibilities is provided in Figure 2-2.

2.1 NATIONAL NUCLEAR SECURITY ADMINISTRATION ACTIVITIES SUPPORTED BY Y-12 NATIONAL SECURITY COMPLEX

Y-12 plays an important role in U.S. national security and is a one-of-a-kind facility in the NNSA nuclear security enterprise. Y-12's role in support of the nuclear security enterprise includes the following activities:

- Manufacturing, dismantlement, disposition, and assessment of nuclear weapons secondaries, radiation cases, and other weapons components;
- Safely and securely storing and managing special nuclear material (SNM);
- Supplying SNM for use in naval reactors;
- Promoting international nuclear safety and nonproliferation; and
- Reducing global dangers from weapons of mass destruction (NNSA 2008a).

The following sections describe the missions at Y-12.

2.1.1 Defense Programs

The Defense Programs activities performed at Y-12 include maintaining the capability to produce secondaries and radiation cases for nuclear weapons, storing and processing uranium and lithium materials and parts, dismantling nuclear weapons secondaries returned from the stockpile, and providing special production support to NNSA weapons laboratories and to other NNSA programs. To accomplish the storage mission, some processing of SNM is required to recover materials from returned secondaries. In addition, Y-12 performs stockpile surveillance activities on the components it produces.

The Defense Programs work structure at Y-12 includes the following missions:

- Weapons Dismantlement and Disposition;
- EU Operations;
- Life Extension Programs;
- Nuclear Materials (and Lithium) Management, Storage and Disposition;
- Quality Control and Surveillance;
- Stockpile Evaluation and Maintenance;

Facility Responsibility

National Nuclear Security Administration (NNSA)	5,763,291 Square Feet
DOE Office of Science and Office of Nuclear Energy	1,268,775 Square Feet
DOE Office of Environmental Management	606,706 Square Feet
Total Gross Square Feet	7,638,772 Square Feet

Key Site Infrastructure

Plant Site Acreage	over 800 acres
Number of Buildings	over 440
Storm Drain System	50 miles
Sanitary Sewer System	20 miles
Treated Water System	24 miles
Industrial Gas System	12 miles
Roads	15 miles
Parking Lots	70 acres
Electrical Distribution System	25 miles
Substations	2
Industrial Gas Plants	5
Steam Plant	1
Cooling Towers	18
PIDAS Fencing	2.5 miles

Source: NNSA 2008a.

Figure 2-2. Programmatic Responsibility for Y-12 Facilities.

- Materials Recycle and Recovery;
- Nuclear Packaging Systems;
- Campaigns;
- Modernization;
- Infrastructure Reduction; and
- Office of Secure Transportation.

A list of the Y-12 Defense Program Major Facilities is shown in Table 2-1 at the end of this chapter. A summary of each of the missions is provided in the following sections. Additional information related to the Defense Program Major Facilities is contained in Appendix A, Section A.3.

2.1.1.1 *Weapons Dismantlement and Disposition*

The Y-12 Dismantlement and Disposition Program receives, dismantles, and dispositions retired weapon components and subassemblies from the stockpile. Dismantling nuclear weapons is a complex process that involves almost all of the sites within the nuclear weapons enterprise. First, NNSA's design labs work with the production facilities to identify and mitigate any hazards that may arise before a particular weapon type is to be dismantled. The labs apply the unique knowledge they gained during the original design process for each weapon in the stockpile.

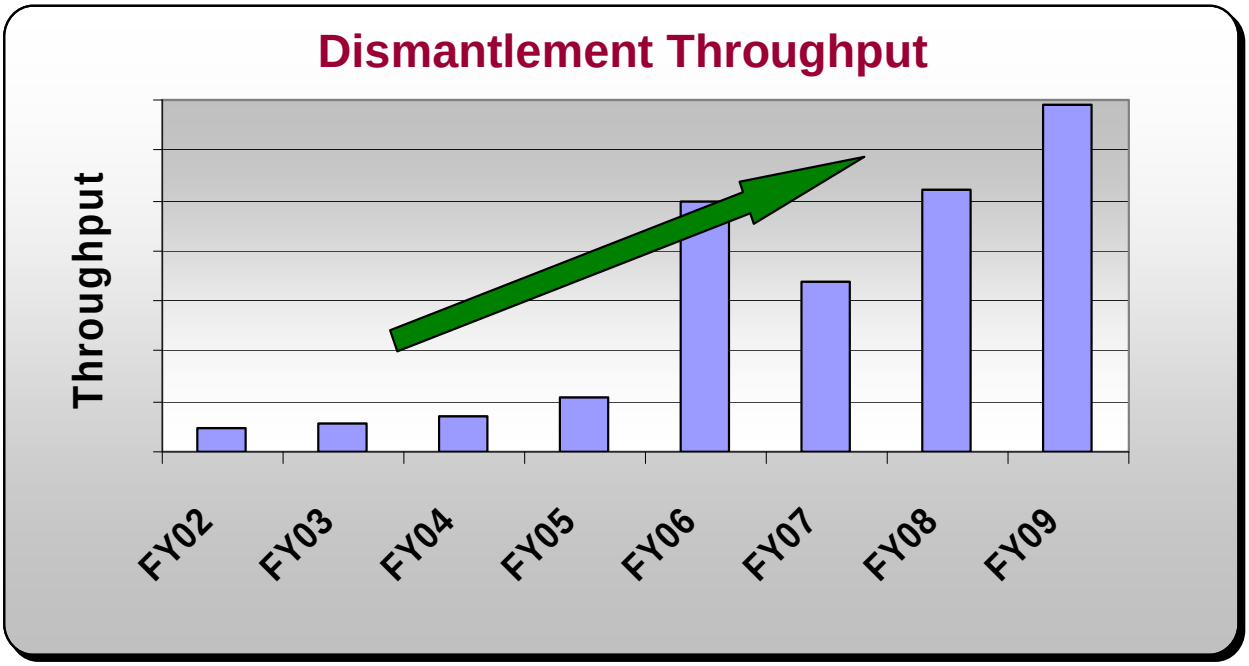
When a weapon is retired, it is transported to NNSA's Pantex Plant, near Amarillo, Texas, where the high explosives are removed from special nuclear material, and the plutonium core is removed from the weapon. The plutonium is placed in highly secure storage at Pantex. Eventually, excess material may be turned into fuel at the Mixed Oxide (MOX) Fuel Fabrication Facility at the Savannah River Site (SRS), near Aiken, South Carolina. Other non-nuclear components are sent to SRS (e.g., gas storage devices) and the Kansas City Plant (e.g., electrical components) for final processing.

Part of the weapon is then transported to Y-12 using the NNSA's secure transport system. At Y-12, the uranium components are removed and stored in the newly operational Highly Enriched Uranium Materials Facility (HEUMF). The dismantlement process at Y-12 involves the appropriate separation techniques such as machining and infrared debonding to completely reduce the components to piece parts that are dispositioned. If a UPF is constructed, NNSA would be capable of performing all required dismantlement operations in a modernized facility that is safer and more secure. Such a facility would contain essentially the same equipment and have the same inherent capabilities as a facility that might be used for dismantlements only, if that were ever the only mission at Y-12.

Y-12's goal is to identify safe and secure disposition paths for all materials under its control, including uranium. Components retained for reuse are placed into safe and secure storage following dismantlement operations. Legacy components (parts produced for weapons that have been retired or are surplus) are recycled or packaged for burial in secure, licensed landfills at Y-12 or the Nevada Test Site.

Over the past few years, consistent with the President's goal of establishing the smallest stockpile possible consistent with national security needs, NNSA made weapon dismantlements

a priority. More efficient processes and techniques have allowed rates to substantially increase. In fact, in 2009, Y-12 achieved the highest nuclear weapon dismantlement throughput level in more than 25 years (YSO 2009). As more retirements are announced, NNSA is able to absorb more weapons into the dismantlement queue, ensuring that the original timeline for dismantling U.S. nuclear weapons is kept. Figure 2-3 presents an unclassified graph of recent dismantlement throughputs at Y-12.



Source: YSO 2010a.

Figure 2-3. Dismantlement Throughput at Y-12, 2002-2009.

2.1.1.2 *Enriched Uranium Operations*

Over 100 operations or processes have been, or are capable of being performed within the EU Facilities Complex (EU Complex). The primary missions performed in the current EU Complex include the following:

- Casting of EU metal (for weapons, reactor fuels, storage, and other purposes);
- Accountability of EU from Y-12 activities;
- Recovery and processing of EU to a form suitable for storage and/or future disposition (from Y-12 activities and commercial scrap);
- Packaging EU for off-site shipment;
- Preparation of special uranium compounds and metals for research reactor fuel; and
- Preparation of special uranium compounds and metals for production of medical isotopes.

The EU Complex houses two major process areas which include the EU Recovery Operations (also called Chemical Recovery Operations) and the EU Metallurgical Operations.

Enriched Uranium Recovery Operations

Uranium recovery operations include recovery/purification of EU-bearing scrap into forms suitable for reuse and accountability of the EU contained therein. The majority of this scrap and waste was generated by Y-12 weapon production or disassembly operations and by the recovery processes themselves. Some scrap and waste were generated through nuclear materials production; additional scrap is received from other sites for recovery or for accountability of the EU it contains. The nature of these EU-bearing materials varies from combustible and noncombustible solids to aqueous and organic solutions. Concentrations of EU vary in these materials from pure uranium compounds and alloys to trace quantities (parts per million levels) in combustibles and solutions. The recovery and purification process currently used at Y-12 can be divided into general groupings as shown in Table 2.1.1.2-1

Table 2.1.1.2-1. Groupings of the Recovery and Purification Process.

Head End and Wet Chemistry Operations
Bulk reduction of scrap (mostly burning)
Dissolution of scrap into uranyl nitrate solution
Separation of uranyl nitrate from non-uranium materials
Continuous Recovery and Purification Operations
Organic solvent extraction
Evaporation
Conversion of uranyl nitrate to UO_3
Conversion of UO_3 to UF_4
Reduction
Blending of UF_4
Calcium reduction of UF_4 powder to uranium metal
Special Processing
Special materials production
Accountability of scrap
Scrap dissolution
Packaging of materials for shipment
Waste Streams and Materials Recovery
Nitrate disposition
Materials storage and handling
Chemical makeup

Enriched Uranium Metallurgical Operations

Casting of EU metal and alloys today occurs in vacuum induction furnaces. Cast components are then shipped for machining. Machine turnings are washed in water and solvent to remove machine coolant and boron, then dried, and pressed into briquettes for reuse in the casting operation. A number of presses and shears are used to condition recycled weapons components and other metal parts for casting. Recycled metal may be washed with nitric acid to remove surface oxide prior to casting. Waste from the casting operations is sent to the chemical recovery operations for accountability and recovery. Metallurgical operations for casting involve preparation of metal feed, casting metal into parts or cylinders, packaging of materials for shipment, and machine turnings recycle.

Assembly and Disassembly Operations

Current EU activities include assembly, quality certification of components and assemblies, disassembly of retired weapons assemblies and parts recovery, storage of assemblies, subassemblies, and components and Quality Evaluation Shelf Life Program for Medium and Long Term Evaluations.

2.1.1.3 *Life Extension Programs*

The full range of Life Extension Program (LEP) approaches include: refurbishment of existing warheads, reuse of nuclear components from different warheads, and replacement of nuclear components. Activities include, but are not limited to, production of materials and parts designated as essential for national security needs, supporting direct manufacturing specifications and procedures, and training personnel needed to meet steady-state production rates. LEPs depend on Y-12's capability to sustain and refurbish all nuclear weapons in the active and reserve stockpile. This capability includes performing design, development, and production for authorized refurbishment programs; providing the required production capability to refurbish weapons on a schedule negotiated with the Department of Defense (DoD); and sustaining production competence to support production needs. Canned subassembly (CSA) reuse is assumed to be a fraction of the work content of that required for refurbished or replacement secondaries. When CSA reuse only requires re-inspection, the capacity is over and above that assumed for refurbished or new CSAs. Detailed requirements for a UPF are found in the "UPF Program Requirements Document, Revision 4" (YSO 2010c).

2.1.1.4 *Nuclear Materials (Including Lithium) Management, Storage and Disposition*

This program ensures safe, secure, compliant storage of the Nation's strategic reserve of highly enriched uranium (HEU) and lithium, as well as storage of all nuclear materials at Y-12. Y-12 is NNSA's current national repository of HEU.

Nuclear materials are stored at Y-12 in compliance with two major security levels. The areas requiring the highest level of security are designated as material access areas (MAAs) and house EU materials that require the highest safeguards and security. The remaining storage is defined as non-MAAs and includes lithium, thorium, depleted uranium, low-enriched uranium (LEU), EU materials that require less stringent safeguards and security; and other non-MAA qualified weapon components and materials.

The transfer of EU from a warehouse in operation since the 1940s into the nation's new HEUMF was completed in April, 2010. About 40 percent of Y-12's HEU now is stored at HEUMF. Additional EU currently located in four processing areas at Y-12 will be moved to the HEUMF over the next year and a half to provide more efficient and secure storage, and to free up valuable space for materials needed in manufacturing operations. The HEUMF replaces multiple aging facilities with a single state-of-the-art storage facility.

The Nuclear Materials Management, Storage and Disposition Program will continue to provide safe, secure management and storage of the Nation's HEU inventories and other weapons materials with improved facilities, technologies, and practices (NNSA 2007).

2.1.1.5 *Quality Evaluation and Surveillance*

The Quality Evaluation and Surveillance Program provides for the activities required to assess the integrity of the stockpile, including safety, reliability, design compatibility, and functionality of components over the life of each weapons system in the stockpile. Confidence in the safety and reliability of the Nation's nuclear weapons stockpile is acquired and sustained through a quality evaluation program beginning in early production and continuing throughout each weapon system's life to retirement. The condition of the stockpile is determined through a number of unique tests. Stockpile quality evaluation is supplemented by a surveillance program that includes testing and evaluating accelerated aging units, production core samples, and shelf-life units. These units and/or components never enter the stockpile, but provide additional baseline data that are used to judge the condition of a secondary throughout its life in the stockpile.

Y-12 has the responsibility of the Quality Evaluation and Surveillance Program pertaining to the secondaries, case parts, shelf-life units, core samples, and other vital components. The Program consists of testing, sampling, disassembly, and collecting and evaluating data. The data and information obtained provide and establish the reliability of the weapon systems. Unique tests and data history provide the basis for a sound technical response for extending the stockpile life.

Quality evaluation is a material performance activity conducted on a sampling of components and assemblies to evaluate their functionality. The sampled materials may come from stockpiled weapons; retrofit evaluation systems test units, which are randomly selected during production, contain newly produced materials, and are tested in a laboratory; stockpile flight test units, which are randomly selected from the stockpile and evaluated by flight tests; stockpile laboratory test units, which are randomly selected from the enduring stockpile and evaluated; and production samples.

2.1.1.6 *Stockpile Evaluation and Maintenance*

The Stockpile Evaluation and Maintenance Program includes activities directed at continuing the fitness of nuclear weapon warheads in the enduring stockpile and producing weapon-related hardware to support DOE and DoD requirements. The activities include all direct and indirect production efforts to provide Joint Test Assemblies and components for testing stockpile representative hardware.

2.1.1.7 *Materials Recycle and Recovery*

The Materials Recycle and Recovery Program supports the recovery of EU and lithium from parts recovered from retired weapons and quality evaluation weapons teardowns, residue materials from manufacturing processes, lightly irradiated EU from other DOE sites or commercial and private facilities throughout the country and internationally, and wastes containing EU generated from operations throughout Y-12. The program is responsible for receipt, accountability, processing to a storable form, and interim storage of EU and lithium. Material recovered internationally is discussed in Section 2.1.2.2, Global Threat Reduction Initiative.

The Uranium Central Scrap Management Office (CSMO) is responsible for making arrangements, including transfer of material, for recovery, storage, and disposition of uranium scrap from DOE sites. In addition to DOE sites, many U.S. colleges/universities and other government agencies possess DOE-owned nuclear materials obtained under DOE contractual or loan/lease agreements for research purposes. The CSMO is also responsible for managing the recovery, and storage and disposition of uranium scrap derived from these sources.

2.1.1.8 *Nuclear Packaging Systems*

The Nuclear Packaging Systems Program includes the activities required for safe, efficient, and economical packaging for transporting and storing general cargoes, radioactive materials, and other hazardous materials within Y-12 and other approved sites. The packaging program fully complies with DOE directives and Federal, state, tribal, and international regulations, requirements, and standards. Key elements of the program include: (1) design, development, and testing methods; (2) preparation of Safety Analysis Reports for packaging; (3) an extensive procurement base for packaging needs; (4) a tracking system for required maintenance, testing, and inspection to include mission oversight of fabrication, refurbishment, packing and unpacking, and decommissioning of packaging; and (5) a rigorous quality assurance program compliant with DOE and other applicable regulations and industry standards.

2.1.1.9 *Campaigns*

In 1999, DOE developed a new structure for the Stockpile Stewardship Program that included a series of what DOE called “campaigns,” which DOE defined as technically challenging, multiyear, multifunctional efforts to develop and maintain the critical capabilities needed for the long-term stewardship of the stockpile. These efforts will result in the revitalization of Y-12’s ability to meet its mission requirements in a more responsive, efficient, and cost effective manner while improving security and worker safety and health. Campaigns also continue and accelerate the development and prototyping of advanced, cost effective, and environmentally acceptable nuclear weapons production technologies and design processes required to maintain an affordable and reliable nuclear weapons stockpile.

2.1.1.10 *Modernization*

Modernization supports the planning definition, development, and execution of activities required to support the missions of the NNSA at Y-12 and transform the Y-12 Site to a modern nuclear security enterprise. Modernization is the integrating element for long range plans, new facilities, infrastructure improvement, and D&D.

2.1.1.11 *Infrastructure Reduction*

Infrastructure Reduction (IR) is a series of individual projects to remove excess buildings and infrastructure. The primary goal of the IR is to remove or demolish structures no longer required to meet Y-12 missions. Since 2002, total operational space at Y-12 was reduced by approximately 1.3 million square feet and more than 284 buildings were demolished or removed. Each demolition has been reviewed pursuant to NEPA prior to initiation and found to be covered

by the Categorical Exclusion established by 10 CFR Part 1021 Appendix B1.23 (Demolition and Subsequent Disposal of Buildings, Equipment, and Support Structures). Demolition of surplus buildings directly supports the Y-12 mission by reducing the site footprint, improving the site's safety posture, lowering total ownership costs, clearing future facility sites for beneficial reuse, and improving the ability to manage the facilities remaining on the Y-12 site.

2.1.1.12 *Office of Secure Transportation*

The fundamental mission of the Office of Secure Transportation (OST), operated by DOE and NNSA, is to safely and securely transport nuclear weapon components, special nuclear material, and limited-life-components; and to conduct other missions as required in support of national security. The OST operates approximately 70,000 square feet of facilities at ORR, all of which are located near the ETTP.

2.1.2 National Security Programs

The National Security Program (NSP) is a program management organization that directs and oversees all mission work in support of the Office of Defense Nuclear Nonproliferation; the supply of SNM for use in naval reactors; and all work for other agencies that is complementary to other Y-12 missions, i.e. Homeland Security. Under the NSP, Y-12 focuses on Nonproliferation missions, Global Threat Reduction Initiatives, and supplying EU to the Naval Reactors propulsion program and Foreign Research Reactors (FRR).

Y-12's expertise in Safeguards and Security is also passed on to municipal, state, and other federal agencies through the NSP organization. Support of the NSP effort by Y-12 has required little use of facilities, beyond a few office and classroom type spaces, since the organization primarily draws on Y-12 expertise more than facilities and equipment. Facility utilization, to date, has consisted of using available facilities and/or equipment. This causes a minimal impact to existing Y-12 mission work. The demand for NSP work is increasing, and it is expected that additional, surplus facilities will be used to support this demand. Potential buildings for such training presently exist, but with most of the current inventory of excess facilities scheduled for demolition over the next 10 to 15 years, a new facility may be required in the future.

The NNSA Office of Defense Nuclear Nonproliferation and other federal organizations utilize the NSP and Y-12's comprehensive and rigorous safeguards and security training and operations opportunities. International & Homeland Security (IHS) targets domestic and foreign organizations related to homeland security, homeland defense, and nonproliferation. These Y-12 assets are also used by the NNSA Office of International Materials Protection and Cooperation, DoD agencies such as the Defense Threat Reduction Agency, and various agencies under the Department of Homeland Security.

Nuclear Technology & Nonproliferation (NTN) also draws on Y-12's core competencies related to S&S, nuclear expertise and other technologies, in order to address the needs of emerging markets. The NTN programs cover activities associated with the nuclear power industry; nuclear threat reduction; the NNSA Defense Nuclear Nonproliferation Offices of Global Threat

Reduction, Nonproliferation & International Security, and Nonproliferation Technology Research and Development (R&D); and special projects for intelligence work.

The following sections describe the NSP missions in further detail.

2.1.2.1 *Nonproliferation*

The NNSA nonproliferation mission is actively supported at Y-12. With regard to nonproliferation, NSP develops and implements domestic and international programs and projects aimed at reducing threats, both internal and external, to the United States from weapons of mass destruction. The primary focus is reducing the threat posed by the proliferation of nuclear weapons, particularly EU weapons and EU materials.

The components of these nonproliferation activities include managing the HEU Disposition Program Office located at Y-12, which provides programmatic support to the NNSA Office of Fissile Materials Disposition to ensure efficient disposition of the surplus EU stored at DOE sites across the country. The objective of the program is to make surplus EU unusable for weapons and dispose of it in a safe, secure, and environmentally acceptable manner.

Another component of Y-12's nonproliferation program includes leading activities in the foreign and domestic Reactor Supply Program, which supports nuclear nonproliferation by supporting the Reduced Enrichment Research and Test Reactor (RERTR) program. This program provides low-enriched uranium produced by down blending surplus weapons-usable EU. Y-12 is a primary source of enriched uranium for use in research reactors and the primary supplier of enriched uranium and U-235 for the DOE Isotope Distribution Office. Other nuclear materials (such as depleted uranium and enriched lithium) are supplied to various customers from Y-12. As HEU reactors are converted for LEU fuels use as a part of the RERTR program, new fuel development and production work may take place at Y-12. The current work may include the production of monolithic foils for fuel fabrication.

2.1.2.2 *Global Threat Reduction Initiative*

NNSA operations based at Y-12 are uniquely qualified to support the Office of Global Threat Reduction (NA-21) otherwise known as the Global Threat Reduction Initiative (GTRI). There are three components to GTRI in which Y-12 contributes to all three: Convert, Protect, and Remove.

In the functional area of Convert, Y-12 supports the conversion of research reactors, both domestic and foreign, with the supply of low enriched uranium (LEU), the development/production of LEU fuel or components, and the development of LEU medical isotope targets. An example of Y-12's current work is the development of a uranium-molybdenum foil manufacturing process including the application of coatings. The uranium-molybdenum coated foils would be used in the conversion of high powered research reactors such as the High Flux Isotope Reactor located at ORNL. In some cases, Y-12 may be requested to manufacture unique fuels and components. Y-12 has historically manufactured one-of-a-kind cores such as the pulse reactors for Sandia National Laboratory and elsewhere. Y-12 is also working to develop a new LEU medical isotope target that could be used in various domestic

research reactors. The target development is a collaborative effort with U.S. universities and others.

In the functional area of Protect, Y-12 serves a lead role by providing training for responders at facilities with sources of concern that may be attractive as a radiological dispersion device or an improvised nuclear device. The course is aimed at those personnel responsible for developing and executing a response plan at facilities where high-activity radioactive materials may be potential targets for theft or used for other nefarious purposes. The Alarm Response Training Program provide training in areas of radiological response events and to provide an opportunity for the security forces, as well as health and safety, and other responsible parties to develop, discuss, and exercise their tactics, techniques, procedures, and protocols when responding to theft, sabotage, and/or radiological events. In addition to this activity, Y-12 provides subject matter experts who provide security assessments at these facilities.

For the Remove area, Y-12 supports GTRI in the removal or disposition of EU of various forms, both U.S. and non-U.S. origin, from locations all over the world. Removal includes planning, coordinating, and executing missions that will characterize, package, load, secure, and transport the EU back to Y-12 or an alternate location as directed by NNSA. Examples of Y-12 removal activities that pre-date GTRI include activities in Kazakhstan, Republic of Georgia, Russia, Libya and elsewhere. Since the creation of GTRI in 2004, Y-12 has been involved in removals in Argentina, Canada, Chile, France, and South Korea. A detailed description of Y-12's transport analysis over global commons is documented in the Supplement Analysis for the Air and Ocean Transport of Enriched Uranium between Foreign Nations and the United States (DOE 2006b) (see Section 5.15).

2.1.2.3 *Naval Reactors*

The primary mission of the NNSA Office of Naval Reactors is to provide the U.S. Navy with safe, militarily effective nuclear propulsion plants and to ensure their continued safe and reliable operation. In supporting this critical NNSA mission, Y-12 is the base of operations to act as the supplier of EU feedstock and conduct limited development work for the Naval Nuclear Propulsion Program. Examples of this work include the following:

- Validating processes used to fabricate feedstock material;
- Conducting analysis on processed uranium to ascertain chemical purity; and
- Developing packaging methods for shipping EU feedstock material.

Supporting the Naval Reactors Propulsion Program requires storage, processing, and shipping support from several Y-12 operational areas, primarily for enriched uranium. The Y-12 Analytical Laboratory also performs analytical chemistry work in support of these activities.

2.1.2.4 *Domestic Research Reactors and Other DOE Material Supply Program*

The DOE's Office of Nuclear Energy (DOE-NE) provides funding for the infrastructure, maintenance and fuel supply of university and research reactors domestically in the United States. The program provides nuclear materials (HEU/LEU/depleted uranium [DU], Lithium 6 and 7, Heavy Water, etc.) for domestic research and isotope production, reactor fuel and target fabrication, and other various DOE, DoD, and private sector projects and facilities. Fresh fuel elements for High Flux Isotope Reactor (HFIR) are received at Y-12 from the commercial fuel fabricator. These fuel elements are stored until needed by HFIR for refueling.

2.1.2.5 *Foreign Research Reactors Program*

This program supplies HEU and LEU from Y-12 in the form of metal and oxides (UO_2 and U_3O_8) to Foreign Research Reactors (FRRs) for fuel or target fabrication. These FRRs produce medical isotopes for the world community and/or do basic nuclear research and material testing. The supply contracts are between NNSA Y-12 Site Office (YSO) and the equivalent foreign government agencies. HEU material is supplied to FRRs on a case-by-case basis. The material is packaged for shipment both commercially and militarily.

2.2 NON-NNSA PROGRAMS

Several non-NNSA Programs are conducted at Y-12. Among these non-NNSA Programs are the following:

- Complementary Work/Work for Others Program;
- Environmental Management Programs;
- Nondefense Research and Development Program; and
- Complementary Work/Technology Transfer Program.

The following sections briefly describe these programs.

2.2.1 Complementary Work/Work for Others Program

The NSP manages programs that leverage the technical expertise and capabilities of Y-12 to perform similar work for other Federal agencies, contractors, and organizations within the DOE Complex and the private sector. Such work must be "complementary" to core mission work. The Work for Others Program is staffed with personnel working in computer science, mathematics, statistics, physical sciences, social sciences, life sciences, technology development and all engineering disciplines. The objectives of the program are to make Federal R&D and prototyping capabilities available to other Federal agencies (such as the DoD, National Aeronautics and Space Administration, etc.) and the private sector to:

- Solve complex problems of national importance;
- Improve present capabilities for future DOE programs; and
- Transfer technology to industry to strengthen the U.S. industrial base.

The Work for Others Program at Y-12 has been and is currently involved in advanced work in the environmental research, information management, materials, precision machining, hardware prototyping, and robotics technologies. These activities are carried out in various Y-12 facilities in conjunction with ongoing NNSA activities.

2.2.2 Environmental Management Program Operations at Y-12

The Office of Environmental Management activities at Y-12 include waste management and environmental restoration which are described below. Beginning in 2006, the Office of Environmental Management transferred the scope of work associated with newly generated wastes to NNSA.

2.2.2.1 *Waste Management*

Waste Management Program activities at Y-12 are divided into five functional areas: (1) pollution prevention, (2) waste treatment, (3) waste storage, (4) waste disposal, and (5) continuity of operations and program support. The Y-12 waste management activities address all types of facility waste: radioactive, polychlorinated biphenyl (PCB), hazardous, mixed (both radioactive and hazardous), sanitary, and industrial. There are over 35 active waste management facilities at Y-12. These facilities are described in Section 4.13. Most waste management facilities at Y-12 are for waste storage and treatment. Three land disposal facilities are currently in operation at Y-12, and two more have been permitted and constructed. In addition to active waste management facilities, there are numerous inactive waste management facilities. Many of these are Solid Waste Management Units (SWMUs) managed under the RCRA. Some former waste management units are now being addressed through response actions under the *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA). Closed and inactive waste management facilities are not described individually in waste management sections of this SWEIS.

2.2.2.2 *Environmental Restoration*

EM oversees and manages ORR remedial activities pursuant to the *Federal Facility Agreement* (FFA) *for the Oak Ridge Reservation* (DOE/OR 1992). The Office of Environmental Management serves as primary contact and coordinator with the regulators (the Tennessee Department of Environment and Conservation [TDEC] and the U.S. Environmental Protection Agency [EPA]) for implementing the FFA. There are several environmental restoration projects within the Y-12 area of analysis. These include the Bear Creek and Upper East Fork Poplar Creek (UEFPC) watershed projects. The environmental restoration projects, which are undertaken pursuant to CERCLA, are not expected to change as a result of the alternatives analyzed in the SWEIS.

2.2.2.3 *Integrated Facility Disposition Program*

The purpose of the Integrated Facility Disposition Program (IFDP) is to eliminate the high-risk legacies of the Manhattan Project and Cold War, complete the ORR environmental cleanup mission, and enable the ongoing modernization of ORNL and Y-12. Modernization activities at

Y-12 will consolidate activities into smaller facilities, resulting in the need to eliminate excess, obsolete facilities that are no longer useful and interfere with current and future missions at the site. The D&D of these excess facilities is a major component of the IFDP. This initiative also is directed at integrating the process to address disposition of excess facilities and associated soil and groundwater remediation between multiple DOE departments, programs and organizations in Oak Ridge including Office of Environmental Management, DOE Offices of Science (DOE-SC) and Nuclear Energy (DOE-NE), and NNSA programs. Because the entire ORR is identified as a Superfund site on the National Priorities List, activities under the IFDP are performed in accordance with CERCLA requirements. The IFDP includes facilities currently in the EM life cycle baseline, newly identified excess facilities, and facilities projected to become excess at Y-12. The IFDP would allow for the D&D of over 3.8 million square feet of NNSA, DOE-SC, DOE-NE, and DOE-EM excess space over the next 30 to 40 years.

2.2.2.4 *American Recovery and Reinvestment Act*

The current American Recovery and Reinvestment Act (ARRA) scope under the Waste Management and IFDP consists of the demolition of five facilities, the removal of legacy material in part or total from two facilities, D&D of a filter housing in a single facility, and the remediation of two facilities/areas over approximately the next 2 to 3 years. Specific projects include:

- Removal of All Legacy Material from 9201-5 (Alpha-5)
- Removal of Legacy Material from the second floor of 9204-4 (Beta-4)
- Salvage Yard Remediation
- Deactivation and Demolition (D&D) of Building 9206 bag filter house and associated recovery furnace
- Demolition of Buildings 9211, 9220, 9224, 9735, and 9769
- West End Mercury Area (Storm Sewer) Remediation

Activities under the ARRA are performed in accordance with CERCLA requirements.

2.2.3 Nondefense Research and Development Program

Manufacturing and material science projects make use of manufacturing and development facilities throughout Y-12. Technical Computing is located in the IT Services Building and in the recently-completed New Hope Center at Y-12. The on-site location is conducive to, and essential for, supporting Y-12 NNSA mission activities. Technical Computing relies on Y-12's network capabilities for internal and external connectivity. As the Complementary Work customer base grows, connectivity will be critical for performing research in new network environments such as the next generation Internet.

2.2.4 Oak Ridge National Laboratory Relocation Plans

DOE-SC has relocated all of its programs residing on the Y-12 site to their main campus in Bethel Valley. NNSA has supported DOE-SC in these efforts because a number of facility and program related actions require an integrated relocation plan. Most of the large buildings that ORNL occupied at Y-12 were constructed for the uranium separation mission of the Manhattan

Project. For all facilities that ORNL vacated, DOE-SC is responsible for the safe and compliant shutdown and long-term surveillance and maintenance of such facilities until their transfer and disposition.

DOE-SC is placing all excess space at Y-12 in a safe and secure shutdown mode. Surveillance and maintenance will continue until funding is identified for their D&D. Because the entire ORR is identified as a Superfund site on the National Priorities List, activities associated with such D&D would be performed in accordance with CERCLA requirements.

2.2.5 NNSA Complex Transformation

In October 2008, NNSA published a *Final Supplemental Programmatic Environmental Impact Statement for Complex Transformation* (SPEIS) (NNSA 2008). The SPEIS evaluated programmatic alternatives (as well as several project alternatives that would not affect Y-12) that involve the restructuring of facilities that use or store significant (i.e., Category I/II) quantities of SNM including HEU. NNSA considered a reasonable range of alternatives that could reduce the size, capacity, number of sites with Category I/II SNM and eliminate redundant sites. NNSA proposed to decide where facilities for plutonium, HEU, and assembly and disassembly activities would be located, whether to construct new or renovate existing facilities for those functions, and whether to further consolidate SNM storage. The programmatic functional capabilities evaluated in the SPEIS included enriched uranium operations, including canned subassembly manufacturing, assembly, and disassembly; Category I/II SNM storage; and related research and development including those currently performed at Y-12. Among the alternatives evaluated are alternatives that could relocate the bulk of the NNSA mission at Y-12 to another location. With respect to uranium manufacturing and research and development, NNSA identified the following preferred alternative: Y-12 would continue as the uranium center producing components and canned subassemblies and conducting surveillance and dismantlement. NNSA will consolidate EU storage in HEUMF. NNSA will build a Uranium Processing Facility (UPF) at Y-12 in order to provide a smaller and modern EU production capability. NNSA issued Records of Decision informed by the SPEIS on December 19, 2008 (73 FR 77644 and 77656). The preferred alternative in this Y-12 SWEIS (see Section 3.6) is consistent with the Complex Transformation ROD (73 FR 77644).

2.2.6 Complementary Work/Technology Transfer Program

The Technology Transfer Program is hosted by DOE and has as its goal to apply expertise, initially developed for highly specialized military purposes, to a wide range of manufacturing situations to support expansion of the capabilities of the U.S. industrial base. These activities are carried out in various Y-12 facilities in conjunction with ongoing activities.

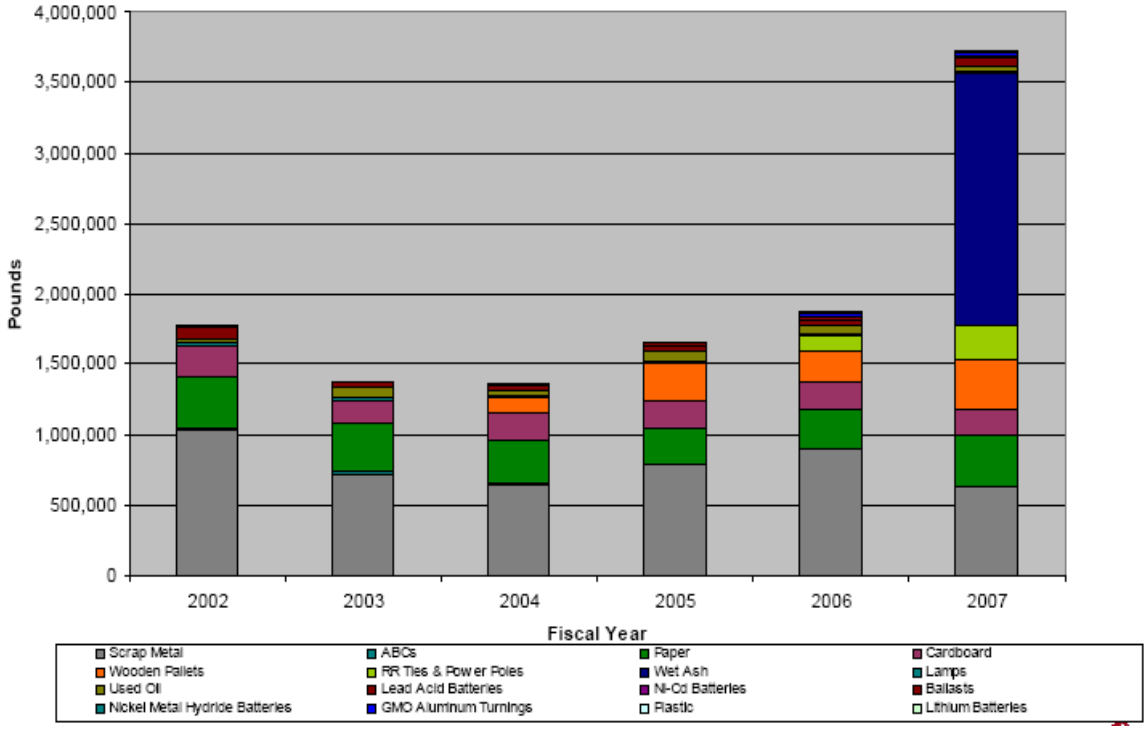
2.2.7 Pollution Prevention, Conservation, and Recycling Programs

Y-12 has a demonstrated record of implementing programs to reduce waste, conserve energy, and clean-up legacy environmental contamination. Part of making Y-12 greener is the multitude of activities undertaken by the Waste Management group. Acting as an umbrella that encompasses recycling, pollution prevention, and source reduction, the Sustainability and Stewardship Program also aids environmental compliance by allowing for a successful

Environmental Management System. Y-12's Clean Sweep Program has recycled unneeded resources and created a safer, cleaner site. Y-12 has a strong record of procuring environmentally preferable products, including materials with recycled-content and energy efficient appliances. In 2007, Y-12 procured materials with recycled-content valued at more than $2.5 million for use at the site (Y-12 2008).

Infrastructure consolidation activities have already significantly changed the face of the Y-12 Complex. Y-12 documented environmental success stories demonstrating measurable results in pollution prevention. Notable results include reducing more than 436 metric tons of waste including low-level and hazardous waste; reducing energy usage by more than 93 million kilowatt hours since fiscal year 2004 through modernization activities; eliminating more than 5,000 pounds or 70 percent of trichlorofluoromethane (CFC-11) compared to 2005 levels; conserving more than 86,000 cubic yards of landfill space and establishing 3.5 acres of native grasses; and reducing gasoline consumption in fiscal year 2006 by 15,500 gallons while increasing flex fuel usage. In FY 2008, Y-12 implemented 96 pollution prevention initiatives with a reduction of more than 66.5 million pounds of waste with a cost avoidance of more than $4.15 million. Since 1993, Y-12 has completed more than 802 pollution prevention projects including on-going recycling projects that have resulted in the elimination of more than 1.87 billion pounds of waste at an estimated cost avoidance of more than $53 million (TDEC 2009).

Y-12 has a strong recycling program, and as can be seen from Figure 2-4, Y-12 has greatly increased recycling activities over the past several years.



Source: Y-12 2008.

Figure 2-4. Y-12 Recycling Activities.

In 2007, Y-12 installed heating, cooling, ventilation, and lighting upgrades in two major facilities. Additionally, approximately 700 old-style cathode ray tube (CRT) monitors were replaced with the more energy-efficient and ergonomic flat screen liquid crystal display (LCD) monitors in FY 2007. In addition, during FY 2007, more than 750 LEED silver-rated desktops, more than 975 silver-rated LCD monitors, 1 bronze-rated laptop, and more than 65 gold-rated laptops were purchased (DOE 2008).

Y-12 teamed with the ORNL and an offsite smelting operation to avoid the generation of mixed-hazardous waste at Y-12 and to reduce the need for procurement of a hazardous material at ORNL and across the DOE nuclear security enterprise. ORNL had identified the need for lead for use as shielding in onsite operations but did not have enough onsite to meet its needs. Additionally, an offsite smelting operation needed lead for use across the DOE nuclear security enterprise. In contrast, Y-12 had excess lead on site that if not reused would ultimately be deemed a mixed RCRA hazardous waste. Through these joint efforts, approximately 53,323 pounds of excess lead located at Y-12 was transferred to contractors at ORNL for reuse as shielding and to the off-site smelting operation for use across the DOE nuclear security enterprise.

Y-12 has further expanded the battery recycling initiative to include the recycling of silver, lithium, and mercury batteries to an off-site recycling vendor. This initiative was fully-implemented during September 2007. This recycling initiative is expected to contribute to waste-reduction amounts and cost avoidances in the future (DOE 2008).

The commitment of Y-12 to energy efficiency, pollution prevention, recycling and other such green practices is exemplified by the more than 40 external awards received since November 2000. Some of the more recent awards are as follows:

- 2006 White House Closing the Circle Award for Partnering in Recycling and Reuse
- 2007 White House Closing the Circle Honorable Mention Award for Expanding the Use of Alternative Fuels
- 2006 Tennessee Chamber of Commerce and Industry Environmental Award for Recycling
- 2007 Tennessee Chamber of Commerce and Industry Environmental Award for Energy Efficiency
- 2007 Environmental Protection Magazine Award for Environmental Achievement
- 2009 Tennessee Department of Environmental and Conservation Tennessee Pollution Prevention (TP3) Green Flag for Demonstrated Achievement.

Table 2-1. Y-12 Defense Program Major Facility Overview.

Facility	Function	Mission	Current Status
EU Complex	• Uranium Recovery Operations • Metallurgical Operations • In-Process Storage • X-ray density	• Recovery of EU to a form suitable for storage • Casting EU metal (for weapons, storage, reactors, or other uses) • EU down-blending • Accountability of EU from Y-12 activities • Nondestructive evaluation of parts • Packaging for Off-site Transportation	Operating
Intermediate Assay Building	• Chemical recovery of intermediate enrichments of EU (20% to 85% U-235) • In-Process Storage	• Recovery of EU to a form suitable for storage	Not Operating-EU materials will be transferred to other areas for processing or to a storage location. Operations in this building will not resume
EU By-Products Storage Building	• Storage of combustibles, residues and other solid by-product material contaminated by EU	• Storage of combustibles, residues, and other solid materials awaiting chemical recovery of EU	In use as a storage facility
Metalworking Building	• Storage • Fabrication (rolling, heat treating, forming, shearing, machining, inspection, etc.) of parts	• Storage and handling of EU and DU • Fabrication and inspection of metal parts	Operating
EU Storage Building	• Storage of EU • Receiving • Shipping • SNM vehicle material transfers	• Warehouse for shipping and receiving EU from other sites • Transient, interim, and long-term storage of EU • In-plant material transfers in SNM vehicle	Operating

Table 2-1. Y-12 Defense Program Major Facility Overview (*continued*).

Facility	Function	Mission	Current Status
Assembly and Special Materials Process Buildings	• Assembly • Product Certification • Disassembly • Storage • Quality Evaluation	• Assembly of new or replacement weapons components/assemblies • Quality operations for certification • Disassembly of retired weapons components/assemblies and part recovery • Storage of retired weapons assemblies, subassemblies, and components • LiH/LiD production • Shelf Life Program – Medium and Long Term Evaluations	Operating
Quality Evaluation Building	Formerly: • Quality Evaluation/Disassembly • DU Metalworking • Testing	• Quality Evaluation/Disassembly was conducted	No longer Operating QE function now being performed in the Assembly Bldg. and DU metalworking performed in the Metalworking facility complex
Plant Laboratory Building	• Analytical Chemistry Organization	• Provides analytical support services for Y-12 and regulatory compliance	Operating
Special Materials Machining	• Metal machining	• Machining of metal parts	Not operating
DU Metalworking Building	• Machining • Dimensional Inspection • Electroplating • X-ray density	• Depleted uranium and stainless-steel machining • Dimensional inspection of parts • Electroplating of parts • Nondestructive evaluation of parts	Operating

Table 2-1. Y-12 Defense Program Major Facility Overview (*continued*).

Facility	Function	Mission	Current Status
Development Buildings	• Process Development • Beryllium Operations	• Development and refinement of manufacturing processes employed at Y-12 • Technology transfer support	Operating
Tooling Storage Building	• Storage	• Tooling and material storage	Operating
General Manufacturing Building	• Metal and graphite machining	• General machine shop • Machining and tooling • Work for others • Technology transfer	Operating
DU Processing Building	• Machining processes • Dimensional Inspection • Nondestructive Evaluation (X-ray density)	• DU operations • Dimensional inspection of parts • Nondestructive evaluation of parts	Operating
HEUMF	• Storage of EU • Receiving • Shipping • SNM vehicle material transfers	• Warehouse for shipping and receiving EU from other sites • Transient, interim, and long-term storage of EU • In-plant material transfers in SNM vehicle	Operating
Purification Facility	• Chemical Processing	• Special Material production	Operating

Source: B&W 2005b.
Note: SNM - special nuclear material, EU – enriched uranium, DU – depleted uranium, LiH – lithium hydride, LiD – lithium deuteride.