DOE/EIS-0387

Draft Site-Wide Environmental Impact Statement for the Y-12 National Security Complex

October 2009

U.S. Department of Energy
National Nuclear Security Administration
Y-12 Site Office

COVER SHEET

RESPONSIBLE AGENCY: United States (U.S.) Department of Energy (DOE), National Nuclear Security Administration (NNSA)

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Abstract: The NNSA, a separately organized agency within the DOE, has the responsibility to maintain the safety, reliability, and security of the U.S. nuclear weapons stockpile to meet national security requirements. NNSA manages nuclear weapons programs and facilities, including those at the Y-12 National Security Complex (Y-12) at Oak Ridge, Tennessee. This Draft Y-12 SWEIS analyzes the potential environmental impacts of reasonable alternatives for ongoing and foreseeable future operations, facilities, and activities at Y-12.

Five alternatives are analyzed in this Draft Y-12 SWEIS: (1) No Action Alternative (maintain the status quo); (2) Uranium Processing Facility (UPF) Alternative; (3) Upgrade-in-Place Alternative; (4) Capability-sized UPF Alternative; and (5) No Net Production/Capability-sized UPF Alternative. This document assesses the potential environmental impacts of operations on land uses and applicable plans, socioeconomic characteristics and environmental justice, prehistoric and historic cultural resources, visual resources, geology and soils, biological resources, water, air quality, noise, traffic and transportation, utilities and energy, waste management, human health and safety, intentional destructive acts, and accidents. The Capability-sized UPF Alternative is the preferred alternative.

Public Involvement: On November 28, 2005, NNSA published a Notice of Intent (NOI) in the *Federal Register* (70 FR 71270) announcing its intent to prepare this Y-12 SWEIS and starting the public scoping period. The scoping period continued through January 31, 2006. (Note: In the NOI, the public scoping comment period was scheduled to end on January 9, 2006; however, in response to public requests, the public scoping comment period was extended until January 31, 2006 (71 FR 927). NNSA invited the public to submit comments during the scoping period by postal mail, electronic mail, fax, and through written and verbal comments. Two public scoping meetings were held on December 15, 2005, in Oak Ridge, Tennessee. All comments received during the scoping period were considered during the preparation of this Draft Y-12 SWEIS.

NNSA had originally planned to issue the Draft Y-12 SWEIS in late 2006; however, in October 2006, NNSA decided to prepare a supplemental programmatic environmental impact statement (SPEIS) related to transforming the nuclear weapons complex ("Complex Transformation SPEIS"). As a result, NNSA decided to delay the Draft Y-12 SWEIS until the programmatic decisions on the Complex Transformation SPEIS were made. On December 19, 2008, NNSA announced a Record of Decision related to the Complex Transformation SPEIS (73 FR 77644). In that decision, NNSA decided that the manufacturing, storage, and research and development missions involving uranium will remain at Y–12, and NNSA will construct and operate a Uranium Processing Facility at Y–12. This Draft Y-12 SWEIS assesses the potential environmental impacts of reasonable alternatives for implementing that programmatic decision at Y-12.

A 60-day comment period on this document begins with the publication of the Environmental Protection Agency's Notice of Availability in the *Federal Register*. NNSA will consider comments received after the 60-day period to the extent practicable. NNSA will hold public hearings to receive comments on this document at the times and locations to be announced in local media and the DOE Notice of Availability. Written comments may also be submitted by U.S. mail to Ms. Pam Gorman at the above address or electronically at www.y12sweis.com. This document and related information are available on the Internet at www.y12sweis.com.

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Prepared by:

U.S. Department of Energy
National Nuclear Security Administration
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National Nuclear Security Administration

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ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
ACGIH	American Conference of Governmental Industrial Hygienists
ACHP	Advisory Council of Historic Preservation
ACO	Analytical Chemistry Organization
AEA	*Atomic Energy Act*
ALARA	as low as reasonably achievable
AMSL	above mean sea level
AQCR	Air Quality Control Region
ASER	Annual Site Environmental Report
ASTM	American Society for Testing and Materials
BA	Biological Assessment
BC	Bear Creek
BFK	Bushy Fork Kilometer
BLM	Bureau of Land Management
BMAP	Biological Monitoring and Abatement Program
BMP	Best Management Practice
BO	Biological Opinion
BSWTS	Big Spring Wastewater Treatment System
B&W	Babcock & Wilcox Technical Services Y-12, LLC, the management and operating contractor at Y-12
CAs	Central Alarm System
CAA	*Clean Air Act*
CATV	Cable Television Network
CAUP	Compressed Air Upgrades Project
CCC	Complex Command Center
CD	Critical Decision
CEDE	collective committed effective dose equivalent
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFR	Code of Federal Regulations
CMC	Consolidating Manufacturing Complex
CMTS	Central Mercury Treatment System
CRMP	Cultural Resource Management Plan
CSF	Cancer Slope Factors
CSMO	Central Scrap Management Office
CTBT	Comprehensive Test Ban Treaty
CWA	*Clean Water Act*
CWAP	Clean Water Action Plan
CX	categorical exclusion
CY	calendar year
D&D	decontamination and decommissioning
DARA	disposal area remedial action
DBT	Design Basis Threat
DLA	Defense Logistics Agency

DNFSB	Defense Nuclear Facility Safety Board
DNL	Day-Night Average Sound Level
DoD	Department of Defense
DOE	U.S. Department of Energy
DOE-NE	U.S. Department of Energy Office of Nuclear Energy, Science, and Technology
DOE-SC	U.S. Department of Energy Office of Science
DOT	Department of Transportation
DP	Defense Programs
DSWM	Division of Solid Waste Management
DU	depleted uranium
EA	Environmental Assessment
ECF	Entry Control Facility
EDE	effective dose equivalent
EDSU	Electrical Distribution System Upgrades
EEMTS	East End Mercury Treatment System
EFK	East Fork Poplar Creek Kilometer
EFPC	East Fork Poplar Creek
EIS	Environmental Impact Statement
EM	Environmental Management
EMWMF	Environmental Management Waste Management Facility
EO	Executive Order
EOC	Emergency Operations Center
EOL	End-of-Life
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
ESCO	Emergency Savings Contractor
ES&H	environment, safety and health
ETTP	East Tennessee Technology Park
EU	enriched uranium
EUMF	Enriched Uranium Manufacturing Facility
FAA	Federal Aviation Administration
FFA	*Federal Facilities Agreement*
FFCA	*Federal Facilities Compliance Act*
FIRP	Facilities and Infrastructure Recapitalization Program
FOD	Fire Department Operations
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FRR	foreign research reactor
FY	Fiscal Year
GTRI	Global Threat Reduction Initiative
GSMNP	Great Smoky Mountain National Park
HAP	Hazardous Air Pollutant
HDPO	HEU Disposition Program Office
HEPA	high-efficiency particulate air
HEU	highly enriched uranium
HEUMF	Highly Enriched Uranium Materials Facility

HFIR	high flux isotope reactor
HI	Hazard Index
HPP	*National Historic Preservation Act* Historic Preservation Plan
HQ	hazard quotient
HVAC	heating, ventilation, and air conditioning
IAEA	International Atomic Energy Agency
ICP	inductively coupled plasma
ICP-MS	mass spectrometry
IFDP	Integrated Facility Disposition Project
INEL	Idaho National Engineering Laboratory
IR	Infrastructure Reduction
LANL	Los Alamos National Laboratory
LCF	latent cancer fatality
LEP	Life Extension Program
LEU	low-enriched uranium
LLW	low-level waste
LMES	Lockheed Martin Energy Systems, Inc.
LOS	Level-of-Service
LWB	Lower Watts Bar
LWD	Lost Workdays
MAA	material access area
MBA	Material Balance Area
MCL	Maximum Concentration Limits
MEI	maximally exposed individual
MLLW	mixed low-level waste
NAAQS	National Ambient Air Quality Standard
NABIR	Natural and Accelerated Bioremediation Research
NDA	nondestructive assay
NDT	nondestructive testing
NE	Office of Nuclear Energy, Science and Technology
NEPA	*National Environmental Policy Act*
NERP	National Environmental Research Park
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	*National Historical Preservation Act*
NIOSH	National Institute for Occupational Safety and Health
NN	Nuclear Nonproliferation and National Security
NNSA	National Nuclear Security Administration
NOI	Notice of Intent
NOX	nitrogen oxides
NP	Natural Phenomena
NPDES	National Pollutant Discharge Elimination System
NPR	Nuclear Posture Review
NPT	Nuclear Nonproliferation Treaty
NRHP	National Register of Historic Places
NSDWS	National Secondary Drinking Water Standard
NSP	National Security Program

NTS	Nevada Test Site
NWC	Nuclear Weapons Complex
ODS	Ozone Depleting Substances
O&M	operation and maintenance
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
ORO	Oak Ridge Office
OSHA	Occupational Safety and Health Administration
OST	Office of Secure Transportation
PEL	permissible exposure limits
P&PDs	Production and Planning Directives
PC	performance categories
PCB	polychlorinated biphenyl
PEIS	Programmatic Environmental Impact Statement
PIDAS	Perimeter Intrusion Detection and Assessment System
PRG	Preliminary Remediation Goals
PSS	Plant Shift Superintendent
POTW	Oak Ridge Publicly Owned Treatment Works
RCRA	*Resource Conservation and Recovery Act*
REM	roentgen equivalent man
RERTR	Reduced Enrichment Research and Test Reactor
R&D	research and development
ROD	Record of Decision
ROI	region of influence
SA	Supplemental Analysis
SAS	secondary alarm system
SARA	*Superfund Amendments and Reauthorization Act*
S&D	Storage and Disposition
SGT	Safeguard Transporters
S&M	service and maintenance
SEAB	Secretary of Energy Advisory Board
S-HEU	surplus highly enriched uranium
SHPO	State Historic Preservation Officer
SIP	Security Improvement Project
SLEP	Stockpile Life Extension Programs
SMC	Special Materials Complex
SMR	Standard Metabolic Rates
SNF	Spent Nuclear Fuel
SNM	special nuclear material
SNS	Spallation Neutron Source
SPLE	steam plant life extension
SR	State Route
SRS	Savannah River Site
SSM	Stockpile Stewardship and Management
SSM PEIS	*Programmatic Environmental Impact Statement for Stockpile Stewardship and Management*

SST	safe secure trailer
START	Strategic Arms Reduction Talks
SWEIS	Site-Wide Environmental Impact Statement
SWMU	solid waste management unit
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
T&E	threatened and endangered
TEEL	temporary emergency exposure limits
TEV	Threshold Emission Value
TLV	Threshold Limit Value
TRAGIS	Transportation Routing Analysis Geographic Information System
TRC	Total Recorded Cases
TRU	transuranics
TSCA	*Toxic Substances Control Act*
TSHPO	Tennessee State Historic Preservation Officer
TSR	Tennessee State Route
TSWMA	*Tennessee Solid Waste Management Act*
TVA	Tennessee Valley Authority
TYCSP	Ten-Year Comprehensive Site Plan
TYSP	Ten Year Site Plan
UCNI	Unclassified Controlled Nuclear Information
UEFPC	Upper East Fork Poplar Creek
UPF	Uranium Processing Facility
USEC	United States Enrichment Corporation
USFWS	US Fish and Wildlife Service
USACE	U.S. Army Corps of Engineers
VOCs	volatile organic compounds
VRM	Visual Resource Management
WAC	waste acceptance criteria
WETF	West End Treatment Facility
WIPP	Waste Isolation Pilot Plant
WMA	Wildlife Management Area
WVDP WM	West Valley Demonstration Project Waste Management
Y-12	Y-12 National Security Complex
YSO	Y-12 Site Office

UNIT OF MEASURE AND ABBREVIATIONS

A-weighted decibel	dBA
cubic meters	m^3
cubic meters per year	m^3/yr
cubic yards	yd^3
decibel	dB
gallons per day	gal/day
gallons per year	gal/yr
kilovolt	KV
kilowatt hour	kWh
kilowatt hours per year	kWh/yr
megavolt ampere	MVA
megawatt	MW
megawatt hours	MWh
million	M
million gallons per day	M gal/day
million gallons per year	M gal/yr
millirem	mrem
millirem per year	mrem/yr
particulate matter of aerodynamic diameter less than 10 micrometers	PM_{10}
pounds per square inch gauge	psig
rem per year	rem/yr
square feet	ft^2
standard cubic feet	scf
tons per year	tons/yr

CONVERSION CHART

TO CONVERT FROM U.S. CUSTOMARY INTO METRIC			TO CONVERT FROM METRIC INTO U.S. CUSTOMARY		
If you know	**Multiply by**	**To get**	**If you know**	**Multiply by**	**To get**
		Length			
inches	2.540	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.03281	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.6214	miles
		Area			
square inches	6.452	square centimeters	square centimeters	0.1550	square inches
square feet	0.09290	square meters	square meters	10.76	square feet
square yards	0.8361	square meters	square meters	1.196	square yards
acres	0.4047	hectares	hectares	2.471	acres
square miles	2.590	square kilometers	square kilometers	0.3861	square miles
		Volume			
fluid ounces	29.57	milliliters	milliliters	0.03381	fluid ounces
gallons	3.785	liters	liters	0.2642	gallons
cubic feet	0.02832	cubic meters	cubic meters	35.31	cubic feet
cubic yards	0.7646	cubic meters	cubic meters	1.308	cubic yards
		Weight			
ounces	28.35	grams	grams	0.03527	ounces
pounds	0.4536	kilograms	kilograms	2.205	pounds
short tons	0.9072	metric tons	metric tons	1.102	short tons
		Temperature			
Fahrenheit (^oF)	subtract 32, then multiply by 5/9	Celsius (^oC)	Celsius (^oC)	multiply by 9/5, then add 32	Fahrenheit (^oF)
Kelvin (K)	subtract 273.15	Celsius (^oC)	Celsius (^oC)	add 273.15	Kelvin (K)

Note: 1 sievert = 100 rem

CHAPTER 1: INTRODUCTION AND PURPOSE AND NEED FOR ACTION

Chapter 1 presents an overview of this Y-12 Site-Wide Environmental Impact Statement (SWEIS), including the relevant history and SWEIS scope. The Chapter also discusses the purpose and need for agency action and the national security considerations that are involved in developing this SWEIS. Next, the Chapter describes related National Environmental Policy Act *(NEPA) documents. The chapter concludes with an overview of the public involvement process, including a discussion of the comments that were received during the public scoping period.*

1.0 INTRODUCTION

The National Nuclear Security Administration (NNSA), a separately organized agency within the U.S. Department of Energy (DOE), is the federal agency responsible for maintaining and enhancing the safety, security, reliability, and performance of the U.S. nuclear weapons stockpile. This *Site-Wide Environmental Impact Statement for the Y-12 National Security Complex* (Y-12 SWEIS) analyzes the potential environmental impacts of ongoing and future operations, facilities, and activities at the Y-12 National Security Complex (Y-12). The primary purpose of continuing to operate Y-12 is to provide support for NNSA's national security missions.

Secondaries and Cases

A secondary is a component of a nuclear weapon that contains elements needed to initiate the fusion reaction in a thermonuclear explosion. A case contains the secondary and other components.

Y-12 is one of three primary installations on the DOE Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee (Figure 1-1). The other installations are the Oak Ridge National Laboratory (ORNL) and the East Tennessee Technology Park (ETTP) (formerly the Oak Ridge K-25 Site). Construction of Y-12 started in 1943 as part of the World War II Manhattan Project. The early missions of the site included the separation of uranium-235 from natural uranium[1] by the electromagnetic separation process and the manufacture of nuclear weapons components from uranium and lithium. Today, as one of the NNSA major production facilities, Y-12 is 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. Y-12 is unique in that it is the only source of **secondaries**,[2] **cases**, and other nuclear weapons components within the NNSA nuclear security enterprise.[3] Y-12 also dismantles weapons components, safely and securely stores and manages special nuclear material (SNM)[4],

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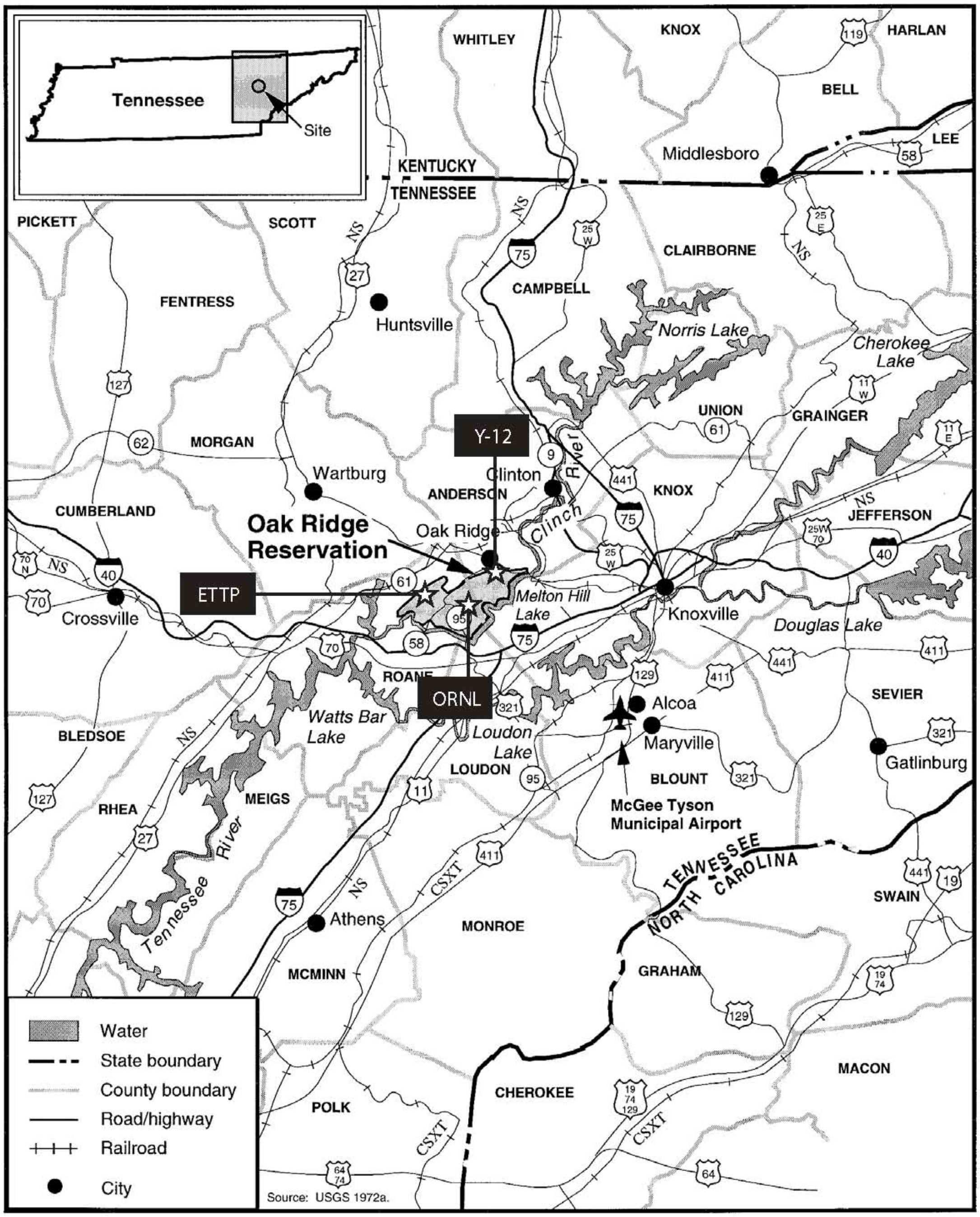
[1] Natural uranium is a mixture of uranium-238 (99.2739 percent), uranium-235 (0.7205 percent) and uranium-234 (0.0056 percent).

[2] Text boxes provide additional information on terms that are bold-faced.

[3] "Nuclear security enterprise" is a relatively new term that refers to the NNSA complex in its entirety. In the past, NNSA used the term "nuclear weapons complex". NNSA believes that "nuclear security enterprise" more accurately describes its basic mission as a "nuclear security" organization that addresses a broad range of nuclear security items (the stockpile, nuclear non-proliferation, nuclear counter-terrorism, incident response, emergency management, etc.).

[4] As defined in Section 11 of the *Atomic Energy Act of 1954*, the term SNM means: (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Nuclear Regulatory Commission determines to be SNM, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material.

supplies SNM for use in naval and research reactors, and dispositions surplus materials. Y-12 nuclear nonproliferation programs play a critical role in securing our nation and the globe by combating the spread of weapons of mass destruction by removing, securing, and dispositioning SNM.



Source DOE 2001a.

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

Y-12 also conducts and/or supports nondefense-related activities including environmental monitoring, remediation, and decontamination and decommissioning (D&D) activities of the DOE Environmental Management (EM) Program; manages waste materials from past and current operations; supports the production of medical isotopes; and develops highly specialized technologies to support the capabilities of the U.S. industrial base, and the down-blending of weapons-grade materials to non-weapons forms suitable for use in commercial reactors.

This chapter provides background information on Y-12, describes the scope of this SWEIS, explains the purpose and need for agency action, discusses Y-12's past ***National Environmental Policy Act*** (NEPA) (42 *United States Code* [U.S.C.] §4321 et seq.) activities, and addresses the scoping comments received during the scoping period. Chapter 2 provides an overview of Y-12 missions, operations, programs, and facilities. Chapter 3 discusses the alternatives considered in this SWEIS. Chapter 4 describes the existing environment. Chapter 5 identifies the environmental consequences of the alternatives. The remaining chapters and appendices provide additional details on the information in Chapters 1 through 5.

> ***National Environmental Policy Act***
>
> NEPA requires the preparation of an environmental impact statement for every major federal action that may significantly affect the quality of the human environment. NEPA's main purpose is to provide environmental information to decisionmakers and the public so that actions are based on an understanding of the potential environmental consequences of a proposed action and its reasonable alternatives.

1.1 BACKGROUND

In the mid-1990s, DOE prepared several Programmatic EISs (PEISs) to inform decisionmakers and the public on the potential environmental impacts of alternatives for carrying out its national security missions (see Section 1.7.1 for a discussion of those PEISs and their relevance to this Y-12 SWEIS). DOE then made a number of decisions related to the nuclear security enterprise operations at Y-12 and the long term storage and disposition of fissile material.[5] Specifically, DOE decided that the mission of Y-12 would not change, and Y-12 would continue to maintain the capability and capacity to fabricate nuclear weapons secondaries, cases, and limited-life components in support of the nuclear weapons stockpile, and store/process nonsurplus, highly enriched uranium (HEU) long term and surplus HEU pending disposition. See Section 1.7.1 for a discussion of these previous PEISs.

Following the PEIS decisions, DOE/NNSA prepared the 2001 Y-12 SWEIS (DOE/EIS-0309) to evaluate alternatives for implementing the PEIS decisions. The Final Y-12 SWEIS, issued in September 2001, evaluated alternatives related to the operation of Y-12 for an approximate 10-year planning period. One of the primary goals of the 2001 Y-12 SWEIS was to provide an overall NEPA baseline for all DOE activities at Y-12, including an assessment of a Y-12 Modernization Program consistent with previous programmatic decisions. The purpose of the Modernization Program (see Section 1.2) is to develop and implement a program to modernize Y-12's facilities to meet future stockpile needs.

[5] Fissile materials are plutonium-239, uranium-233, uranium 235, or any material containing any of the foregoing.

In the 2001 Y-12 SWEIS, NNSA recognized and acknowledged that the Modernization Program would be implemented over a number of years so as not to interfere with Y-12 meeting required and planned mission activities. Although many potential modernization projects were identified in the 2001 Y-12 SWEIS, only two projects had reached the stage of development to have been included as proposals in that SWEIS. Alternatives for those two projects, the Highly Enriched Uranium Materials Facility (HEUMF) and the Special Materials Complex (SMC), were analyzed in the 2001 Y-12 SWEIS.

In the 2002 Record of Decision (ROD) for the 2001 Y-12 SWEIS (67 *Federal Register* [FR] 11296, March 13, 2002), NNSA announced its decision to continue operations at Y-12 and to construct and operate two new facilities: (1) the HEUMF and (2) the SMC. Construction of the HEUMF was completed in 2008 and the facility is scheduled to begin full-scale operations in 2010. In addition to being a significant contribution to modernization at Y-12, the 110,000 square-foot HEUMF will reduce the current storage footprint (by phasing out excess facilities), while improving security and lowering costs. The SMC was subsequently cancelled due to changing mission requirements and replaced by a smaller, single-function Purification Facility (*Supplement Analysis for Purification Facility, Site-Wide Environmental Impact Statement for the Y-12 National Security Complex*, DOE/EIS-0309/SA-1, August 2002 [NNSA 2002]), and the installation of new equipment in existing facilities.

Most recently, NNSA prepared the *Complex Transformation Supplemental PEIS* (SPEIS) (DOE/EIS-0236-S4) (NNSA 2008) to analyze potential environmental impacts of alternatives for transforming the nuclear weapons complex into a smaller, more efficient enterprise. (See Section 1.7.1 for a more detailed discussion of that SPEIS and its relevance to this Y-12 SWEIS.) In the ROD for that SPEIS, NNSA affirmed that manufacturing and research and development (R&D) involving uranium will remain at Y-12 (73 FR 77644, December 19, 2008). NNSA also announced that it will construct and operate a Uranium Processing Facility (UPF) at Y-12 as a replacement for existing facilities that are more than 50 years old and face significant safety and maintenance challenges to their continued operation. The NNSA committed to evaluating the site-specific issues associated with continued production operations at Y-12 in this SWEIS, including issues related to construction and operation of a UPF, such as its location[6] and size. In this new Y-12 SWEIS, NNSA continues to assess alternatives for the modernization of Y-12, including implementation of the Complex Transformation SPEIS decisions.

1.2 Y-12 TODAY AND THE VISION FOR TOMORROW

Over the past approximately 15 years, Y-12 has been taking the first steps to modernize and transform its Cold War-era site and facilities into a modern, more cost-effective enterprise. Modernization and transformation envisions the eventual replacement or upgrade of select major production and support facilities with the goal to improve Y-12 capabilities by:

[6] As described in Section 3.2.2 and shown in Figure 3.2.2-2, the proposed UPF would be located adjacent to the HEUMF, at a site just west of the HEUMF. In the 2001 Y-12 SWEIS, DOE evaluated alternative locations for the HEUMF, and in the 2002 ROD DOE decided to construct the HEUMF at the Y-12 West Portal Parking Lot Site (67 FR 11296, March 13, 2002). Construction of the HEUMF was initiated in 2005 and completed in 2008. The facility is scheduled to start full-scale operations in 2010. Locating a UPF adjacent to the HEUMF is consistent with the analysis performed in support of the 2001 Y-12 SWEIS, the Complex Transformation SPEIS, RODs based on these documents, and the Y-12 Modernization Plan. Siting a UPF at a location other than adjacent to the HEUMF would not allow for certain operational efficiencies and reduced security footprint.

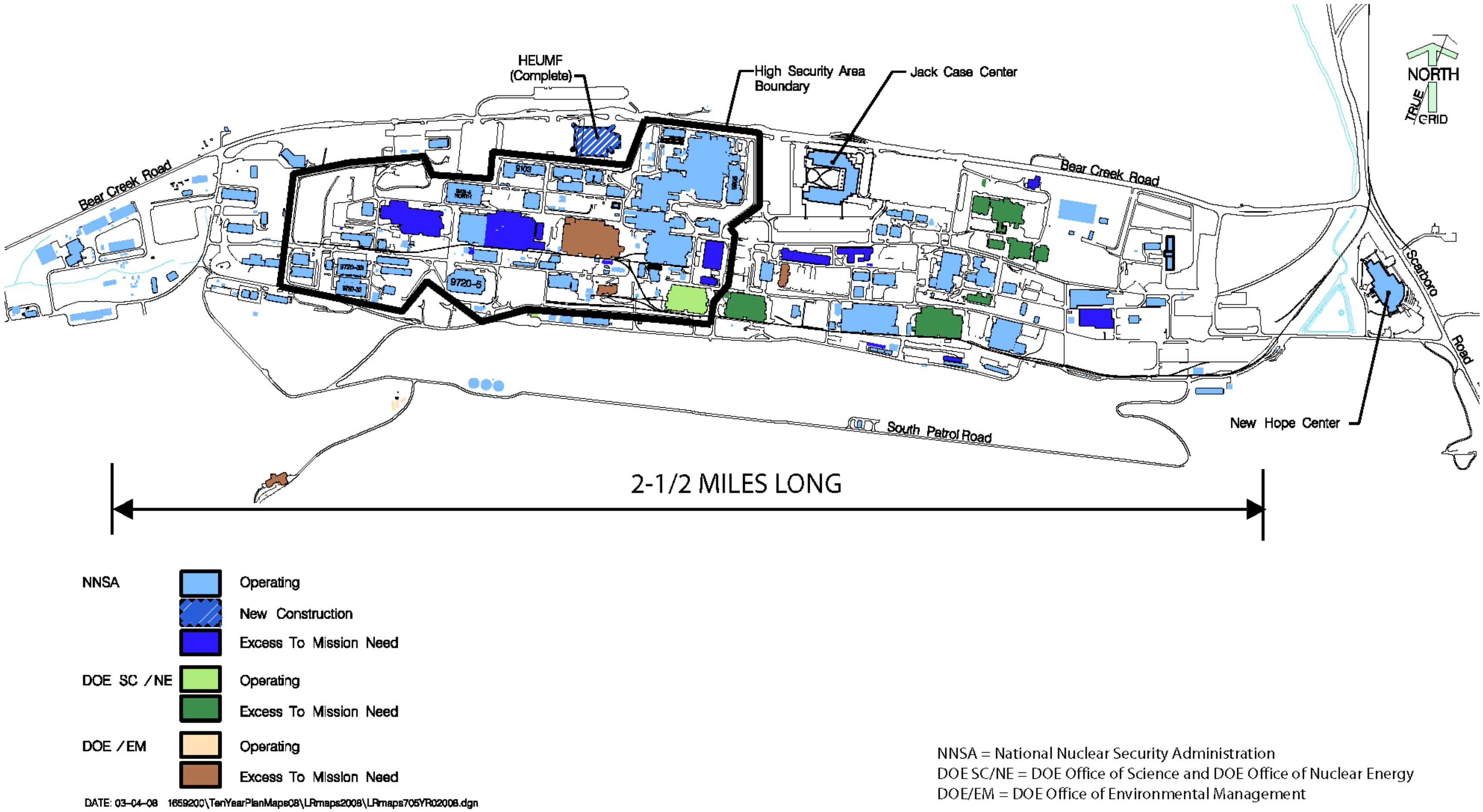
- Improving worker protection through the use of engineered controls;
- Improving safety, environmental, and security compliance through the use of modern facilities and advanced technologies;
- Supporting responsiveness to the science-based Stockpile Stewardship Program through increased flexibility and use of advanced technologies;
- Reducing costs and improving operating efficiencies.

To date, the following important actions have been completed:

- Construction of the HEUMF, Y-12's first major EU modernization project, was completed in 2008 and the facility is expected to begin full operations in 2010.
- Construction of two new technical/administrative facilities was completed in 2007. The Jack Case Center and the New Hope Center now house over 1,400 employees from Babcock & Wilcox Technical Services Y-12, LLC (B&W Y-12), the Management and Operating contractor for Y-12, and the NNSA Y-12 Site Office. Construction of these facilities facilitated the demolition of a number of excess facilities and the cancellation of several offsite leases.
- Approximately 135,469 square feet of excess floor space was demolished in 2008. Since 2002, Y-12's total footprint reduction is 1,035,076 square feet (NNSA 2008a).

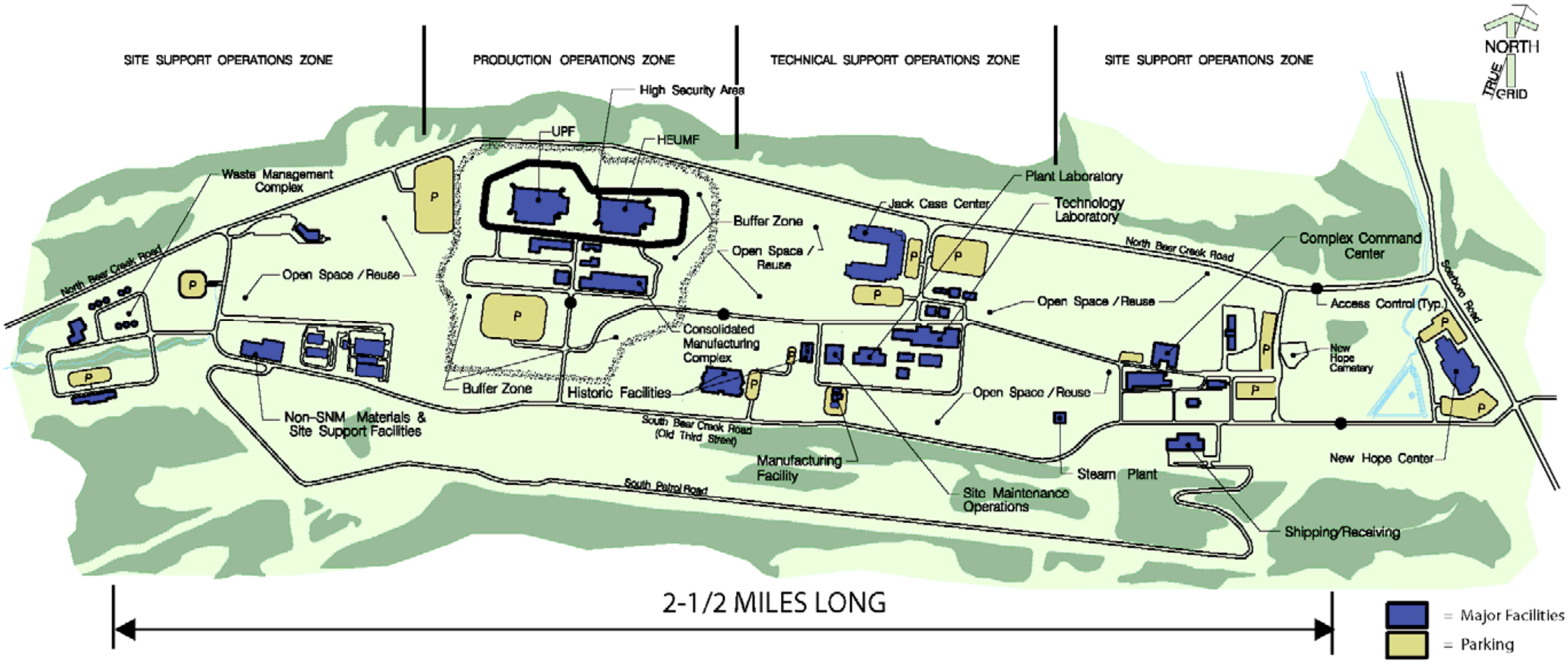
Currently, the Y-12 workforce consists of approximately 6,500 people (DOE employees and multiple contractors and subcontractors) operating approximately 393 facilities with approximately 5.8 million square feet of NNSA-owned space and leased space. This represents 75 percent of the total Y-12 site footprint (NNSA 2008a). The DOE Office of Environmental Management, Office of Science, and Office of Nuclear Energy operate the remaining facilities at Y-12. Figure 1.2-1 depicts the major operational facilities currently supporting the Y-12 missions, which are described in Chapter 2. As shown in that figure, there are numerous facilities located within an approximately 150-acre, high-security area.

While important modernization and transformation have already been accomplished, the overall vision will continue to be a work in progress. The NNSA has developed a long-range plan, which is updated annually, that reflects the Y-12 modernization plans. The current plan, dated August 2008, is referred to as the Ten-Year Site Plan (TYSP) for 2009-2018 (NNSA 2008a). The TYSP describes the missions, workload, technology, workforce, and corresponding facilities and infrastructure investment and management practices for Y-12. The TYSP also includes a long term vision of the infrastructure changes that NNSA wants to achieve at Y-12 over the next 20 years (see Figure 1.2-2). That vision presents a layout of the major operational facilities that would be required to support future national security missions at Y-12. To fully appreciate the final end-state envisioned, comparing Figure 1.2-1 against Figure 1.2-2 provides a view of the amount of consolidation and elimination of excess facilities envisioned. As can be seen, Y-12 would look significantly different beyond the 2020s than it looks today. By then, Y-12 would have significantly fewer facilities and floorspace, and significantly more open space.



Source: NNSA 2008a.

Figure 1.2-1. Major Operational Facilities Currently Supporting Y-12 Missions.



Source: NNSA 2008a.

Figure 1.2-2. The Proposed End State for the Modernization of Y-12.

From a land-use planning perspective, NNSA envisions a site that would ultimately consist of three functional zones (Production Operations, Technical Support Operations, and Site Support Operations) with significant areas of open space. The three zones are described below. The overall configuration is indicative of a modernization-in-place, or brownfield, approach to redevelopment. The approach must incorporate realistic funding for new facilities and for the D&D of excess facilities that render areas of the plant usable for redevelopment within the zones while at the same time continuing to operate the existing plant. For these reasons, while the facility footprint of Y-12 would decline, the land area requirement would likely remain in support of safeguards and security requirements (NNSA 2008a).

The vision has incorporated the disposition of all buildings that would no longer be required to support the Y-12 missions. The total site footprint is envisioned to be around 3,000,000 square feet. While the locations of some buildings are shown on Figure 1.2-2, it should be noted that some future facilities would be subject to change as more detailed master planning matures over time.

Production Operations. This zone would be dominated by the consolidation of all EU operations into HEUMF (now constructed) and the UPF (currently in preliminary design, and analyzed in this SWEIS for siting, construction, and operation). By consolidating all EU into these two facilities, the high security area that now consists of approximately 150 acres could ultimately be reduced to about 15 acres—significantly reducing security costs. With the use of advanced security surveillance systems and a smaller security area, the EU protective force will be reduced by 40–60 percent. The first phase of this consolidation is under way with the completion of the HEUMF construction. The second facility, UPF, is in the preliminary design stage. UPF is planned for completion in 2016 and for operation in 2018. The production operations zone would also include a facility to consolidate lithium, depleted uranium (DU), special materials, and general manufacturing operations. Currently, these operations are dispersed in several Manhattan Project–era and/or pre-1960 facilities. While some facility upgrades, minor consolidations, and maintenance of these facilities would continue in the short term, NNSA envisions that a small complex, or possibly a Consolidated Manufacturing Complex (CMC), could be designed and engineered to consolidate these various operations.

Technical Support Operations. This zone is dominated by the Jack Case Center (completed in 2007) and several other existing structures. Today, this zone has over 20 major facilities, many of which are Manhattan Project–era structures not designed for their current use as office buildings. Transformation envisions a zone that will contain the Jack Case Center and retain several of the more permanently constructed buildings such as 9106, 9109, 9115, 9116, 9710-3, and 9733-5. The Jack Case Center, a leased facility, houses over 1,000 people. Ongoing site planning activities are evaluating additional facilities in this zone, possibly through private sector investment. These include an R&D Center, Plant Laboratory, Maintenance facility, and warehousing.

Site Support Operations. These zones, located in the eastern and western portions of the existing Y-12 site, will contain various site support functions such as materials management, vehicle maintenance, fire station, and emergency management operations. Also included in this area of the complex is New Hope Center, completed in 2007. This facility contains functions that do not require a higher security level, such as information technology, the Y-12 visitor center, conference and training facilities, light laboratories, and offices. A new Steam Plant, funded by the Facilities and Infrastructure Recapitalization Program (FIRP) is under construction in this area and is expected to be completed in September 2010. Another FIRP-funded project, the Potable Water System Upgrades project, which is currently under construction and is expected to be completed in early 2010, will also make improvements in this area. The western site support operations zone also houses several onsite waste management facilities, including the West End Treatment Facility, tank farms, and tanker terminal. This land would continue to be used to support Y-12 operations and cleanup actions.

Open Space Reuse. As implied by the site vision, there will be a significant amount of real estate that can generally be described as open space. The space is generated as a result of legacy facility and material disposition and site cleanup over time. This land area will provide, as some of it does today, potential reuse or reindustrialization opportunities to support future programs.

Approximately 3.1 million square feet of facilities would be eliminated if the end-state is achieved. Overall, NNSA has established the following site-specific goals for Y-12:

- 90 percent reduction in the high security area;
- 60 percent reduction in the nuclear operations footprint;
- 50 percent reduction in the total building footprint (an approximate 3.1 million square foot reduction); and
- 20–30 percent reduction in the Defense Programs staff (NNSA 2008a).

Because of the long term nature of modernization and transformation, not all of the facilities/actions envisioned in the TYSP are analyzed within the alternatives considered in this SWEIS. This is due to the fact that not all of the facilities/actions are ripe for analysis. Some of these buildings are concept facilities with no established funding. Such potential future projects are described in Section 3.3 (Potential Future Y-12 Modernization Projects), based on current information. These future projects are also considered in the cumulative impacts chapter of this SWEIS (see Chapter 6). Further NEPA review would be required when these facilities are formally proposed and ripe for decision.

Additionally, some actions envisioned by the TYSP are not analyzed as proposals in this SWEIS because they are either addressed by other regulatory actions or have been analyzed in other NEPA documents. The Integrated Facilities Disposition Project (IFDP) is one such example. The IFDP is a strategic project for disposing of legacy materials and facilities at ORNL and Y-12 using an integrated approach that results in risk reduction, eliminates $70 to $90 million per year in cost of operations, provides surveillance and maintenance of excess facilities, and management of other legacy conditions. The IFDP includes both existing excess facilities and newly identified excess (or soon to be excess) facilities. Under the IFDP, the D&D of approximately 188 facilities at ORNL, 112 facilities at Y-12, and remediation of soil and groundwater contamination would occur over the next 30-40 years. The IFDP will be conducted as a remedial action under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). Cleanup and D&D activities conducted under CERCLA are reviewed through the CERCLA process. (Section 1.4 discusses the scope of this SWEIS and the alternatives addressed.)

1.3 PURPOSE AND NEED

Purpose and Need

The purpose and need for NNSA action is to support the Stockpile Stewardship Program and to meet the missions assigned to Y-12 in the Complex Transformation SPEIS ROD efficiently and safely.

The continued operation of Y-12 is critical to NNSA's **Stockpile Stewardship Program** and to preventing the spread and use of nuclear weapons worldwide. Y-12 is unique in that it is the only source of secondaries, cases, and other weapons components within the NNSA nuclear security enterprise. Y-12 also dismantles weapons components, safely and securely stores and manages SNM, supplies SNM for use in naval and research reactors, and dispositions surplus materials. Y-12's nuclear nonproliferation programs play a critical role in securing our Nation and the globe and in combating the spread of weapons of mass destruction. As explained in Section 1.5, the Y-12 missions are consistent with, and supportive of, national security policies and international treaties.

Stockpile Stewardship Program

The Stockpile Stewardship Program is designed to ensure the safety and reliability of the U.S. nuclear weapons stockpile without underground testing by using the appropriate balance of surveillance, experiments, and simulations.

Continued operation of Y-12 is made more difficult by the fact that most of the facilities at Y-12 are old, oversized, and inefficient. For example, more than 70 percent of all the floor space at Y-12 was constructed prior to 1950 as part of the Manhattan Project. Further, the total operating space estimated to perform the future NNSA missions and functions at Y-12 is significantly less than the current operating space. NNSA estimates that the future NNSA footprint should be approximately 2.2 million square feet of space versus the 5.3 million square feet it is today.[7] These old and oversized facilities are costly to maintain and have no inherent value for future missions. Continued long-range reliance on World War II-era facilities designed for enrichment, and on support facilities built to be temporary in some cases, would not meet NNSA's responsive infrastructure requirements, would not provide the level of security and safeguards required for the future, and would become more and more costly to operate. Over time, nearly all of Y-12's facilities would need to be replaced with structures designed for their intended use. Modernizing this old, over-sized, and inefficient infrastructure is a key strategic goal of Y-12 and is consistent with NNSA strategic planning initiatives and prior programmatic NEPA documents (NNSA 2007, NNSA 2008, NNSA 2008a).

Perimeter Intrusion Detection and Assessment System (PIDAS)

A PIDAS is a combination of barriers, clear zones, lighting, and electronic intrusion detection, assessment, and access control systems constituting the perimeter of the Protected Area and designed to detect, impede, control, or deny access to the Protected Area.

The existing EU operations require significant funding to address security, facility, and process equipment aging and other infrastructure issues. For example, existing EU operations are decentralized in several buildings that are not connected and require

[7] 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 B&W Y-12.

many inefficient transports of SNM. The resulting protected area within the **Perimeter Intrusion Detection and Assessment System (PIDAS)** is large, and operating costs are not optimized. Over time, an elaborate system of administrative controls has been put in place to adequately manage environmental compliance, worker safety, criticality safety, fire protection, and security. The maintenance of these administrative controls requires an increasingly large number of personnel to ensure compliance and operations. In addition, maintaining effective safeguards and security posture for materials and processes in this patchwork of facilities is increasingly costly during a time when security threats are increasing (B&W 2004a).

The current SNM facilities at Y-12 have physical protection challenges with the amount and nature of material and the number and location of storage and operations areas. In addition, the physical infrastructure is a sprawling urban environment with many facilities located at less than the optimal distance to employee access roads. With SNM facilities dispersed within the site, the existing Protected Area is large and needlessly encompasses most non-SNM production operations. With the new graded security posture, existing SNM facilities are very labor intensive to secure (B&W 2005b).

In this SWEIS, NNSA is considering alternatives that would support decisions regarding the modernization of Y-12. The goals and objectives of modernizing Y-12 are to accomplish the following:

- Improve the level of security and safeguards;
- Replace/upgrade end-of-life facilities and ensure a reliable EU processing capability to meet the mission of NNSA;
- Improve efficiency of operations and reduce operating costs by consolidating and modernizing equipment and operation;
- Reduce the size of the Protected Area by 90 percent and reduce the operational cost necessary to meet the security requirements;
- Improve worker protection with an emphasis on incorporating engineered controls; and
- Comply with modern building codes and environment, safety, and health (ES&H) standards (B&W 2004a).

1.4 SCOPE OF THIS Y-12 SWEIS AND ALTERNATIVES

This new Y-12 SWEIS expands on and updates the analyses in the 2001 Y-12 SWEIS, and includes alternatives for proposed new actions and changes since the 2002 Y-12 SWEIS ROD (see Chapter 3 for a more detailed discussion of these alternatives). The No Action Alternative for this SWEIS is the continued implementation of the 2002 ROD, as modified by decisions made following analysis in subsequent NEPA reviews.

Four action alternatives are considered in this SWEIS in addition to the No Action Alternative. The four alternatives differ in that: Alternative 2 involves a new, fully modernized manufacturing facility (the UPF) optimized for safety, security, and efficiency; Alternative 3 involves upgrading the existing facilities to attain the highest level of safety, security and efficiency possible without constructing new facilities; and Alternatives 4 and 5 involve a reduction in the production capacity of Y-12 to support smaller stockpile requirements. The alternatives are described in detail in Chapter 3 and summarized below.

1.4.1 Alternative 1 – No Action Alternative

The No Action Alternative reflects the current nuclear weapons program missions at Y-12 and includes the manufacture and assembly/disassembly of weapons components, the continued processing and storage of enriched uranium materials, the operation of the HEUMF and Purification Facility, disposition of excess materials, and Infrastructure Reduction, which will remove excess buildings and infrastructure. Construction of a UPF is not part of the No Action Alternative. The No Action Alternative would be capable of supporting a baseline throughput of approximately 125 secondaries and cases per year. As part of the No Action Alternative, other construction projects are also underway or planned for the future. Some are refurbishments or upgrades to plant systems, such as those for potable water, which have been analyzed in separate NEPA documentation. Section 1.7.2 identifies and describes these projects in more detail. The No Action Alternative also includes continued operations related to other National Security Programs, such as Nonproliferation, Global Threat Reduction Initiatives, and support to Naval Reactors (see Chapter 2). Additionally, there are many non-NNSA programs at Y-12 that would continue under the No Action Alternative. Chapter 2 describes these programs.

1.4.2 Alternative 2 – Uranium Processing Facility Alternative

Under this alternative, NNSA would implement all actions in the No Action Alternative, and construct and operate a modern **UPF** and a new Complex Command Center (CCC). This alternative also includes continued operations related to other National Security Programs, such as Nonproliferation, Global Threat Reduction Initiatives, and support to Naval Reactors (see Chapter 2). Additionally, there are many non-NNSA programs at Y-12 that would also continue under this alternative. Chapter 2 describes these programs. This alternative is referred to as the "UPF Alternative" throughout this SWEIS. The UPF Alternative would be capable of supporting a baseline throughput of approximately 125 secondaries and cases per year.

UPF Project

The UPF would improve security and safety, reduce costs, and ensure that Y-12 maintains the capability to meet national security requirements for the foreseeable future.

Uranium Processing Facility

The UPF would consolidate EU operations into an integrated manufacturing operation, sized to satisfy programmatic needs. The UPF is proposed to be sited adjacent to the HEUMF to allow the two facilities to function as one integrated operation. Transition of EU production operations to the UPF (Alternative 2) and transition of EU storage operations into HEUMF (No Action Alternative) would enable the creation of a new high-security area 90 percent smaller than the current high security protected area. Operations to be consolidated in the UPF are currently located in multiple facilities. After startup of UPF operations some of these facilities could be used to consolidate non-EU operations already existing in those facilities and others would undergo D&D.

The UPF Alternative (Alternative 2), which would involve a major capital investment, was developed to continue with modernization efforts to correct the deficiencies described in Section 1.3. For example, the UPF, if constructed, would consolidate current and future EU operations in approximately 388,000 square feet of floor space and free up approximately 633,000 square feet of space for eventual D&D. The consolidation of all **Category I and II (Cat I/II) SNM** into two facilities (the proposed UPF and the recently constructed HEUMF) would significantly improve physical protection and effectively meet the new graded security posture; optimize material accountability; enhance worker, public, and environmental safety; and consolidate operations to greatly reduce operational costs (B&W 2004a).

> **Categories of SNM**
>
> A designation determined by the quantity and type of SNM. NNSA uses a cost-effective, graded approach to providing SNM safeguards and security. SNM is categorized into security Categories I, II, III, and IV, with Categories I and II requiring the highest safeguards and security.

The benefits of executing the UPF project include reliable, long term, consolidated EU processing capability for the nuclear security enterprise with modern technologies and facilities; improved security posture for SNM; improved health and safety for workers; and a highly attractive return on investment. While operational today, the reliability of the existing facilities will continue to erode because of aging facilities and equipment. The UPF would replace multiple aging facilities with a modern facility that would be synergistic with the HEUMF to provide a robust SNM capability and improve responsiveness, agility, and efficiency of operations (B&W 2004a).

With the consolidation of SNM operations, incorporation of integral security systems, and the 90 percent reduction of the Protected Area, the security posture would be greatly improved under the UPF Alternative. The use of engineered controls to reduce reliance on administrative controls and personal protection equipment to protect workers would improve worker health and safety. In addition, use of new technologies and processes may eliminate the need for some hazardous materials, reduce emissions, and minimize wastes. Cost savings and cost avoidance as a result of UPF would include the following:

- Savings from consolidation related to right-sizing of facilities/footprint, more efficient operations, and simplification of SNM movement;
- Operating and maintenance (O&M) cost reductions of approximately 33 percent from current operations;
- Reducing the footprint of the PIDAS-protected area by 90 percent (from 150 acres to 15 acres), which would allow better concentration of the protective force over a smaller area. It is expected that the average annual security costs over the 50-year facility life could be reduced by $32 million in FY 2007 dollars;
- Reducing the number of workers required to access the Protected Area, which would improve the productivity of workers assigned to non-SNM activities that are currently located in the Protected Area. By reducing the size of the PIDAS, it is forecast that approximately 600 employees would not have to enter the PIDAS. It is conceivable that a 20 percent efficiency in non-SNM operations could be realized by not being encumbered with access requirements and restrictions of the PIDAS. Projects that support non-SNM

operations would be less expensive because of improved productivity. The life cycle cost analysis predicts an average annual savings over the UPF 50-year facility life of $205 million in FY 2007 dollars (B&W 2004a).

Significant improvements in cost and operational efficiency would be expected from a new UPF. These improvements would include the expectation that new, reliable equipment would be installed, greatly reducing the need for major corrective maintenance (e.g., less than half of the existing casting furnaces are normally available because of reliability problems). New facilities built within the Material Access Areas (MAAs) are expected to greatly increase efficiencies over the current practice of multiple entries and exits daily into the MAAs. It is also expected that the inventory cycle would be greatly reduced because of more effective means of real-time inventory controls. A more efficient facility layout is expected to decrease material handling steps, including structurally, physically, and operationally integrated material lock-up facilities (B&W 2004a).

If a UPF is constructed, the existing non-nuclear processing facilities supporting a UPF would not be upgraded; instead, NNSA would consider pursuing modernization of these facilities in the future if a CMC reaches a stage of development that is ripe for decisionmaking (see Section 3.3).

Complex Command Center

The CCC is proposed under all action alternatives (Alternatives 2-5). The CCC would comprise a new Emergency Services Complex for Y-12. The new facility would house equipment and personnel for the plant shift superintendent (PSS), Fire Department, and Emergency Operations Center (EOC). Approximately 50,000-80,000 square feet of enclosed facility space would be required to accommodate operational needs. The facility would include office space for 60 Fire Department personnel, 120 EOC personnel, and up to 12 PSS Personnel; 15,000 square feet of pull through garage space; redundant emergency power supply connections and/or supplemental dedicated emergency generators; records storage and processing areas; modern training and conference facilities; shower and changing facilities; specialized equipment storage; food service areas; janitorial closets; separate mechanical and electrical equipment rooms; and telecommunication rooms.

1.4.3 Alternative 3 – Upgrade in-Place Alternative

Under this alternative, NNSA would continue the No Action Alternative and upgrade the existing EU and nonnuclear processing facilities to contemporary environmental, safety, and security standards to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations. Under this alternative there would be no UPF and parts of the current high-security area would not be downsized. Although existing production facilities would be modernized, it would not be possible to attain the combined level of safety, security and efficiency made possible by the UPF Alternative. The CCC, described above, would also be proposed under this alternative. This alternative also includes continued operations related to other National Security Programs, such as Nonproliferation, Global Threat Reduction Initiatives, and support to Naval Reactors (see Chapter 2). Additionally, there are many non-NNSA programs at Y-12 that would continue under this alternative. Chapter 2 describes these programs. This alternative is referred to as the "Upgrade in-Place Alternative" throughout this SWEIS. The Upgrade in-Place Alternative would be capable of supporting a baseline throughput of approximately 125 secondaries and cases per year.

Although an upgrade of existing facilities was not selected in the Complex Transformation SPEIS ROD, the Upgrade in-Place Alternative is included as a reasonable alternative because it would correct some of the facility deficiencies associated with the existing EU and nonnuclear processing facilities, and could potentially require smaller upfront capital expenditures than the UPF.

1.4.4 Alternative 4 – Capability-sized UPF Alternative

As discussed in Section 1.5.1, the nuclear weapons stockpile and the nuclear security enterprise have undergone profound changes since the end of the Cold War. Since that time, more than 12,000 U.S. nuclear weapons have been dismantled, no new-design weapons have been produced, three former nuclear weapons plants (Mound, Pinellas, and Rocky Flats) have been closed, nuclear material production plants (Hanford, K-25 at ORR, most of the Savannah River Site [SRS], and Fernald) have stopped production and are being decontaminated, and the U.S. is observing a moratorium on nuclear testing. By 2012, the U.S. nuclear stockpile will be less than one-quarter its size at the end of the Cold War—the smallest stockpile in more than 50 years (D'Agostino 2008). Further, as discussed in Section 1.5.1, on July 6, 2009, Presidents Obama and Medvedev signed a Joint Understanding to reduce their nations' strategic warheads to a range of 1500-1675, and their strategic delivery vehicles to a range of 500-1100 (White House 2009).

Although the size of the stockpile beyond 2012 is not known, the trend suggests a significantly smaller one. Consistent with this trend, NNSA developed an alternative, referred to as the "Capability-Based Alternative" in the Complex Transformation SPEIS, to analyze the potential environmental impacts associated with operations at Y-12 that would support stockpiles smaller than those currently planned. NNSA has assumed that such a stockpile would be approximately 1,000 operationally deployed strategic nuclear warheads. This assumption is consistent with the Complex Transformation SPEIS Capability-Based Alternative (NNSA 2008). In addition, analysis of this alternative enhanced NNSA's understanding of the infrastructure that might be appropriate if the U.S. continues to reduce stockpile levels.

Under Alternative 4, NNSA would maintain a basic manufacturing capability to conduct surveillance and produce and dismantle secondaries and cases. To support this alternative, NNSA would build a smaller UPF (350,000 square feet) compared to the UPF described under Alternative 2 (388,000 square feet). A smaller UPF would maintain all capabilities for producing secondaries and cases, and capabilities for planned dismantlement, surveillance and uranium work for other NNSA and non-NNSA customers. This UPF would have a baseline throughput of approximately 50-80 secondaries per year (compared to 125 secondaries per year for the UPF Alternative). The CCC, described in Section 1.4.2, would also be proposed under this alternative. This alternative also includes continued operations related to other National Security Programs, such as Nonproliferation, Global Threat Reduction Initiatives, and support to Naval

Reactors (see Chapter 2). Additionally, there are many non-NNSA programs at Y-12 that would continue under this alternative. Chapter 2 describes these programs.

1.4.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Similar to Alternative 4, a No Net Production/Capability-sized UPF Alternative would maintain the capability to conduct surveillance, dismantle secondaries and cases, and produce secondaries and cases, but would not support adding new types or increased numbers of secondaries to the total stockpile. It would reduce the operational throughput of facilities to a throughput of approximately 10 secondaries per year, which would support a limited Life Extension Program (LEP)[8] workload. This alternative would involve an even further reduction of production throughput at Y-12 compared to Alternative 4. The CCC, described in Section S.1.4.2.2, would also be proposed under this alternative. This alternative also includes continued operations related to other National Security Programs, such as Nonproliferation, Global Threat Reduction Initiatives, and support to Naval Reactors (see Chapter 2). Additionally, there are many non-NNSA programs at Y-12 that would continue under this alternative. Chapter 2 describes these programs.

For either Alternative 4 or Alternative 5, although many of the current facilities at Y-12 would be operated at a reduced throughput, NNSA would need to maintain them in a "ready-to-use" state in the event changes were directed by the President. This means unused capacity would be exercised periodically and standard preventive maintenance and minimal corrective maintenance would be performed on all equipment that could be required for future needs. The related effects on other plant operations of this alternative would include a reduction in utility usage and waste generation, a reduction in staffing, and a steady security posture. Section 1.4.6 provides a summary of the differences among the UPF capacity alternatives.

1.4.6 Capacity Alternatives for the Uranium Processing Facility

This SWEIS assesses three alternative sizes for the UPF:

- A nominal-sized UPF, described under Alternative 2, with a capacity of approximately 125 secondaries and cases per year. This alternative is described in Section 3.2.2;
- A capability-sized UPF, described under Alternative 4, that would maintain a basic manufacturing capability with a throughput of approximately 50–80 secondaries and cases per year. This alternative is described in Section 3.2.4.1.
- A no net production/capability-sized UPF, described under Alternative 5, with a throughput of approximately 10 secondaries and cases per year. This throughput would support surveillance operations and a limited LEP workload, but would not support adding new types or increased numbers of secondaries and cases to the stockpile. This alternative is described in Section 3.2.4.2.

Regardless of the ultimate capacity of a UPF, in order to maintain the basic capability to perform the enriched uranium missions, all of the required enriched uranium processes must be included

[8] An LEP is a systematic approach that consists of a coordinated effort by the design laboratories and production facilities to: 1) determine which components will need refurbishing to extend each weapon's life; 2) design and produce the necessary refurbished components; 3) install the components in the weapons; and 4) certify that the changes do not adversely affect the safety and reliability of the weapon.

in the facility. In many cases, installing the basic processes in the facility would allow the facility to support multiple units per year. Although the smaller, capability-sized UPFs could be physically smaller than the nominal-sized UPF, an assessment conducted by the UPF Project team at the request of the Nuclear Weapons Council (NWC) Integrating Committee in early 2008 identified only 15 pieces of duplicate equipment that could be eliminated by reducing capacity requirements (NNSA 2008). In terms of square footage of the facility constructed, there would only be a reduction of approximately 38,000 square feet compared to the approximately 388,000 square feet proposed for the nominal-sized UPF described under Alternative 2. Consequently, the capability-sized UPFs described under Alternative 4 and Alternative 5 would not be significantly smaller than the UPF described under Alternative 2. From a square footage standpoint, any "capability"-sized UPF requires a "minimum" of 350,000 square feet to accommodate production equipment/glove boxes. As such, construction requirements for the three UPF capacity alternatives would not vary significantly among the alternatives.

However, there would be notable differences among the three UPF capacity alternatives related to operations. Many of the environmental impacts resulting from operations would be directly affected by the number of components assumed to be produced. For example, operating a nominal-sized UPF with a throughput of 125 components per year would require more electricity, water, and employees than a capability-sized UPF with a throughput of 10 or 50-80 components per year. Similarly, operating a nominal-sized UPF with a throughput of 125 components per year would emit more uranium to the atmosphere, increase the dose to workers, and produce greater quantities of wastes. However, any UPF option significantly reduces uranium atmospheric discharge, worker dose and waste quantities compared to the No Action or the Upgrade-in-Place Alternatives. Table 1.4.6-1 depicts the operational differences among the UPF alternatives.

1.5 NATIONAL SECURITY CONSIDERATIONS

There are two principal national security policy overlays and related treaties that are potentially relevant to this SWEIS: (1) Nonproliferation and Treaty Compliance (Section 1.5.1); and the (2) Nuclear Posture Review (Section 1.5.2). Each of these is discussed below.

1.5.1 Nonproliferation and Treaty Compliance

NNSA's overarching mission is to contribute to U.S. security by providing the Nation with a safe and reliable nuclear weapons stockpile through the Stockpile Stewardship Program. NNSA intends to do this fully consistent with current treaty obligations. This mission requires NNSA to assess and certify the stockpile regardless of size, including replacements and repairs. The Stockpile Stewardship Program is fully consistent with and supports the U.S.'s commitment to the Nuclear Nonproliferation Treaty (NPT) and enables the U.S. to continue its 1992 moratorium on underground nuclear testing. Another benefit of the Stockpile Stewardship Program is that preventing the loss of credibility in the U.S. nuclear stockpile avoids creating an incentive within non-weapon states, whose security relies on the U.S. nuclear deterrent, to develop their own nuclear weapons (DOE 1996a).

Table 1.4.6-1. Operational Differences Among UPF Alternatives.

Requirements	No Action	Nominal-Sized UPF	Capability-Sized UPF	No Net Production/ Capability-Sized UPF
Electrical Energy Use (MWe)	360-480	360-480	220-290	200-260
Site-wide Water Use (million gallons/year)	2,000	2,000	1,200	1,080
Y-12 Site Employment (workers)	6,500	5,750	3,900	3,400
Steam Plant Generation (billion pounds)	1.5	1.0	0.9	0.8
Normal Radiological/Uranium Air Emissions (Curie)	0.01	0.007	0.006	0.005
Total No. of Y-12 Monitored Workers	2,400	2,050	1,825	1,600
Average Individual Worker Dose (mrem)	20.6	10.3	10.3	10.3
Collective Worker Dose (person-rem)	49.4	21.1	18.8	16.5
Waste Category				
Low-level Waste				
Liquid (gal)	713	476	428	403
Solid (yd^3)	9,405	5,943	5,643	5,314
Mixed Low-level Waste				
Liquid (gal)	1,096	679	640	619
Solid (yd^3)	126	81	76	71
Hazardous (tons)	12	12	7.2	7.2
Nonhazardous Sanitary (tons)	10,374	9,337	6,224	5,705

Source: NNSA 2008, B&W 2009a.

Article VI of the NPT obligates the parties "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control" (NPT 1970). The NPT does not identify a specific date for achieving nuclear disarmament. U.S. compliance with its commitment under Article VI, however, has been outstanding. In 1995, when the NPT was indefinitely extended, the U.S. reiterated its commitment under Article VI to work toward the ultimate goal of eliminating nuclear weapons, and to general and complete disarmament (DOE 1996a). Over the past 20 years, significant progress has been made in fulfilling this commitment. The U.S. has been reducing its nuclear forces and nuclear weapons stockpile in a consistent fashion through both unilateral and bilateral initiatives, and working cooperatively with allies and partners to further reduce nuclear threats, as evidenced by the following examples:

- The 2001 Nuclear Posture Review articulated a reduced reliance on nuclear forces in achieving U.S. national security objectives;

- The *Moscow Treaty*, which entered into force in 2003, commits the U.S. and Russia to deep reductions (i.e., to a level of 1,700-2,200 operationally deployed strategic nuclear warheads by 2012);
- Under the *Strategic Arms Reduction Treaty* (START) and the *Moscow Treaty*, the U.S. will have decommissioned, over the period of two decades, more than three-quarters of its strategic nuclear warheads attributed to its delivery vehicles;
- On December 18, 2007, the White House announced the President's decision to reduce the nuclear weapons stockpile by another 15 percent by 2012. This means the U.S. nuclear stockpile will be less than one-quarter its size at the end of the Cold War—the smallest stockpile in more than 50 years (D'Agostino 2008);
- On April 1, Presidents Obama and Medvedev agreed in London that America and Russian negotiators would begin work on a new, comprehensive, legally binding agreement on reducing and limiting strategic offensive arms to replace START, which expires on December 5, 2009;
- On July 6, Presidents Obama and Medvedev signed a Joint Understanding to guide the remainder of the negotiations. The Joint Understanding commits the United States and Russia to reduce their strategic warheads to a range of 1500-1675, and their strategic delivery vehicles to a range of 500-1100. Under the expiring START and the *Moscow Treaty* the maximum allowable levels of warheads is 2200 and the maximum allowable level of launch vehicles is 1600 (White House 2009).

The nonproliferation and treaty compliance aspects of the Stockpile Stewardship Program were evaluated in Chapter 2 of the *Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (SSM PEIS) (DOE/EIS-0236) (DOE 1996a). The SSM PEIS analyzed the nonproliferation aspects of the Stockpile Stewardship Program and concluded that implementation of the Stockpile Stewardship Program is fully consistent with the NPT while maintaining nuclear weapons competencies and capabilities (DOE 1996a). This evaluation included the operation of Y-12 and its responsibilities under the Stockpile Stewardship Program. These conclusions remain valid whether or not Y-12 modernization continues.

1.5.2 Stockpile Stewardship Program

In 2001, Congress directed the Department of Defense (DoD) to conduct a comprehensive Nuclear Posture Review (NPR) to lay out the direction for the U.S. nuclear forces over the next 5–10 years. The centerpiece of the NPR is the new triad, with flexible response capabilities (see Figure 1.5.2-1). The new triad is composed of the three elements: (1) nuclear and nonnuclear offensive strike systems; (2) active and passive defenses; and (3) a revitalized defense infrastructure that will provide capabilities in a timely fashion to meet emerging threats.

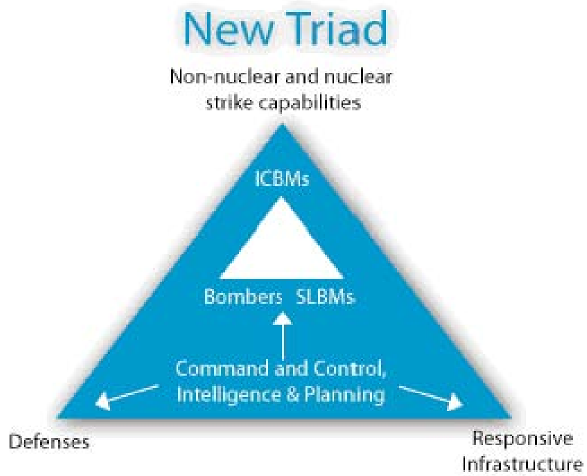


Figure 1.5.2-1. The New Triad.

Of particular interest to DOE and NNSA is the third element of the new triad, which reflects a broad recognition of the importance of a robust and responsive nuclear weapons infrastructure in sustaining deterrence. In this respect, the NPR notes that the flexibility to sustain the U.S. nuclear weapons stockpile depends on a robust stockpile stewardship program. The purpose of the stockpile stewardship program is to ensure that our nuclear weapons continue to serve their essential deterrence role by maintaining and enhancing the safety, security, and reliability of the U.S. nuclear weapons stockpile. In its Strategic Plan (NNSA 2004a), NNSA identifies several goals to achieve its missions in support of the NPR. Achieving these goals requires the continued operation of a facility such as Y-12 to accomplish the following missions:

- Modification, repair, or replacement of uranium, lithium, and other components and radiation cases;
- Production of hardware to support design laboratory tests required for stockpile certification;
- Surveillance of weapons through disassembly, inspection, and electronic documentation of findings;
- Dismantlement, storage, and disposition of nuclear weapon materials and components returned from the stockpile;
- Management and secure storage of nuclear materials and other strategic assets designated for national security purposes and/or pending disposition;
- Supply of SNM for use in naval reactors;
- Processing of weapon materials—including chemical recovery, purification, and conversion to a form suitable for safe, secure, long term storage, disposition, and future use; and
- Management, technical, and applied technology expertise in support of nonproliferation, Homeland Security, and other programs of national importance (NNSA 2007).

While the long term exact size and configuration of the stockpile cannot be predicted with certainty, it is likely that nuclear weapons will continue to provide an element of our national security resources as long as other nations possess nuclear weapons that pose a threat to our national security.

1.5.3 Potential Changes in National Security Requirements

There are currently underway two important nuclear strategy reviews that will help inform Congress and the Administration on a path forward that clearly defines the future direction and role of nuclear weapons as an element of our national security resources: (1) a Bipartisan Congressional Commission on the United States Strategic Posture and (2) a new nuclear posture review. These two reviews are discussed below.

Congress, in 2008, established the Bipartisan Congressional Commission on the United States Strategic Posture to identify the basic principles for reestablishing a national consensus on strategic policy. The Commission is examining the role of deterrence in the 21st century, assessing the role of nuclear weapons in the U.S. national security strategy, and making recommendations as to the most appropriate strategic posture for the U.S. On May 6, 2009, an advance copy of the Commission's report was published (see "America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States," available at http://media.usip.org/reports/strat_posture_report.pdf). With respect to Complex Transformation, the Commission stated that, "The NNSA's plan has merit and should be seriously considered by the Congress." With respect to the state of existing facilities, the Commission stated that, "Existing facilities are genuinely decrepit and are maintained in a safe and secure manner only at high cost." Specific to the existing uranium facility at Y-12, the report further stated that, "The current facility was constructed as part of the Manhattan Project in World War II and the many problems and high cost of keeping it running are a testimonial to the failure over the years to make needed investments in the production complex." The report also offered the following suggestion: "If priority must be given, the Los Alamos plutonium facility should receive it. A delay in construction of the Y-12 uranium processing facility may also allow some redesign to tailor the plan to new arms control agreements and their implications for long term stockpile requirements. The time might also be used to find ways to minimize the facility's size and cost, and to learn more about secondary reuse." This SWEIS considers alternatives such as a smaller UPF that are consistent with the Committee's recommendations.

Congress, also in 2008, required the Secretary of Defense to conduct a comprehensive review of the nuclear posture of the U.S. for the next 5 to 10 years. The Secretary of Defense was directed to conduct the review in consultation with the Secretary of Energy and the Secretary of State. The nuclear posture review is to include the following elements:

(1) The role of nuclear forces in U.S. military strategy, planning, and programming.
(2) The policy requirements and objectives for the U.S. to maintain a safe, reliable, and credible nuclear deterrence posture.
(3) The relationship among U.S. nuclear deterrence policy, targeting strategy, and arms control objectives.
(4) The role that missile defense capabilities and conventional strike forces play in determining the role and size of nuclear forces.

(5) The levels and composition of the nuclear delivery systems that will be required for implementing the U.S. national and military strategy, including any plans for replacing or modifying existing systems.
(6) The nuclear weapons complex that will be required for implementing the U.S. national and military strategy, including any plans to modernize or modify the complex.
(7) The active and inactive nuclear weapons stockpile that will be required for implementing the U.S. national and military strategy, including any plans for replacing or modifying warheads.

This new nuclear posture review will be used by Congress and the President to establish requirements for nuclear weapons over the following 5–10 years.

1.6 LAWS AND REGULATIONS AND *NATIONAL ENVIRONMENTAL POLICY ACT* COMPLIANCE STRATEGY

NEPA and the regulations promulgated by the Council on Environmental Quality (CEQ) (40 CFR 1500-1508) establish environmental policy, set goals, and provide a means for implementing the policy. The key provision of NEPA requires preparation of an EIS for "major Federal actions significantly affecting the quality of the human environment" (40 CFR 1502.3). NEPA ensures that environmental information is available to public officials and citizens before decisions are made and actions are taken (40 CFR 1500.1[b]). This SWEIS has been prepared in accordance with Section 102(2)(c) of NEPA of 1969, as amended in the United States Code (42 U.S.C. 4321 et seq.), and regulations promulgated by the CEQ (40 CFR 1500-1508) and DOE's regulations implementing NEPA (10 CFR 1021).

The purpose of a SWEIS is to (1) provide DOE and its stakeholders with an analysis of the potential individual and cumulative environmental impacts associated with ongoing and reasonably foreseeable new operations and facilities, (2) provide a basis for site-wide decision making, and (3) improve and coordinate agency plans, functions, programs, and resource utilization. Additionally, a SWEIS provides an overall NEPA baseline for a site that is useful as a reference when project-specific NEPA documents are prepared.

1.7 RELATIONSHIP OF THIS SWEIS WITH OTHER *NATIONAL ENVIRONMENTAL POLICY ACT* REVIEWS

DOE/NNSA has prepared or is currently preparing other programmatic, project-specific, and site-wide NEPA documents that have influenced the scope of this SWEIS. These documents, and their relationship to the Y-12 SWEIS, are discussed below.

1.7.1 Programmatic *National Environmental Policy Act* Reviews

DOE/NNSA has prepared several NEPA documents to determine how best to carry out its national security requirements. As a result, DOE/NNSA has already decided that Y-12 would continue its historic missions and modernize and downsize the site consistent with future national security requirements. This SWEIS, which "**tiers**" from these prior PEISs, analyzes the potential environmental impacts associated with the various Y-12 proposed actions and alternatives for implementing these decisions. The prior NEPA documents are summarized below:

> **Tiering**
>
> As stated in 40 CFR Part 1508.28 "tiering" refers to the coverage of general matters in broader environmental impact statements or environmental analyses incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared. For example, this SWEIS uses the prior decisions made as a result of broad PEISs/SWEISs as a starting point, rather than revisiting those prior issues.

- ***Complex Transformation Supplemental Programmatic Environmental Impact Statement* (DOE/EIS-0236-S4)** (NNSA 2008). A ROD was issued on December 19, 2008 (73 FR 77644), in which DOE decided to maintain the existing national security missions at Y-12 and build a UPF in order to provide a smaller and modern highly-enriched uranium production capability to replace existing 50-year old facilities. This new Y-12 SWEIS, which tiers off of the Complex Transformation SPEIS and analyzes alternatives for implementing the decisions reached in the Complex Transformation SPEIS ROD, is the next major step.

- ***Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (DOE/EIS-0236)** (DOE 1996a). A ROD was issued on December 19, 1996 (61 FR 68014), in which DOE decided to maintain the existing national security missions at Y-12, but modernize and downsize the facilities. The original 2001 Y-12 SWEIS was the initial major step in implementing the SSM PEIS ROD for Y-12.

- ***Storage and Disposition of Weapons-Usable Fissile Materials, Final PEIS* (DOE/EIS-0229) (S&D PEIS)** (DOE 1996b). A ROD was issued on January 14, 1997 (62 FR 3014), in which DOE decided that Oak Ridge, in particular Y-12, would continue to store nonsurplus HEU (long term) and surplus HEU (on an interim basis) in upgraded and/or new facilities pending disposition. The 2001 Y-12 SWEIS tiered off of the S&D PEIS and analyzed alternatives for implementing the decision reached in the S&D PEIS ROD. The S&D ROD formed the basis for continuing the HEU Storage Mission at Y-12 and the proposal to construct and operate a new HEUMF. This new Y-12 SWEIS continues to tier off of the S&D PEIS by continuing the HEU storage mission at Y-12. However, there are no new site-specific proposals related to HEU storage in this new SWEIS.

- ***Waste Management PEIS* (DOE/EIS-0200-F)** (DOE 1997). The Final PEIS was issued in May 1997. Multiple RODs were prepared for various categories of waste. A ROD for the Treatment of Non-Wastewater Hazardous Waste was issued on July 30, 1998 (63 FR 41810). In the ROD, DOE decided to continue to use offsite facilities for the treatment of major portions of the non-wastewater hazardous waste generated at DOE sites. In accordance with the ROD, ORR, including Y-12, will treat some of its own non-wastewater hazardous waste onsite, where capacity is available in existing facilities and where this is economically favorable. The treatment of Y-12 non-wastewater hazardous waste is included in the Y-12 SWEIS No Action Alternative. A second ROD for transuranic (TRU) waste was issued on January 23, 1998 (63 FR 3629). TRU waste at ORR will be packaged to meet waste acceptance criteria for the Waste Isolation Pilot Plant (WIPP) in New Mexico and then stored onsite for eventual disposal at the WIPP. A third ROD for management of low-level waste (LLW) and mixed LLW (MLLW) was issued on February 25, 2000 (65 FR 10061). For the management of LLW, DOE decided to establish regional LLW disposal at two DOE sites: the Hanford Site and the Nevada Test Site (NTS). Specifically, the Hanford Site and NTS will each dispose of its own LLW onsite, and will receive and dispose of LLW that is generated and shipped (by either truck or rail) by other sites that meets the waste acceptance criteria. In addition, DOE will continue, to the extent practicable, to dispose of LLW onsite at Idaho National Laboratory (INL), Los Alamos National Laboratory (LANL), ORR, and SRS. For mixed LLW, DOE decided to establish regional MLLW disposal operations at two DOE sites: the Hanford Site and NTS. The Hanford Site and NTS will each dispose of its own MLLW onsite, and will receive and dispose of MLLW generated and shipped (by truck or rail) by other sites, consistent with permit conditions and other applicable requirements. For this Y-12 SWEIS, waste management activities for all alternatives would be carried out consistent with these RODs. (See Section 4.13 for a discussion of the waste management activities at Y-12.)

- ***Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components*** **(DOE/EIS-0225)** (DOE 1996c). A ROD was issued on January 27, 1997 (62 FR 3880), in which DOE decided that Pantex would continue operations involving assembly and disassembly of nuclear weapons. The decision did not affect the continued shipment of HEU and depleted uranium components to Y-12 resulting from the disassembly of weapons. Uranium components received from Pantex are included in the Y-12 activities analyzed in this Y-12 SWEIS and are included in the No Action Alternative.

- ***Site-wide Environmental Impact Statement for the Y-12 National Security Complex*** **(DOE/EIS-0309)** (DOE 2001a). The Final Y-12 SWEIS, issued in September 2001, evaluated alternatives related to the operation of Y-12 for approximately a 10-year planning period. One of the primary goals of the 2001 Y-12 SWEIS was to provide an overall NEPA baseline for all DOE activities at Y-12, including an assessment of a Y-12 Modernization Program and infrastructure reduction consistent with previous programmatic decisions. In the ROD for the 2001 Y-12 SWEIS (67 FR 11296, March 13, 2002), NNSA decided to implement the alternative that includes the continued operations at Y–12 to meet the NNSA mission requirements and other DOE program activities, together with the construction and operation of two new facilities: HEUMF and the SMC. Currently, Y-12 completed construction of the HEUMF, which is scheduled to begin full-scale operations in 2010. Since publication of the ROD, the NNSA decided to not construct the SMC, but to construct a Purification Facility instead (see the discussion of the *Supplement Analysis for Purification Facility*, *Site-Wide Environmental Impact Statement for the Y-12 National Security Complex* (DOE/EIS-0309/SA-1) (NNSA 2002) in Section 1.7.2 below. In this new Y-12 SWEIS, NNSA proposes to continue assessing alternatives related to the continued modernization of Y-12. The No Action Alternative in this SWEIS is the continued implementation of the actions identified in the original Y-12

SWEIS ROD, together with implementation of decisions subsequent to that ROD which have undergone separate NEPA review (see Section 1.7.2).

1.7.2 Project-Specific *National Environmental Policy Act* Reviews

- ***Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*** **(DOE/EIS-0240)** (DOE 1996d). A ROD was issued on August 5, 1996 (61 FR 40619). Y-12 is one of four domestic sites selected to potentially down-blend weapons-usable surplus HEU to non-weapons-usable low enriched uranium (LEU) for use as commercial reactor fuel or as a LLW. Capabilities exist at Y-12 to perform only small-scale (500–700 kilograms per year) HEU blending operations. The small-scale (500–700 kilograms per year) down-blending of HEU is included in the Y-12 No Action Alternative. The large-scale (tons/year) down-blending operations cannot be performed at Y-12 without major building and process upgrades or new construction. No projects have been proposed or are reasonably foreseeable to increase the capacities at Y-12 at this time. Therefore, the potential impacts of this operation are not included in this Y-12 SWEIS. In October 2007, NNSA prepared a supplement analysis (SA) to summarize the status of HEU disposition activities conducted to date and to evaluate the potential impacts of continued program implementation (DOE/EIS-0240-SA1). In addition, that SA considered the potential environmental impacts of proposed new DOE/NNSA initiatives to support the surplus HEU disposition program. Specifically, DOE/NNSA proposed new end-users for existing program material, new disposal pathways for existing program HEU discard material, and down-blending additional quantities of HEU.

- ***Potable Water Systems Upgrade Project Environmental Assessment*** **(DOE/EA-1548) (**DOE 2006a). NNSA recently completed an Environmental Assessment (EA) to upgrade the potable water system at Y-12. The Potable Water Systems Upgrade Project EA analyzes five alternatives: (1) New Elevated Water Tanks along Bear Creek Road (Proposed Action), (2) New Water Tanks on Pine Ridge, (3) Pump Station Feed Loop alternative, (4) Local Pumping Stations alternative, and (5) the No Action Alternative. The Proposed Action is to install two new elevated water tanks, a pumping station, and system supply lines north of Bear Creek Road; inspect and replace if necessary, original potable water distribution lines; inspect and replace where necessary, the original water supply lines (potable and fire) to individual buildings expected to remain in use past 2010; replace approximately 40 obsolete fire hydrants; and install backflow prevention, convert to dry pipe or isolate approximately 85 existing fire suppression loops in order to prevent cross contamination from propylene glycol sprinkler systems.

  Upgrades to the Y-12 potable water system would allow Y-12 to (1) meet regulatory requirements for safe drinking water by providing backflow protection for known cross connections and ensuring proper chlorine residual maintenance in the system; (2) provide Y-12 control and monitoring of water coming into the Y-12 distribution system to ensure adequate water flow and pressure to support current and future Y-12 operational needs; and (3) address deferred maintenance and ensure continued system reliability by inspecting, evaluating, and repairing or replacing deteriorated cast iron water mains and building feeds and obsolete fire hydrants. Based on the analysis in the EA, a Finding of No Significant Impact (FONSI) was issued in March 2006.

- ***Supplement Analysis for Purification Facility, Site-Wide Environmental Impact Statement for the Y-12 National Security Complex*** **(DOE/EIS-0309/SA-1)** (NNSA 2002). As discussed in Section 1.7.1, the NNSA issued a ROD on the Y-12 SWEIS which included a decision to construct and operate the SMC. The proposed SMC comprised several facilities including the Purification Facility. The SMC was subsequently cancelled due to changing mission requirements and replaced by a smaller facility that pertains to purification only. In the SA, Y-12 proposed to construct and operate the Purification Facility in order to successfully meet its current accelerated mission requirement for purification of material, as established by the Stockpile Stewardship Program. The Purification Facility was proposed as a facility restricted to special materials wet chemistry processing capability. The Purification Facility would use a purification process that mimics the historical purification process, using modern control equipment that satisfies current engineering codes and standards. The Purification Facility was proposed as a single-story building, approximately 10,000 square feet, constructed from structural steel framing with a metal roof deck and siding. The facility would have an adjoining tank farm with a concrete pad and roof but no exterior walls. After completing the SA in August 2002, NNSA determined that no further NEPA documentation was required.

  Construction of the Purification Facility began in August 2003 and was completed in 2004. Engineering test and checkout were completed in 2005, and the Purification Facility is now operational. The Purification Facility is the first major production facility built at Y-12 in more than 30 years.

- ***Environmental Assessment for the Alternate Financed Facility Modernization*** **(DOE/EA-1510)** (NNSA 2005d). As part of the NNSA modernization initiative, NNSA proposed to transfer two parcels of real estate at Y-12, under Section 161(g) of the *Atomic Energy Act*, to a private development corporation. The private development corporation would finance and construct technical, administrative, and light laboratory facilities in an integrated commercial office park approach in support of the NNSA. In addition to the Land Transfer (Proposed Action), the EA analyzed the alternative of constructing the new facilities using the Federal line item process, as well as the No Action Alternative. A FONSI was issued in January 2005 and construction of the two new facilities, the Production Interface Facility and the Public Interface Facility, began in late 2005 and was completed in 2007. The Public Interface Facility (now called "New Hope") is located on Y-12's east end and houses a visitor's center and other functions requiring frequent interaction with the public. The Production Interface Facility (now called "Jack Case"), was built north of the recently demolished Y-12 Administration Building, and houses administrative, technical, and scientific functions previously scattered across the site (Figure 1.7-1). Together, these new facilities replaced about 1 million square feet of obsolete work space with about 540,000 square feet of modern office and laboratory space for about 1,500 employees.

Figure 1.7-1. Production Interface Facility (Jack Case).

- ***Compressed Air Upgrades Categorical Exclusion.*** The Compressed Air Upgrades Project (CAUP) corrects deficiencies related to reliability and efficiency by providing new compressed air capability to meet the current and long-range needs of Y-12. The project upgrades the compressed air system by replacing obsolete equipment with state-of-the-art technology equipment and controls. CAUP installed a new instrument/plant air system in reuse facility 9767-13. During the conceptual design phase, NEPA reviews were completed and a determination was made in January 2003 that CAUP work is covered by an existing **categorical exclusion** (CX). The applicable CX that covers the work is Section B1.3 from the DOE NEPA Regulations (10 CFR Part 1021, Subpart D, Appendix B), regarding the routine maintenance/custodial services for buildings, structures, infrastructures, and equipment.

> **Categorical Exclusion**
>
> A Categorical Exclusion is a NEPA determination applied to an action that DOE has determined does not individually or cumulatively have a significant effect on the human environment

- ***Security Improvements Project (SIP) Categorical Exclusion.*** The purpose of the SIP is to replace the existing Y-12 security system with the NNSA-preferred ARGUS security system, a special purpose, automated information system that will be continuously operating and monitored by Y-12 security personnel. The project would provide a comprehensive and integrated security system that performs the required security functions and meets applicable DOE Orders. The project directly supports the mission by maintaining the security capabilities of Y-12 to protect national security by applying advanced technology to the nation's defense. SIP's scope is limited to installing the ARGUS technology backbone in the existing Central and

Secondary Alarm Stations, installing software gateways to existing alarms, and installing new ARGUS components in the HEUMF.

During the conceptual design phase, NEPA reviews were completed and a determination was made in May 2007 that the SIP is covered by existing CXs. The applicable CXs that cover the work are: from the DOE NEPA Implementing Procedure (10 CFR Part 1021, Subpart D, Appendix B) regarding routine maintenance/custodial services for buildings, structures, infrastructures, and equipment (Section B1.3 and Section B1.31), and installation/ improvement of fire detection and protection systems (Section B2.2).

- ***Nuclear Facility Risk Reduction (NFRR) Project Categorical Exclusion.*** The NFRR line item project will directly contribute to the safety and reliability of Building 9212 and Building 9204-2E which are needed to continue NNSA current missions at Y-12. The NFRR Project will reduce risk of failure of infrastructure in these mission-essential Y-12 facilities by implementing practical, capital modifications determined prudent and necessary to ensure continued safe operations at existing levels. The project scope includes improving maintainability and reliability needed to address the risk of failure of selected, high priority, infrastructure utility systems, structures, and components through planned replacement of critical electrical control centers, switchgear, stacks, casting furnace vacuum system, and cooling tower and steam system pipes. Execution of this project will address the 2005 Defense Nuclear Facility Safety Board (DNFSB) risk review recommendations and backlogged deferred maintenance by replacing failing and obsolete equipment with new. During the conceptual design phase, NEPA reviews were completed and a determination was made in December 2008 that NFRR work is covered by existing CXs.

- ***Y-12 Steam Plant Replacement Project.*** In August 2007, NNSA completed an EA to replace the existing Y-12 steam plant with a new centralized steam plant. Deteriorated systems, structures, and components with the existing Y-12 Steam Plant are quickly reaching the end of their useful process life and studies conducted to determine the best value for continuing steam production are recommending replacement options rather than life extension of the existing steam plant. The Y-12 Steam Plant EA analyzed three alternatives: (1) Installation of skid mounted gas fired boilers (Proposed Action), (2) renovation of the existing steam plant, and (3) the No Action Alternative. The proposed action proposed to utilize skid mounted gas fired boilers and would require a new building, several package boilers, water treatment units and two fuel oil storage tanks.

  The Y-12 Steam Plant Replacement Project would provide a long term source for steam production at Y-12 to continue reliable operations. Reliable and cost-effective steam generation is vital to the operation of Y-12. It is the primary source of building heat for personnel comfort and it provides freeze protection for critical services that include fire protection systems and heat tracing of exterior above ground water systems. Steam is also necessary to support the production mission that includes regeneration of dehumidification systems and operation of steam-powered ejectors in wet chemistry operation of Enriched Uranium Operations. A FONSI was signed on September 6, 2007

(YSO 2007). Currently, the steam plant is under construction and is scheduled to be completed in September 2010.

- ***Environmental Assessment for the Transportation of Highly Enriched Uranium from the Russian Federation to the Y-12 National Security Complex and Finding of No Significant Impact*** **(DOE/EA-1471)** (DOE 2004d). DOE/NNSA prepared this EA in January 2004 to evaluate the environmental impacts of transporting HEU from Russia to Y-12 for safe, secure storage. The amount of HEU to be transferred under the proposed action would be, on average, approximately 366 pounds per year over a period of 10 years. The HEU would eventually be sent to a facility in Lynchburg, Virginia, where it would be fabricated into reactor fuel. The analysis in the EA shows that the proposed transfer of HEU from Russia to the U.S. entails little or no risk to the quality of the environment or to human health. Based on the analysis in the EA, a FONSI was issued in 2004 (DOE 2004d).

- ***Environmental Assessment for the Transportation of Unirradiated Uranium in Research Reactor Fuel from Argentina, Belgium, Japan and the Republic of Korea to the Y-12 National Security Complex (*****DOE/EA-1529)** (DOE 2005h). DOE/NNSA prepared this EA in June 2005 to evaluate the environmental impacts of transporting uranium from various foreign countries to Y-12 for safe, secure storage. The uranium would eventually be sent to a facility in Lynchburg, Virginia, where it would be fabricated into reactor fuel. The analysis in the EA shows that the proposed transfer of uranium from the various foreign countries to the U.S. entails little or no risk to the quality of the environment or to human health. Based on the analysis in the EA, a FONSI was issued in 2005 (DOE 2005h).

- ***Supplement Analysis for the Air and Ocean Transport of Enriched Uranium Between Foreign Nations and the United States*** **(DOE/EIS-0309-SA-2)** (DOE 2006b). DOE/NNSA prepared this SA in August 2006 to evaluate the environmental impacts of incident-free (normal operation) air and sea transport, as well as the environmental impacts of postulated accidents. The impacts are presented in terms of radiological consequences (doses) and risks (latent cancer fatalities [LCFs]) to the aircraft crew, cargo handlers, ship crew, noninvolved workers, and the public. The SA concluded that the environmental impacts of sea transport of enriched uranium are bounded by previous analyses of sea transport of enriched uranium and foreign research reactor spent nuclear fuel.

1.7.3 Other Documents

- ***Final Mercury Management Environmental Impact Statement*** (DLA 2004). This EIS was prepared by the Defense Logistics Agency (DLA) to assess the impacts associated with the disposition of excess mercury that was stockpiled for national defense purposes. Stockpiled mercury is now warehoused at five locations in the U.S., including Y-12. Approximately 1.5 million pounds of DLA-managed mercury is collocated with approximately 1.5 million pounds of DOE-managed mercury at Y-12. DOE was a cooperating agency for the EIS. Because Y-12 did not have suitable storage space, it was not considered as an alternative site for consolidation of DLA-managed mercury. The Final EIS was published on March 26, 2004 (69 FR 15820). On April 30, 2004, a ROD was issued in which DLA decided to consolidate its mercury stockpile at one site (69 FR 23733). As a result of that ROD, DLA-managed mercury at Y-12 has been moved out of Y-12.

- ***Long Term Management and Storage of Elemental Mercury Environmental Impact Statement***. In 2008, Congress passed the Mercury Export Ban Act of 2008 (Pub. L. 110-414), which prohibits the export of elemental mercury from the U.S. effective January 1, 2013. To ensure that elemental mercury is managed and stored safely, the Act directs DOE to take a number of actions. By October 1, 2009, DOE must issue guidance establishing standards and procedures for the receipt, management and long term storage of elemental mercury generated within the U.S. at a facility or facilities of DOE. DOE must designate such facilities by January 1, 2010, but is prohibited by the Act from locating such a facility at DOE's Oak Ridge Reservation. At least one such facility must be operational by January 1, 2013. NNSA is evaluating options for the relocation of the NNSA mercury to a facility designated for long term mercury storage. Until such relocation is executed, NNSA will continue to store this stockpile of mercury at Y-12. Such storage ensures that the mercury will not be released to the global environment thereby minimizing mercury emissions and reducing contamination levels in the environment of this toxic chemical.

1.8 TIME PERIOD CONSIDERED IN ANALYSIS

The affected environment described in Chapter 4 is based on data for the calendar years 2006 and 2007. These data, for the most part, were obtained from the *Oak Ridge Reservation Annual Site Environmental Reports* (ASER) for 2003 through 2007 (DOE 2004e, DOE 2005a, DOE 2006b, DOE 2007b, and DOE 2008). The analysis time period for new projects and activities or upgrades to existing facilities used in the SWEIS is 2010 to 2019. Impacts for construction and operation of new upgraded facilities and the operation of Y-12's missions under the No Action Alternative are presented in annual increments unless noted otherwise.

1.9 PUBLIC INVOLVEMENT

On November 28, 2005, NNSA published a Notice of Intent (NOI) in the *Federal Register* (70 FR 71270) announcing its intent to prepare this Y-12 SWEIS. The public scoping period began on that day and continued through January 31, 2006 (Note: In the NOI, the public scoping comment period was scheduled to end on January 9, 2006. In response to public requests, the public scoping comment period was extended until January 31, 2006 [71 FR 927]). The NOI invited interested parties to attend two public scoping meetings on December 15, 2005, in Oak Ridge. The major comments received during the scoping process are discussed in this section.

During the Y-12 SWEIS scoping process, NNSA received 340 scoping comment documents from members of the public; interested groups; and Federal, state, and local officials. These included two transcripts from the public scoping meetings held in Oak Ridge, Tennessee. Of the 340 total comment documents received, approximately 290 of the documents were part of a letter writing campaign.[9] Table 1.9-1 provides a summary of the scoping comment categories and the number of comments received in each category. Approximately 3,794 comments were identified in the 340 scoping documents received.

Table 1.9-1. Category Distribution of Scoping Comments.

Category	No. of Comments
Policy	870
Purpose and Need	290
Alternatives	875
Nonproliferation	580
Environmental Compliance	290
Water Quality	290
Air Quality	2
Land Use	1
Transportation	1
Mitigation Measures	1
Terrorism	290
Cost	290
Cumulative Impacts	3
NEPA Process	2
Y-12 Missions	1
Worker and Public Health and Safety	3
Out of Scope Comments	5
Total	3,794

Source: Original.

1.9.1 Major Scoping Comments

NNSA has considered all scoping comments in preparing the Draft Y-12 SWEIS. A Scoping Summary Report for the Y-12 SWEIS has been prepared and is part of the Administrative Record for this Y-12 SWEIS (NNSA 2006). The major issues identified during scoping centered on the Nation's nuclear weapon policies, the SWEIS Alternatives, water quality, and the health and safety of workers and the public. The major issues raised during scoping are discussed below. The text below also includes a discussion of NNSA's consideration of these scoping comments and describes how these comments affected the SWEIS scope and analysis.

- ***Shutdown of Y-12.*** *Many commentors opposed continuation of Y-12 operations associated with weapons production and stated that the production of nuclear weapons and materials should be halted immediately. Many of these same commentors expressed opposition to any proposed action, such as the UPF, that would modernize nuclear weapons production capabilities.*

  The decision to continue the weapons production mission at Y-12 was made by DOE in the SSM PEIS ROD in December 1996 and reaffirmed in the ROD for the Complex Transformation SPEIS issued in December 2008. Shutting down Y-12 is not a reasonable alternative (see Section 3.4). The need for nuclear weapons has been determined by the President and Congress, and is an issue beyond the scope of the Y-12 SWEIS. However,

[9] A letter writing campaign generally includes letters from many people with substantively similar comments

the SWEIS does include Alternatives 4 and 5, in which NNSA would reduce the operational capacity of production facilities to a much smaller annual throughput of secondaries. The No Net Production/Capability-sized UPF Alternative would reduce the throughput to a limited number of secondaries beyond those associated with supporting surveillance, but would not support adding new types or increased numbers of secondaries to the total stockpile. Alternatives 4 and 5 are included as reasonable alternatives in this SWEIS in order to provide the NNSA with the flexibility to reduce operations at Y-12 if future considerations warrant such reduction.

- ***Additional Alternatives***. *Many commentors suggested that NNSA consider another reasonable alternative, which they described as the following:*

  - *Cease weapons production activities at Y-12 immediately;*
  - *Pursue long-neglected dismantlement and disposition mission and only those activities necessary to safely fulfill this mission;*
  - *Construct new, safeguarded, zero-emission facilities with built-in transparency for disassembly and dismantlement;*
  - *Undertake Manhattan Project 2, dedicated to finding solutions to long term contamination dilemmas;*
  - *Use Oak Ridge's long history of service to the nation, and the clear evidence of need, to leverage funds for thorough cleanup and responsible long-term management of legacy wastes in Oak Ridge;*
  - *Utilize the expertise and resources of ORNL in Manhattan Project 2.*

  As explained above, the decision to continue the weapons production mission at Y-12 was made by DOE in the SSM PEIS ROD and affirmed in the Complex Transformation SPEIS ROD. Ceasing weapons production activities at Y-12 would not satisfy NNSA's purpose and need at this time. However, NNSA has added the Capability-Based Alternatives (Alternatives 4 and 5), which would reduce production capacity at Y-12. With respect to continuing the dismantlement and disposition mission, all alternatives in the SWEIS include continuation of those missions. With respect to "zero-emission" facilities, the proposed action to construct and operate the UPF is expected to reduce radiological emissions from EU operations at Y-12. With respect to cleanup of existing contamination, ORR has an aggressive program for continuing to accelerate the cleanup of the site and will continue to do so for the foreseeable future.

- ***Additional Alternatives***. *Several commentors suggested that NNSA consider an alternative in which Y-12 would perform only interim upgrades or construction of new facilities with very short-term returns in terms of efficiency, effectiveness, or safety until decisions are made concerning a consolidated plutonium/uranium production plant, per the Nuclear Weapons Complex Infrastructure Task Force recommendation to the Secretary of Energy Advisory Board (SEAB) in 2005.*

  The Complex Transformation SPEIS analyzed alternatives consistent with the Nuclear Weapons Complex Infrastructure Task Force recommendation to the SEAB (SEAB 2005). However, in the Complex Transformation SPEIS ROD, NNSA did not select any of the consolidated Complex alternatives. As such, the alternatives in this SWEIS are consistent with the Complex Transformation SPEIS ROD.

- ***Purpose and Need***. *Many commentors stated that the "Purpose and Need" section of the SWEIS must consider U.S. commitments under the NPT in evaluating the impacts to the "whole of the human environment."*

  The purpose and need section for this SWEIS includes consideration of the NPT (see Section 1.5.1). As discussed in that section, the operations and alternatives considered in this SWEIS are fully consistent with the NPT.

- ***Worker and Public Health and Safety.*** *Several commentors expressed concerns related to worker and public health and safety, and stated that the SWEIS should address enriched uranium, beryllium, and other radiological and hazardous materials.*

  The SWEIS analyzes potential worker and public health impacts associated with criteria pollutants, hazardous pollutants, including beryllium, and radiological pollutants such as enriched uranium, in Section 5.12 of this SWEIS.

- ***Contamination of the East Fork Poplar Creek.*** *Many commentors expressed concern regarding contamination of the East Fork Poplar Creek (EFPC), and stated that DOE must address the health risks of EFPC in the current EIS and explain to the public why, after 20 years and more than $1 billion spent on EFPC alone, levels of contaminants are actually rising.*

  Sections 4.7.2 and 5.7.1.2 of this SWEIS include updated information regarding the water quality of EFPC and an assessment of the potential impacts of the alternatives on the water quality of EFPC and other water resources. The SWEIS also addresses the impacts to health from water contamination (Section 5.12).

- ***Terrorism.*** *Many commentors expressed concern regarding terrorism, stating that the operations at Y-12 make the area a terrorist target. Some commentors wanted to know what the impacts of a terrorist attack at Y-12 would be.*

  NNSA has prepared a classified appendix to this SWEIS that evaluates the potential impacts of malevolent, terrorist, or intentional destructive acts. Substantive details of terrorist attack scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Appendix E (Section E.2.14) discusses the methodology used to evaluate potential impacts associated with a terrorist threat and the methodology by which NNSA assesses the vulnerability of its sites to terrorist threats and then designs its response systems.

- ***Costs.*** *Many commentors expressed concern about the costs associated with nuclear weapons activities and stated that the money would be better spent on environmental cleanup or social programs.*

NNSA will consider the costs associated with the alternatives in the ROD process. With respect to comments about spending priorities, the budget used to support the nuclear weapons stockpile is determined by the Congress and the President.

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

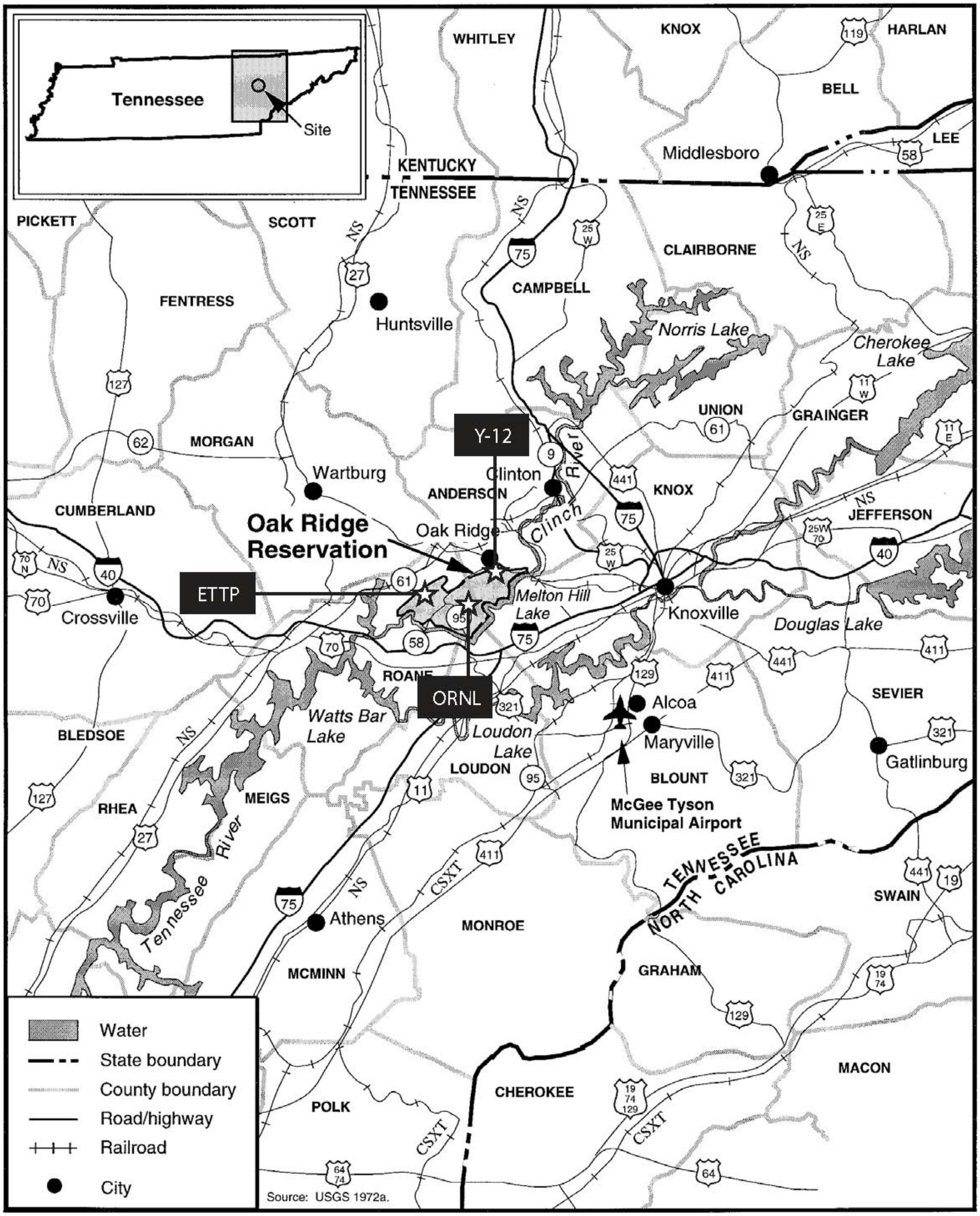
Y-12 is located on the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR), which covers approximately 35,000 acres. Most of ORR lies within the corporate limits of the city of Oak Ridge, Tennessee. The ORR is bordered on the north and east by the city of Oak Ridge and on the south and west by 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; research activities operated by ORNL; 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).

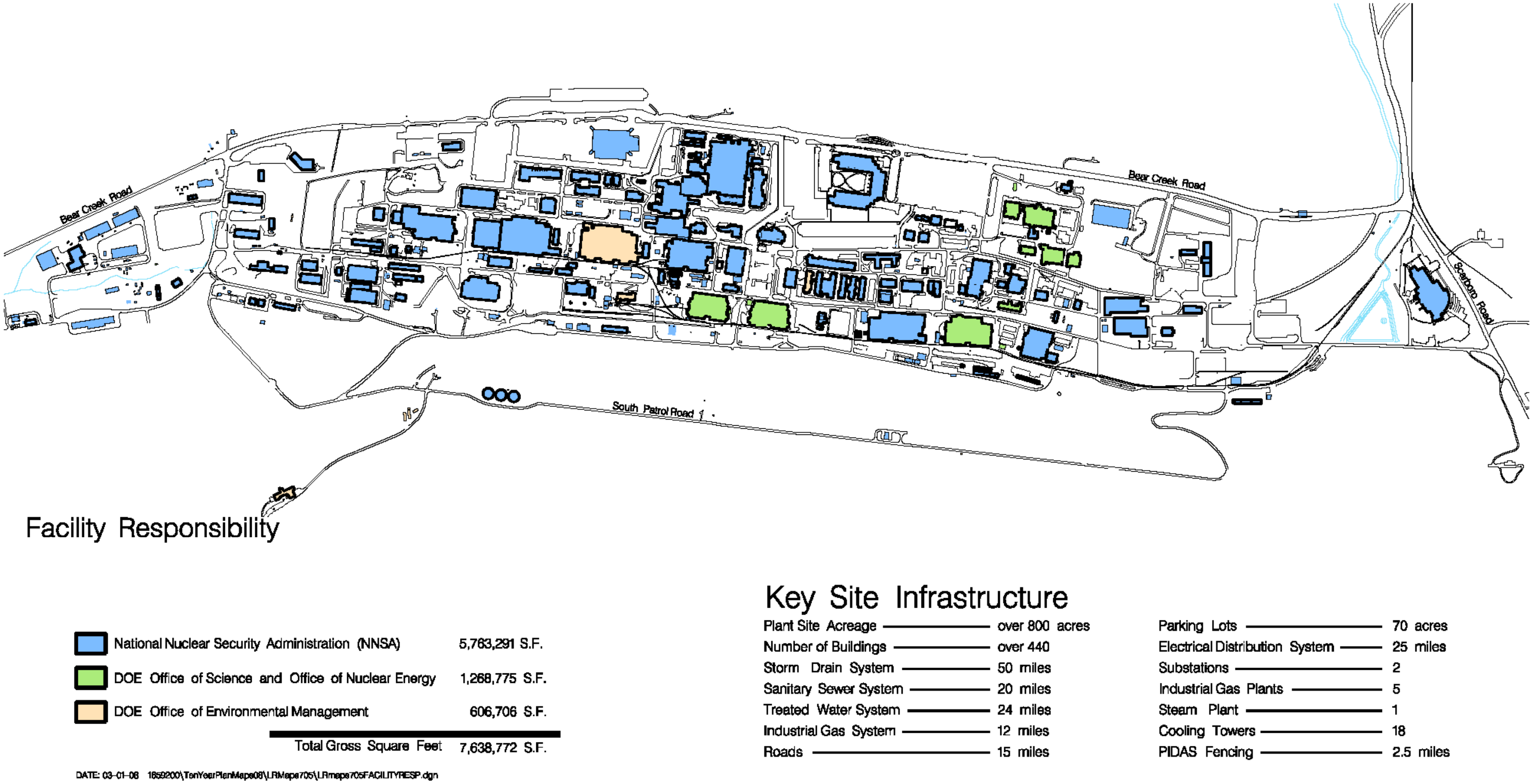
The following sections describe the missions at Y-12.

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 Evaluation and Surveillance;
- Stockpile Evaluation and Maintenance;



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.

2.1.1.1 *Weapons Dismantlement and Disposition*

The Weapons Dismantlement and Disposition mission provides for the receipt, dismantlement, and disposition of weapons systems components returned from the nuclear weapons stockpile. Weapons components returned to Y-12 are received primarily from the Pantex Plant in Amarillo, Texas, following initial dismantlement. Dismantlement includes all activities associated with weapons retirement, disassembly, component characterization, and disposition of materials and components.

Dismantlement, storage, and disposition have provided an ongoing workload for Y-12, driven primarily by material reuse requirements and treaty obligations. Each weapon's dismantlement process requires specific readiness parameters including tooling, procedures, safety documentation, security plans, and training. Y-12 must maintain and/or provide the capability to perform dismantlements and disposition in order to accomplish the dismantlement goals of this Administration.[2]

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 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.

[2] See Section 1.5 for a discussion of the Administration's dismantlement goals.

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 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 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*

Life Extension Programs (LEPs) are directed toward the production of refurbished, replaced, and/or redesigned weapons 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.

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.

Plans are underway to accelerate the transfer of materials into the new Highly Enriched Uranium Manufacturing Facility (HEUMF) which is scheduled to be operational in 2010. The new facility will enable NNSA to consolidate HEU into a modern storage facility and reduce costs associated with facilities that can be vacated or reused through other material consolidation initiatives.

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.

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. As of September 30, 2008, total operational space at Y-12 was reduced by over 1.2 million square feet and 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 assist in removing and dispositioning special nuclear threats from the United States and around the globe. These Y-12 skills and assets can provide a comprehensive response to radiological and nuclear material vulnerabilities anywhere in the world on short notice. Resources from Y-12 have supported activities in Kazakhstan, Republic of Georgia, Russia, Libya and other countries. In addition to material removal and safeguards and security activities, NNSA has entered into low-enriched uranium supply contracts for research reactors in the U.S. and countries such as Argentina, Belgium, Canada, France, Japan, and South Korea. NNSA has worked with the European Atomic Energy Community to supply Romania as well. For more information on the Global Threat Reduction Initiative see Section 5.15, Environmental Impacts of Continued Receipt and Transportation of Nuclear Materials in Support of Global Threat Reduction Initiatives.

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.

The Materials Surveillance Program, through the DOE Business Center for Precious Metals Sales and Recovery, recovers DOE precious metals from contaminated and non-contaminated scrap and excess equipment, and makes this metal available to DOE and its prime contractors. The center has contracts with private refiners and pre-approved refiners for *Resource Conservation and Recovery Act* (RCRA) waste-contaminated, and radiological-contaminated precious metals. Precious metals surplus to DOE programmatic needs may be sold on the open market; any proceeds are returned to the U.S. Treasury.

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;
- 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 & 7, Heavy Water, etc.) for domestic research reactor fuel fabrication and other various DOE and DoD projects and facilities. Additionally HEU in the form of U_3O_8 is produced for research reactors. These materials are packed for shipment both commercially and through the DOE-NE. 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 in the form of metal and oxides (UO_2 and U_3O_8) to FRRs. These FRRs produce medical isotopes for the world community and do basic nuclear research. The contracts are between NNSA Y-12 Site Office (YSO) and the foreign governments. 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 Project*

The purpose of the Integrated Facility Disposition Program (IFDP) is to expand the scope of EM's current environmental restoration program on ORR so that cleanup is completed at Y-12 and ORNL in a manner which supports facility modernization. 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
- Demolition of Building 9735
- Deactivation and Demolition (D&D) of Building 9206 bag filter house and associated recovery furnace
- Demolition of Buildings 9211, 9220, and 9224

- Demolition of Building 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 plans to relocate all of its programs currently residing on the Y-12 site to their main campus in Bethel Valley. NNSA is actively supporting 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 occupies at Y-12 were constructed for the uranium separation mission of the Manhattan Project. For all facilities that ORNL vacates, DOE-SC is responsible for the safe and compliant shutdown and long-term surveillance and maintenance of such facilities until their transfer and disposition. As ORNL completes its relocation plans, NNSA will evaluate its mission needs to determine if reuse of some of the ORNL buildings is required.

As DOE-SC completes its move off the Y-12 Complex, they plan to place 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

NNSA recently 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

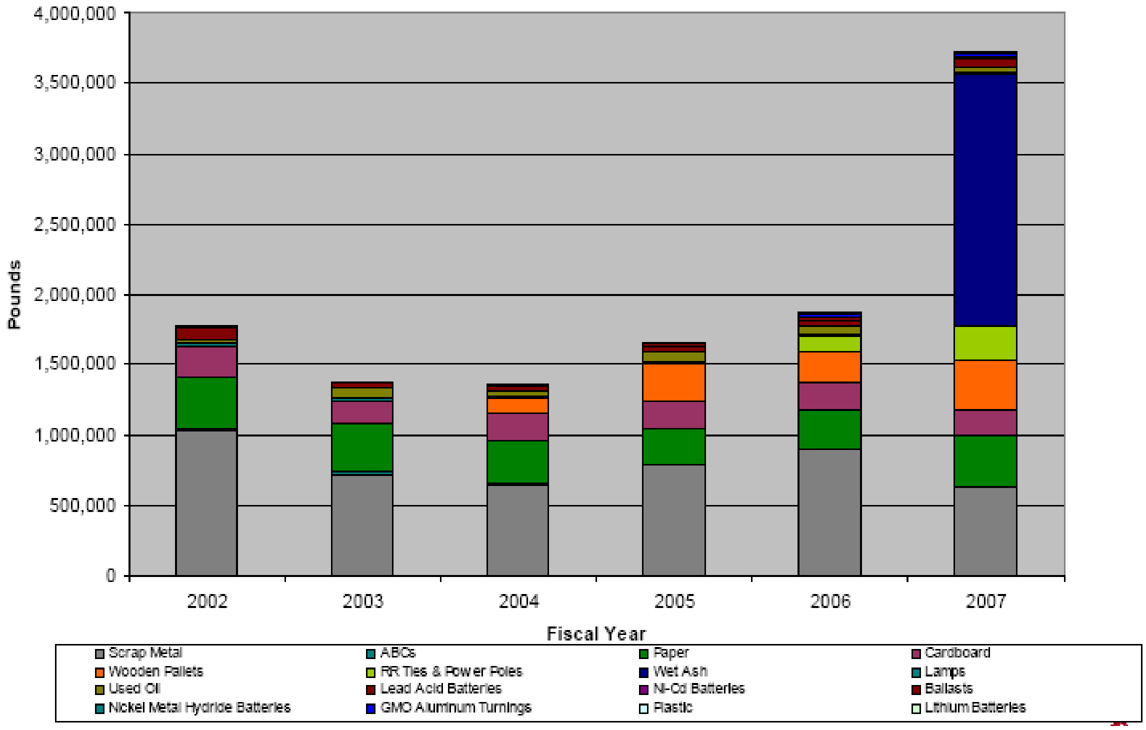
The Technology Transfer Program is hosted by DOE and has as its goal to apply expertise, initially developed for highly specialized military purposes, to a wide range of manufacturing situations to support expansion of the capabilities of the U.S. industrial base. These activities are carried out in 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, created a safer site, and improved storm water compliance. 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; eliminated more than 5,000 pounds or 70 percent of trichlorofluoromethane (CFC-11) compared to 2005 levels; conserved more than 86,000 cubic yards of landfill space and established 3.5 acres of native grasses; and reduced 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, the Y-12 Complex has completed more than 802 pollution prevention projects including on-going recycling projects that 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 2-3, Y-12 has greatly increased recycling activities over the past several years.



Source: Y-12 2008

Figure 2-3. 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 Complex. 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 Complex. 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 Complex.

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, prominent 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% 235U) • 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	• Quality Evaluation/Disassembly • DU Metalworking • Testing	• Quality Evaluation/Disassembly is 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	Construction completed. Operational in 2010.
Purification Facility	• Chemical Processing	• Special Material production	Operating

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

CHAPTER 3: ALTERNATIVES

Chapter 3 begins with a description of the planning assumptions and basis for the Site-Wide Environmental Impact Statement analyses. Next, the reasonable alternatives are described and discussed. The alternatives considered and subsequently eliminated from detailed evaluation also are discussed. The Chapter also identifies future modernization projects that are not yet ready for decisionmaking. The Chapter concludes with a summary comparison of the environmental impacts associated with each of the alternatives and discusses the Preferred Alternative.

3.0 MAJOR PLANNING ASSUMPTIONS AND BASIS OF ANALYSIS

As explained in Section 1.2, decisions from previous *National Environmental Policy Act* (NEPA) documents provide the starting point for this Y-12 Site-Wide Environmental Impact Statement (Y-12 SWEIS). In those decisions, the U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA) decided to downsize and modernize Y-12 while continuing to maintain the capability and capacity to fabricate nuclear weapons secondaries, limited-life components, and case parts in support of the nuclear weapons stockpile, and store nonsurplus highly enriched uranium (HEU) long term and surplus HEU pending disposition. Most recently, NNSA decided to build a Uranium Processing Facility (UPF) at Y-12 as stated in the Record of Decision (ROD) for the Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS) (73 FR 77644, December 19, 2008). This SWEIS evaluates the potential direct, indirect, and cumulative impacts associated with the reasonable alternatives to continue implementing those decisions. The planning assumptions and considerations that form the basis of the analyses and impact assessments presented in the SWEIS are listed below.

- The time-frame for new projects and activities or upgrades to existing facilities considered in this SWEIS is approximately the next 10 years. As such, this SWEIS evaluates modernization projects that could be implemented within approximately 10 years after the Record of Decision (ROD) for this SWEIS. These modernization projects have reached the stage of development in which they are ripe for decisionmaking. However, the potential full modernization of Y-12 will be a long term process, extending beyond the next ten years. Other potential modernization projects in the very early planning stages have been developed to the extent practical and are described in Section 3.3. The potential impacts of these projects are addressed qualitatively and are included in the cumulative impacts in Chapter 6. These potential future projects would be addressed under separate NEPA review when conceptual design information is available and the time is appropriate to make a decision on the need for a specific facility.
- The modernization projects defined by the alternatives in this SWEIS are in a conceptual design stage. As such, best available design information for the analysis is contained in this SWEIS (see the descriptions of alternatives in Section 3.2). For the purpose of the environmental impact analysis, assumptions have been used such that construction requirements and operational characteristics of the modernization projects would represent a conservative assessment of potential environmental impacts. Thus,

the actual impacts from the implementation of any final design are expected to be less severe than those analyzed in this SWEIS.

- In general, the affected environment includes the Y-12 site and the surrounding areas up to, for certain resources, a 50-mile radius from the center of Y-12.
- Both construction and operational impacts are considered for all resources. Construction impacts are generally short-term (e.g., would occur over a period of less than approximately 6 years), while operational impacts are expected to be long term (e.g., would occur annually over the 50-year operating period).
- Generated wastes would be managed in accordance with applicable Federal, state, and local laws, regulations, and requirements, as well as DOE/NNSA's waste management orders and pollution prevention and waste minimization policy.
- For radiological accidents, impacts are evaluated for the general population residing within a 50-mile radius (including the maximally exposed individual), involved workers to the extent possible, and non-involved workers in collocated facilities. The impacts of accidents analyzed for each alternative reflect and are expected to bound the impacts of all reasonably foreseeable accidents that could occur if the alternative were implemented. NNSA has also prepared a classified appendix to this SWEIS that evaluates the potential impacts of malevolent, terrorist, or intentional destructive acts. Substantive details of terrorist attack scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks.
- Y-12 capacity and workload requirements would be established by the following:

    a. Near-term production readiness and capacity will be driven by Production and Planning Directives (P&PDs) and, as deemed necessary, other workload planning guidance received from NNSA;

    b. Long term production readiness and capacity will be driven by the "New Triad" of flexible response capabilities established in the January 2001 Nuclear Posture Review (NPR), as well as any new requirements that may arise from future national security reviews, such as the Bipartisan Congressional Commission on the United States Strategic Posture and a new NPR (see Section 1.5). Workload at Y-12 in direct support of the NPR would involve the following over the next 10 years:

        - The Stockpile Life Extension Programs (SLEPs) will be completed for the B61 and initiated for the W76;
        - The production of high-fidelity flight test units will continue to be required in the enduring stockpile;
        - Quality evaluation (surveillance)[1] rates will remain relatively constant during the 10-year planning period;
        - Dismantlements will increase through 2009 and remain relatively steady thereafter;

[1] Quality evaluation (surveillance) refers to specially designed tests and inspections to collect data and determine the condition of units and components to assess the future reliability of the weapons systems in the stockpile.

   - Other work scope will be driven by compliance, program plans, or other planning documents developed by NNSA and Y-12 organizations in support of NNSA activities (NNSA 2008a).

- The missions at Y-12 conducted by the DOE Office of Science (DOE-SC), Nuclear Energy Science and Technology (DOE-NE), Defense Nuclear Nonproliferation, Work-for-Others, and Technology Transfer programs are not expected to change significantly over the next 10 years and would generally be the same as described in Chapter 2 and reflected in the current affected environment shown in Chapter 4 (NNSA 2007). To the extent that these missions do change or additional buildings or facilities are needed, they would undergo the appropriate NEPA analysis once they become proposals ripe for analysis and decisionmaking.
- DOE-NN missions at Y-12 involve the management of surplus HEU. This mission also includes blending quantities of HEU with low enriched uranium (LEU) or natural uranium to produce a metal or oxide product suitable for use in various reactor programs, and for multiple supply orders to DOE customers. The HEU blending operations using existing Y-12 facilities and processes are included in the No Action Alternative. Additionally, this mission includes the potential shipment of HEU to offsite blending facilities.
- The current industrial use classification for Y-12 would likely remain the same. While some changes to land use will occur as a result of modernization projects, Y-12 will continue to require security and emergency response buffers that preclude release of any real estate for public use (NNSA 2007).
- Y-12 downsizing will continue through the planning period of this SWEIS. Surplus facilities, with no inherent value to DOE, NNSA, or the community, would ultimately be dispositioned or undergo decontamination and decommissioning (D&D) consistent with overall modernization plans. Separate project-specific NEPA reviews would be conducted for these facilities as appropriate. D&D impacts have been analyzed to the extent practicable and are discussed in Section 5.16 of this SWEIS.
- The operations at Y-12 would require transporting secondaries to and from Pantex, where weapons assembly and disassembly operations occur. All transportation of secondaries is assumed to occur via the NNSA transportation fleet of Safeguards Transporters (SGTs) over Federal and state highways to the extent practicable.
- The methodology used to assess the environmental impacts of the alternatives is described in Appendix E.
- If the DOE/NNSA decides to build and operate a UPF, construction would begin in approximately 2010 and be completed in approximately 2016. Mission startup and initial operations would occur thereafter, with full-scale production beginning in approximately 2020. Because a UPF would be designed for a service life of at least 50 years, this SWEIS assesses the environmental impacts associated with the operation of a UPF for a period of 50 years, at which time the facility would undergo D&D. D&D impacts have been analyzed and are discussed in Section 5.16 of this SWEIS.
- Under all alternatives analyzed, the UPF would have the capacity to support dismantlement and the resulting casting schedules as well as convert excess metal and uranium oxide for long term storage or disposition. This SWEIS evaluates the environmental impacts associated with single-shift operations five days per week, as

this represents the most likely long term, normal operating scenario for the UPF (B&W 2004a). For Alternatives 4 and 5, a minimum-sized UPF is analyzed (see Section 3.2.4.1).

- Proven technology is used as a baseline for the UPF. No credit is taken for emerging technology improvements. The design goal of the UPF includes consideration of waste minimization and pollution prevention to minimize facility and equipment contamination, and to make future D&D as simple and inexpensive as possible. Once the UPF becomes operational, the existing EU and other processing facilities would be available for D&D. This SWEIS includes a general discussion of the environmental impacts from D&D, including a discussion of the D&D process, the types of actions associated with D&D, and the general types of impacts associated with D&D. Any discussion of specific D&D impacts are more appropriate for tiered NEPA documents, because the extent of contamination, the degree of decontamination, and the environmental impacts associated with performing D&D, cannot be known without performing a detailed study of the individual facilities at the appropriate time. D&D actions could potentially be conducted as a remedial action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Cleanup and D&D activities conducted under CERCLA are reviewed through the CERCLA process.

3.1 DEVELOPMENT OF ALTERNATIVES

This SWEIS has been prepared in accordance with the Council on Environmental Quality (CEQ) regulations (40 *Code of Federal Regulations* [CFR] 1500–1508) and the DOE regulations implementing NEPA (10 CFR 1021). The SWEIS evaluates the proposed action and reasonable alternatives to the proposed action, as well as the No Action Alternative. The term "reasonable" has been interpreted by CEQ to include alternatives that are practical or feasible from a common sense, technical, and economic standpoint (CEQ 1981).

The proposed action and reasonable alternatives for this SWEIS assume that the missions assigned to Y-12, which are described in Chapter 2 of this SWEIS, will continue for the foreseeable future. Alternative 1 is the No Action Alternative, and represents the baseline conditions; i.e., what is currently going on at the site. Alternative 2 in this SWEIS (which is also the "proposed action") is to construct and operate a new UPF. Alternative 3, the Upgrade in-Place Alternative, would also require additional capital investment and would utilize existing, but upgraded, facilities to accomplish the assigned missions. Alternatives 4 and 5 involve a reduction in the production throughput of Y-12 to support smaller stockpile requirements. Section 3.2 describes the alternatives in more detail.

3.2 ALTERNATIVES

Alternatives analyzed in this Y-12 SWEIS include the No Action Alternative and three action alternatives. These alternatives are described below.

3.2.1 Alternative 1 – No Action Alternative

The No Action Alternative means no change in current plans, including approved projects. Under the No Action Alternative, operations at Y-12 would continue to support the DOE and NNSA programs described in Chapter 2. Figure 3.2.1-1 presents a map of facility location and utilization at Y-12 under the No Action Alternative. Unless noted otherwise, these missions are expected to continue for the foreseeable future. Construction of a UPF is not part of the No Action Alternative.

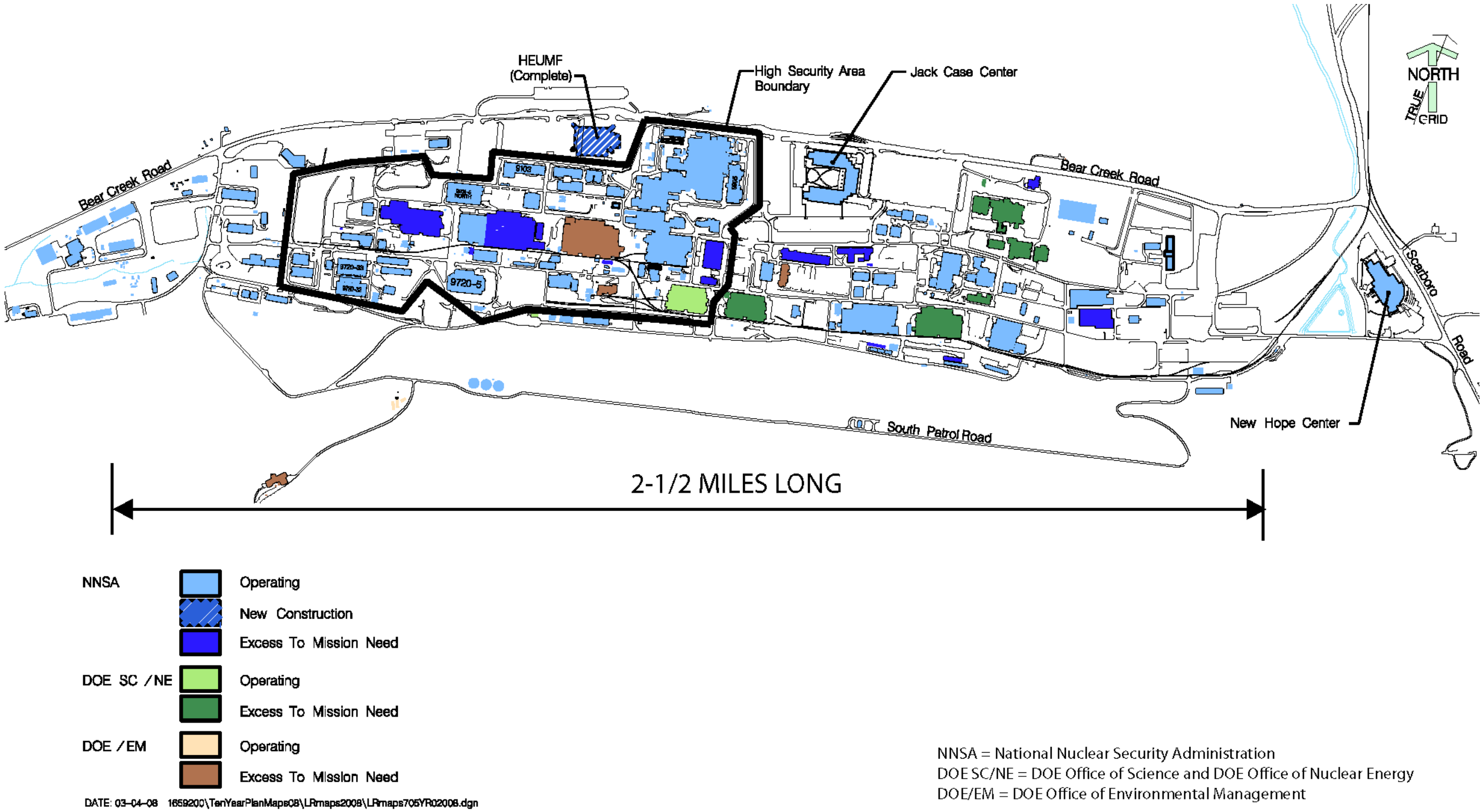
The No Action Alternative includes the continued implementation of planned modernization actions announced in the 2002 ROD for the 2001 Y-12 SWEIS (67 FR 11296, March 13, 2002) as modified by subsequent actions, as well as new actions subsequent to the 2002 ROD that have undergone separate NEPA review (see Section 1.7). The following actions announced in the 2002 ROD, modifications to the actions of the 2002 ROD, and actions undertaken since the 2002 ROD are included in the No Action Alternative.

1. **Highly Enriched Uranium Materials Facility (HEUMF).** The new HEUMF (now constructed) will store HEU that is not being used in manufacturing activities. The HEUMF—completed in 2008 and expected to start full-scale operations in 2010—will reduce the current storage footprint, improve security and lower operating costs (DOE 2001a).

2. **Special Materials Complex (SMC).** This project was cancelled because it was no longer required by the reduced manufacturing requirements of the smaller stockpile. The project was replaced by a new Purification Facility and installation of new equipment within an existing facility to allow reuse of existing special material parts (*Final Supplement Analysis for Purification Facility, Site-Wide Environmental Impact Statement for the Y-12 National Security Complex*, DOE/EIS-0309/SA-1, August 2002) (NNSA 2002). That Supplement Analysis (SA) assessed whether the potential environmental impacts of the stand-alone Purification Facility, a component of the SMC analyzed in the Y-12 SWEIS, would require the preparation of a Supplemental SWEIS. The determination was made that proceeding with the Purification Facility would either reduce or not affect the environmental impacts of the SMC identified in the Y-12 SWEIS, and therefore, no additional NEPA analysis was required.

3. **Infrastructure Reduction.** A series of individual NNSA-managed projects are underway to remove excess buildings and infrastructure, with a goal of reducing the active footprint at Y-12 by 50 percent during the next decade. A total of 149,357 square feet of floor space will have been demolished during 2008. Since 2002, NNSA has demolished over 1.2 million square feet of excess floor space at Y-12 (NNSA 2008a). Each demolition project was reviewed prior to initiation and found to be covered

> **Categorical Exclusion**
>
> A Categorical Exclusion (CX) is a NEPA determination applied to an action that DOE has determined does not individually or cumulatively have a significant effect on the human environment.



Source: NNSA 2008a.

Figure 3.2.1-1. Major Operational Facilities Currently Supporting Y-12 Missions.

by the **Categorical Exclusion** (CX) established by 10 CFR Part 1021, Appendix B, B1.23 (Demolition and Subsequent Disposal of Buildings, Equipment, and Support Structures).

As part of the infrastructure reduction efforts, the No Action Alternative also includes facilities presently being contemplated for closure and D&D under the Integrated Facility Disposition Project (IFDP). The IFDP project is a joint effort on the part of DOE Oak Ridge Office (ORO), NNSA, UT-Battelle, DOE Office of Environmental Management (DOE-EM), and DOE Office of Science (DOE-SC), which have teamed to develop a consolidated project to complete the cleanup scope at Y-12 and ORNL for the disposition of contaminated excess facilities at Y-12 and ORNL (NNSA 2008a).

The IFDP would allow for the D&D of over 3.8 million square feet of DOE and NNSA excess space over the next 15 to 20 years. Existing as well as future facilities may ultimately be considered as part of the IFDP effort. Table 3.2.1-1 is a projection of the NNSA footprint that could be transferred to DOE-EM within the next 3–5 years. The potential Y-12 facilities which may be constructed, as well as the facilities which will be closed and become a part of The Oak Ridge Environmental Management Cleanup Program, may change as modernization plans and the IFDP are developed further (NNSA 2008a).

Table 3.2.1-1. Summary of Y-12 Facilities Planned to begin D&D within the next 3-5 Years.

Facility	Gross Square Footage
9206, Former Uranium Facility	57,812
9731, Former Pilot Plant	37,317
9769, laboratory	20,050
9201-S, Alpha 5	613,642
9204-4, Beta 4	313,771
9201-3, Alpha 3	191,978
9401-3, Steam Plant	32,124
Ancillary facility to above buildings	62,150
Total	**1,328,844**

Source: NNSA 2008a.

4. **Manufacturing Support and Public Interface facilities.** These facilities are technical, administrative, and engineering facilities built on Y-12 land. The managing and operating contractor of the Y-12 plant will lease these facilities. They were included in an Environmental Assessment (EA) and a subsequent Finding of No Significant Impact (FONSI) completed in January 2005 (*Alternate Financed Facility Modernization EA and FONSI,* DOE/EA-1510) (NNSA 2005d).

5. **Transportation of HEU from Foreign Locations to Y-12.** Subsequent to issuance of the 2002 ROD (67 FR 11296, March 13, 2002), the Y-12 site was given the additional mission of securing and storing small quantities of HEU transported from foreign locations to prevent proliferation of nuclear weapons and to minimize or eliminate the use of HEU in civilian reactors. Environmental Assessments were

prepared and FONSI's issued for these actions (*Environmental Assessment for the Transportation of Highly Enriched Uranium from the Russian Federation to the Y-12 Security Complex*, DOE/EA-1471, January 2004 (DOE 2004d); *and Environmental Assessment for the Transportation of Unirradiated Uranium in Research Reactor Fuel from Argentina, Belgium, Japan and the Republic of Korea to the Y-12 National Security Complex,* DOE/EA-1529, June 2005) (DOE 2005h).

6. **Upgrade of Y-12 Potable Water System.** NNSA completed an EA and issued a FONSI in 2006 to upgrade the potable water system at Y-12 DOE/EA-1548 (DOE 2006a). Upgrades to the Y-12 potable water system would allow Y-12 to (1) meet regulatory requirements for safe drinking water by providing backflow protection for known cross connections and ensuring proper chlorine residual maintenance in the system; (2) provide Y-12 control and monitoring of water coming into the Y-12 distribution system to ensure adequate water flow and pressure to support current and future Y-12 operational needs; and (3) address deferred maintenance and ensure continued system reliability by inspecting, evaluating, and repairing or replacing deteriorated cast iron water mains and building feeds and obsolete fire hydrants.

7. **Y-12 Steam Plant Replacement Project.** In August 2007, NNSA completed an EA to replace the existing Y-12 steam plant with a new centralized steam plant. The new centralized steam plant would use natural gas boilers to produce steam to support Y-12 operations. Reliable and cost-effective steam generation is vital to the operation of Y-12. It is the primary source of building heat for personnel comfort and it provides freeze protection for critical services that include fire protection systems and heat tracing of exterior above ground water systems. Steam is also necessary to support EU production operations. A Finding of No Significant Impact was signed on September 6, 2007 (YSO 2007). Currently, the steam plant is under construction and is scheduled to be completed in September 2010.

8. **Compressed Air Upgrades Categorical Exclusion.** The Compressed Air Upgrades Project (CAUP) corrects deficiencies related to reliability and efficiency by providing new compressed air capability to meet the current and long-range needs of Y-12. The project upgrades the compressed air system by replacing obsolete equipment with state-of-the-art technology equipment and controls. CAUP installed a new instrument/plant air system in reuse facility 9767-13. During the conceptual design phase, NEPA reviews were completed and a determination was made in January 2003 that CAUP work is covered by an existing CX.

9. **Security Improvements Project (SIP) Categorical Exclusion.** The purpose of the SIP is to replace the existing Y-12 security system with the NNSA preferred ARGUS security system, a special purpose, automated information system that will be continuously operating and monitored by Y-12 security personnel. The project would provide a comprehensive and integrated security system that performs the required security functions and meets applicable DOE Orders. The project directly supports the mission by maintaining the security capabilities of Y-12 to protect national security by applying advanced technology to the nation's defense. SIP's scope is

limited to installing the ARGUS technology backbone in the existing Central and Secondary Alarm Stations, install software gateways to existing alarms, and install new ARGUS components in the HEUMF. During the conceptual design phase, NEPA reviews were completed and a determination was made in May 2007 that the SIP is covered by existing CXs.

10. **Nuclear Facility Risk Reduction (NFRR) Project Categorical Exclusion.** The NFRR line item project will directly contribute to the safety and reliability of Building 9212 and Building 9204-2E which are needed to continue NNSA current missions at Y-12. The NFRR Project will reduce risk of failure of infrastructure in these mission-essential Y-12 facilities by implementing practical, capital modifications determined prudent and necessary to ensure continued safe operations at existing levels. The project scope includes improving maintainability and reliability needed to address the risk of failure of selected, high priority, infrastructure utility systems, structures, and components through planned replacement of critical electrical control centers, switchgear, stacks, casting furnace vacuum system, and cooling tower and steam system pipes. Execution of this project will address the 2005 Defense Nuclear Facility Safety Board (DNFSB) risk review recommendations and backlogged deferred maintenance by replacing failing and obsolete equipment with new. During the conceptual design phase, NEPA reviews were completed and a determination was made in December 2008 that NFRR work is covered by existing CXs.

These projects are discussed in more detail in section 1.7 of the SWEIS. Additionally, as discussed in Section 1.7.3 of the SWEIS, DOE is currently preparing an EIS for long term management and storage of mercury (74 FR 31723). NNSA will continue to store mercury at Y-12 unless a decision is made to relocate the material.

The environmental conditions described in Chapter 4 of this SWEIS reflect the baseline operational impacts of these missions for the foreseeable future. Chapter 5 of this SWEIS discusses operational impacts. To provide comprehensive baseline data from which operational levels could be projected, NNSA gathered the best available data for the current level of operation. In most instances, the data supporting the No Action Alternative are reflected by the most recent monitoring data (2006 and 2007) for the Y-12 Site as reported in the Annual Site Environmental Reports (ASER) issued in 2007 and 2008; however, data from previous years were used if 2006 or 2007 data were unavailable or if they provided a more conservative analysis.

Under the No Action Alternative, NNSA would continue to operate existing EU and nonnuclear processing facilities without any major upgrades or changes. Under this alternative there would be no UPF and the current high-security area would not be reduced.

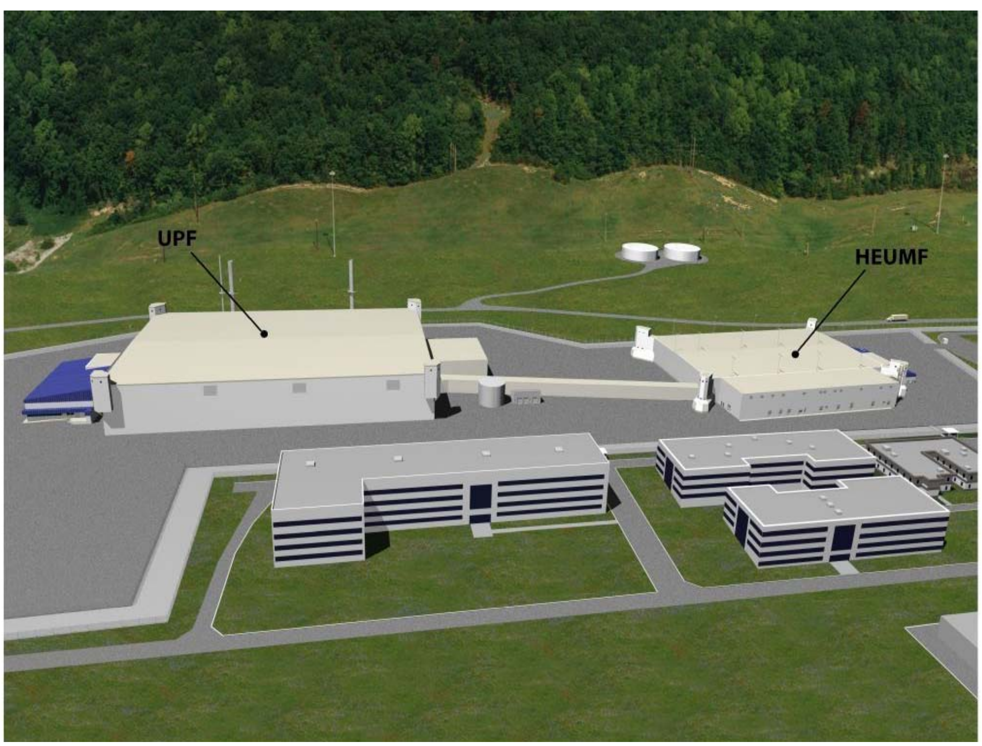
3.2.2 Alternative 2 – Uranium Processing Facility Alternative

Under this alternative, NNSA would take all actions in the No Action Alternative, construct and operate a modern UPF sized to support the smaller nuclear stockpile of the future (Section 3.2.2.1), and construct and operate a new Complex Command Center (CCC) (Section 3.2.2.2).

3.2.2.1 *Uranium Processing Facility*

The UPF would consolidate EU operations into an integrated manufacturing operation sized to satisfy all identified programmatic needs and would be sited adjacent to the HEUMF to allow the two facilities to function as one integrated operation. Transition of EU production operations to the UPF and transition of EU storage operations into HEUMF (No Action Alternative) would enable the creation of a new high security protected area 90 percent smaller than the current high security protected area.

The UPF Project, which is one of the cornerstones of Y-12's Modernization Program, would replace multiple existing EU and other processing facilities. The current operating and support areas occupy approximately 633,000 square feet in multiple buildings, while the consolidated UPF would result in approximately a 33 percent reduction, to approximately 388,000 square feet in one building. Once the UPF becomes operational, some of those existing facilities could be available for D&D, while other facilities could be used for non-EU processes. Figure 3.2.2-1 shows an artist’s rendering of the proposed UPF.



Source: NNSA 2007.

Figure 3.2.2-1. Artist’s Rendering of the Proposed UPF Adjacent to the HEUMF.

Critical Decisions

The DOE project management system uses Critical Decisions (CDs) at specific points in the process to ensure a logical maturing of broadly stated mission needs into well-defined requirements resulting in operationally effective, suitable, and affordable facilities, systems, and other products. There are five CDs that are numbered from zero to five, as follows:

1. **CD-0, Approve Mission Need**, formally establishes a project and begins conceptual planning and design.
2. **CD-1, Approve alternative Selection and Cost Range**, provides authorization to begin the project Execution Phase. Additionally, long-lead procurements may be approved during this phase provided an appropriate NEPA process has been completed.
3. **CD-2, Approve the Performance Baseline,** authorizes submission of a budget request for the total project cost.
4. **CD-3, Approve Start of Construction**, provides authority to execute the project.
5. **CD-4, Approve Start of Operations or Project Completion**, marks the approval of transition to operations.

Source: DOE O 413.3A

In support of the proposed UPF, NNSA has prepared a Pre-Conceptual Design Report (B&W 2004b), and a CD-1 Mission Need has been approved (NNSA 2005a). The proposed location for the UPF was based partially on cost and security requirements and would consolidate EU operations in two designed-denial[2] facilities (UPF and HEUMF). This would significantly improve physical protection and meet the new **graded security posture**, optimize material accountability, enhance worker, public, and environmental safety and health (ES&H), and consolidate operations to greatly reduce operational costs.

Graded Security Posture

The elements of a threat postulated for the purpose of establishing requirements for safeguards and security programs, systems, components, equipment, and information. Further details regarding the graded security posture are classified per DOE Order 470.3B.

The proposed UPF would include EU and EU-containing component and subassembly processing and manufacturing operations. The proposed UPF site is outside of, but adjacent to, the existing Perimeter Intrusion, Detection, and Assessment System (PIDAS). The PIDAS would be extended to encompass the HEUMF and the proposed UPF, if constructed. Figure 3.2.2-2 shows the location of the proposed UPF relative to other buildings at Y-12. The proposed location is close to the existing HEU processing complex, which provides cost and operational efficiencies for consolidating EU operations.

The proposed UPF site preparation involves site design, demolition and/or relocation of several small buildings on the site, relocation of existing utilities, and extension of utilities to the new site. The PIDAS would need to be extended to encompass this area after the UPF was completed.

An additional action under this alternative is to reduce the PIDAS footprint at the Y-12 site. This project will make the necessary modifications to the PIDAS fencing to allow the protected area

[2] "Designed-denial" refers to the utilization of security technologies in the facility design process to achieve a security posture that will meet security requirements

to be limited to surrounding HEUMF and UPF. This project would be active following the construction of the UPF project.

3.2.2.1.1 UPF Construction

The new structures and support facilities that would comprise the UPF complex include the following:

- UPF building;
- UPF electrical switching center;
- chiller building and chiller building switch center;
- cooling tower;
- aboveground water tank for a seismic-qualified firewater system with a firewater pumping facility;
- electrical generators, and
- modified PIDAS to encompass the HEUMF and UPF complex.

The design of the UPF would meet Y-12 Conduct of Operations and Integrated Safety and Security Management requirements, minimize the number of personnel required for operations and security, and meet DOE requirements for Special Nuclear Material (SNM) accountability and control. The design service life of the proposed new facility would be 50 years. The UPF would be equipped with safety support systems to protect workers, the public, and the environment. The UPF would be housed in a multistory, reinforced concrete building designed and built for security. The main building would be a reinforced concrete structure with reinforced concrete exterior walls, floor slabs, and roof. The roof and exterior walls would be sized to protect the interior from tornado- and wind-borne projectiles and blast effects, as well as seismic events.

Conventional construction techniques would be used to build the UPF. Construction activities would be performed in a manner that assures protection of the environment during the construction phase. Disposal of construction debris would be made in accordance with waste management requirements in properly permitted disposal facilities. Throughout the construction process stormwater management techniques, such as silt fences and runoff diversion ditches, would be used to prevent erosion and potential water pollutants from being washed from the construction site during rainfall events.

As shown on Figure 3.2.2-2, construction of the UPF would require approximately 35 acres of land, which includes land for a construction laydown area and temporary parking. Once constructed, the UPF facilities would occupy approximately 8 acres. The construction laydown area for the UPF would be developed on the west side of the proposed UPF site. This area would be finished with an 8-inch thick compacted, stabilized base for the construction phase. Interim employee parking lots would be developed west of the proposed construction laydown area. The site would be sufficiently graded and developed to accommodate a number of temporary construction trailers, storage buildings, and materials storage yards. After construction of the UPF is complete, it may be feasible to rework the laydown area to provide for additional parking.

Relocation of Utilities and Other Features. Prior to starting construction, it would be necessary to clear the UPF site of all existing electrical utilities that might interfere with construction of the facility. For example, pole-mounted lighting fixtures, public address speakers, and associated aerial cables and utility poles which are located on the existing parking lots and along Bear Creek Road would be removed. A section of overhead 161-kilovolt (kV) transmission line running along the north side of Bear Creek Road would be relocated out of the construction zone. The high-mast lighting towers along the northern boundary of the site would be removed. An underground fiber-optic telephone line would be relocated. Area lighting would be added outside the construction zone where necessary to help compensate for lighting equipment that must be removed.

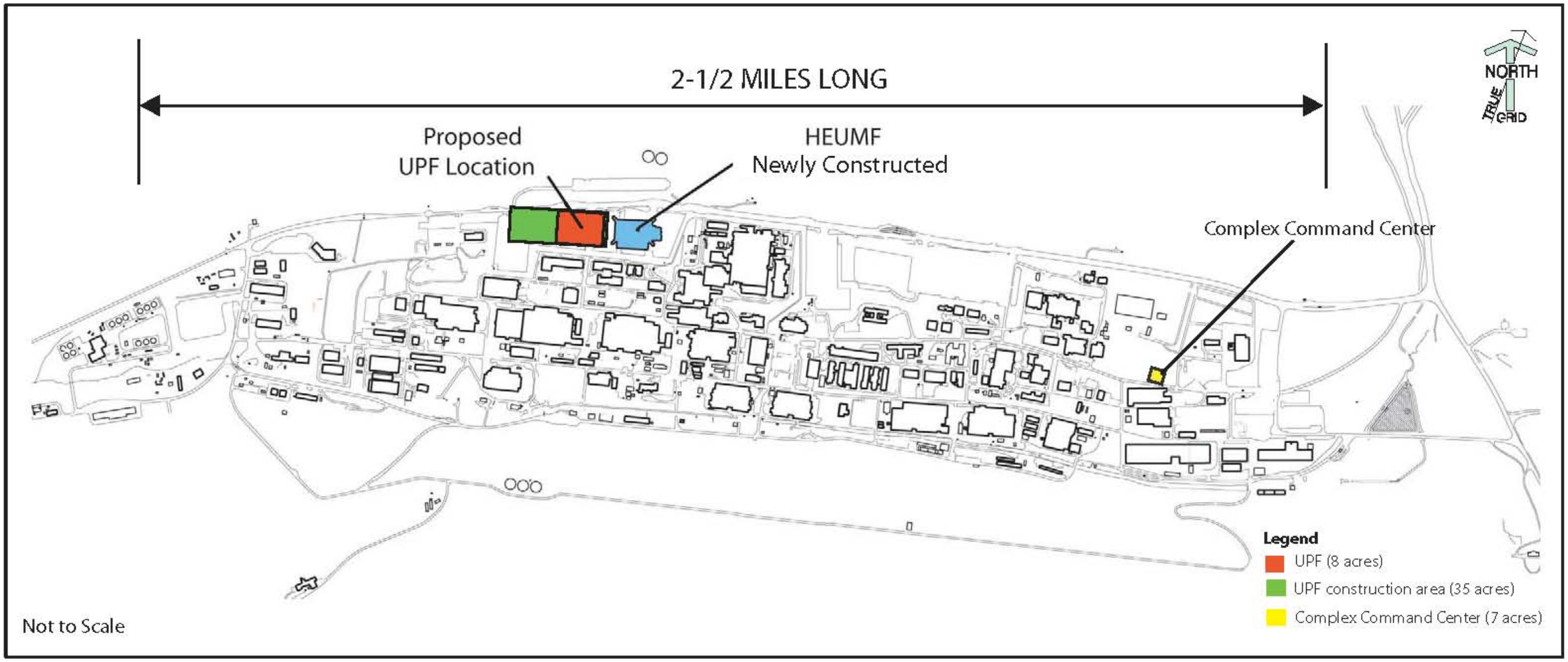
Temporary electrical services would be provided to support construction activities until permanent power sources can be brought on-line. Temporary power sources would be derived from existing 13.8-kilovolts (kV) yard feeders in the vicinity of the construction area. Temporary telephone and other telecommunication services would be installed as necessary to assist and support construction activities.

The existing 24-inch cast iron potable water line along the existing Bear Creek Road would be moved north to facilitate construction for the new site. Approximately 1,300 feet of the east-west main would be moved. The City of Oak Ridge owns this water line and holds adjacent rights of way for the utilities. The line is the sole source of potable water to ORNL. The new 24-inch potable water line would be ductile iron and feature air release valves where required and backflow preventers where existing Y-12 water lines tie into the new water line.

Storm drains already exist on site. The UPF storm sewer system would include a comprehensive collection system that would tie into the existing system near the northeast corner of the project site. Storm sewer pipe would be reinforced concrete and would be designed to collect a 100-year storm event. The UPF storm sewer system would have security barriers that comply with current DOE security standards and philosophy for the prevention of adversary movement through a storm sewer system. The new system would meet the minimum standards for sanitary sewer collection systems established by the Tennessee Department of Environment and Conservation (TDEC).

Traffic Planning and Parking. The UPF footprint and the alignment of the new PIDAS would require Bear Creek Road to be closed to through traffic. Although it would be feasible to reroute Bear Creek Road, this would not be part of this project. The entrance road to the existing Polaris parking lot would be relocated to facilitate site work. Up to 1,200 car spaces may be built to replace the parking spaces lost when the proposed UPF is constructed.

Removal of Small Existing Facilities. The proposed UPF and the related support structures would be sited such that they can be built outside the current area encompassed by PIDAS. To facilitate siting of a construction laydown area and interim parking, the proposed UPF would likely require demolition and relocation of several small structures, including Buildings 9107 and 9720-37, their support facilities, and a Guard Tower. Both Buildings 9107 and 9720-37 are outside of the current Y-12 Protected Area. A demolition plan would be developed during the preliminary design phase and would ensure that environmental resources are protected.



Source: NNSA 2007, modified.

Figure 3.2.2-2. Location of the Proposed UPF and CCC Relative to Other Buildings at Y-12.

The demolition plan would define the extent of demolition, abandonment, and removal of existing facilities and utilities; methods of handling and disposing of hazardous waste materials if encountered; materials to be salvaged; backfilling of removed materials; and clean-up. This demolition could be covered by the CX established by 10 CFR Part 1021, Appendix B, B1.23 (Demolition and Subsequent Disposal of Buildings, Equipment, and Support Structures) or conducted as a remedial action under CERCLA.

Site Preparation and Facility Construction. Table 3.2.2.1-1 lists the construction resource requirements, number of construction workers, and estimated waste generation of constructing the proposed UPF. Site preparation would include any excavation, filling, and grading needed to meet design requirements for an on-grade, reinforced concrete structure. Detailed testing would be conducted to fully characterize site geology, hydrology, and soil compaction, as well as to sample for radioactive contamination, mercury, and other materials of concern before construction.

Table 3.2.2.1-1. UPF Construction Requirements and Estimated Waste Volumes.

Requirements	Consumption
Materials/Resource	
Peak Electrical energy (MWe/month)*	2.2
Concrete (yd^3)	200,000
Steel (tons)	27,500
Liquid fuel and lube oil (gal)*	250,000
Water (gal)	4,000,000
Aggregate (yd^3)	5,000
Land (acre)/Facility Footprint	35/8
Employment	
Total employment (worker years)*	2,900
Peak employment (workers)	950
Construction period (years)	6
Waste Category	**Amount Generated**
Low-level	
Liquid (gal)	0
Solid (yd^3)	70
Mixed Low-level	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous (tons)	4
Nonhazardous (Sanitary) (tons)	800

* See Section 5.6.1.8 for a discussion of greenhouse gas emissions associated with construction.
Source: B&W 2006a and NNSA 2008.

The structure's foundation would be concrete piers that are drilled down into the bedrock of the site. To reduce the overall footprint of the structure, a precast-concrete crib retaining wall would be constructed on the north and west sides of the proposed UPF. The UPF would be constructed with the same rigorous natural phenomena (NP) resistance design as the HEUMF, which is defined as Performance Category[3] (PC) 3.

Security Considerations. Upon completion of construction, both the UPF and the HEUMF (which recently completed construction) would be surrounded by a PIDAS security barrier. The PIDAS would be a multiple-sensor system within a 30-foot wide zone enclosed by two fences that surround the entire Security Protection Area. The encompassing PIDAS would be built and activated when more than 95 percent of facility construction is completed. The new system would tie into the existing system encompassing the HEUMF facility at its northwest corner. The UPF would incorporate ARGUS technology for security protection.

Cooling Tower. A chilled water loop would be installed to support the new UPF HVAC requirements. This also would require that a new cooling tower be completed and brought on-line. Piping would be laid in accordance with all necessary safety and security precautions. A chilled water booster pump and piping would be required in conjunction with the new chiller cell. Return chilled water would be used as condenser water.

Remediate Construction Laydown Area. Once the construction of the UPF is complete, the construction office trailers would be removed and material lay-down areas would be re-graded and seeded after removal of any soil that may have become contaminated with construction-related materials such as diesel fuel. Alternatively, it may be feasible to rework the laydown area to provide for additional parking.

Table 3.2.2.1-1 lists the construction material requirements for the UPF along with the associated waste values. It should also be noted that because the UPF design is not fully developed, minor support facilities and roads may be required to support construction. The construction data shown in Table 3.2.2.1-1 has been conservatively estimated to account for these minor changes that may occur as the UPF design is finalized.

As explained in Section 3.3, NNSA is not proposing to upgrade or otherwise change the non-EU manufacturing processing/production operations under the UPF Alternative. At some time in the future, NNSA may propose a Consolidated Manufacturing Complex (CMC) for the consolidation of these non-EU manufacturing processing/production operations.

3.2.2.1.2 UPF Operations

The core operations of the new consolidated UPF would be assembly, disassembly, Quality Evaluation, specialized chemical and metallurgical operations of EU processing, and product certification/inspection. The full range of operations would include:

[3] Performance Categories classify the performance goals of a facility in terms of facility's structural ability to withstand natural phenomena hazards (i.e., earthquakes, winds, and floods). In general, facilities that are classified as: PC 0 do not consider safety, mission, or cost considerations; PC 1 must maintain occupant safety; PC 2 must maintain occupant safety and continued operations with minimum interruption; PC 3 must maintain occupant safety, continued operations, and hazard materials confinement; and PC 4 must meet occupant safety, continued operations, and confidence of hazard confinement**.**

- Assembly of canned subassemblies from refurbished and new components;
- Disassembly or dismantlement of returned weapons canned subassemblies resulting in recycle, refurbishment, surplus generation, and disposal of components;
- Product certification through dimensional inspection, physical testing, and radiography;
- Quality evaluation (specially designed tests and inspections to collect data and determine the condition of units and components to assess the future reliability of the weapons systems in the stockpile);
- Metallurgical operations, including EU metal casting, rolling, forming, and machining;
- Chemical processing, including conversion to uranium compounds and metal from salvage scrap and oxides. Chemical processing streams would be provided to process high enrichment, mixed enrichment, and special EU materials.

Utility and Safety Support Systems. The material processing areas within the UPF would incorporate the appropriate use of gloveboxes, inert atmosphere, negative air pressure, and other engineered controls, supported by administrative controls, to protect workers and the public from exposure to radiological and hazardous materials. Exhaust emissions for the facility would comply with the applicable Federal and state requirements. In conjunction with other engineered containment measures, the ventilation system barriers would provide a layered system of protection.

Other systems that would be included in the new UPF for facility operation and ES&H protection include:

- Criticality Accident Alarm System
- Emergency Notification System
- Alarm System
- Fire Suppression Alarm Systems
- Telephone and public address system
- Classified and unclassified computer network
- Personnel Monitoring System
- Security-related sensors
- Automated inventory system with continuous real-time monitoring

The UPF would use a three-level negative air pressure approach to maintaining containment of particulate- and vapor-contaminated air, with the area having the lowest air pressure (i.e., highest negative air pressure) being primary containment. Secondary containment would be maintained at a lesser negative pressure, while the office and administrative areas would be maintained at a positive pressure. The primary containment ventilation system would consist of fans and collection ducts, scrubbers, mist eliminators, instrumentation, and high efficiency particulate air (HEPA) filter banks. A secondary containment ventilation system would provide containment, negative pressure confinement, monitoring, and treatment for exhaust air from secondary containment areas frequented or occupied by operating personnel as well as other areas subject to contamination.

HEPA filters would be used in all process exhaust air streams to limit releases of EU. HEPA filters installed for this purpose would be performance qualified to limit offsite exposures to the public and releases to the environment. Current plans have moved from a single exhaust stack being used as a central air emission point from the facility, to a total of five stacks (two stacks each for two mechanical/electrical areas and one process off-gas stack) that serve the primary and secondary exhaust air systems. All UPF process and exhaust air streams would be discharged from this stack, which would be located and designed to optimize the effects of plume dilution from the prevailing winds as well as to minimize the possibility of cross-contamination through the UPF and other Y-12 facility ventilation air intakes. The UPF discharge stack would be equipped with continuous emissions monitors for radiological emissions to meet Y-12 requirements for complying with environmental laws and reporting required data to the State of Tennessee as evidence of meeting those requirements.

Potable water, process water, and safety shower water would be supplied through the utility access corridors. The potable water would be used for sanitary purposes. Process water would be provided by a dedicated system. Safety shower water also would be provided by a dedicated system.

A dedicated breathing air system would be installed within the UPF and would consist of dedicated compressors, receivers, filters, dryers, monitoring instrumentation and alarms, distribution piping, and breathing air stations at points of use throughout the facility.

Liquid effluent monitors would be installed in all discharge lines from processes handling uranium metal or uranium compounds. Systems would be designed to detect and record concentrations in parts per million of uranium in solution. Discharge streams exceeding established limits for concentrations of uranium would be automatically diverted to geometrically safe holdup tanks.

The UPF would be designed, constructed, and operated to prevent the occurrence of a fire and ensure that sufficient means are provided to detect and suppress fires. The facility would be fully sprinklered. All systems, equipment, and processes would be designed in accordance with appropriate fire protection codes, building codes, and other available safety documentation. In addition to the water suppression capabilities, fire extinguishers would be installed throughout the facility. The UPF would be built of noncombustible materials so that the building structure would not contribute to the fire loading. The process building would be separated from all other significant facilities. Roadways serving the UPF would provide access, from either direction, to any point on the exterior of the building and would be configured to allow emergency vehicles to maintain a standoff distance of 50 feet. Fire hydrants would be located 50 feet from the building with the pumper connection pointing to an accessible paved area. Extension of the current fire alarm system would support UPF fire alarm needs. All water flow, smoke, and heat detection would be alarmed. Use of flammable liquids and gases would be minimized to the extent practical. Bulk storage of flammable gases would be located outside the building, and appropriate excess flow valves would be installed in gas supply systems to stop flow in the event of a line break.

A new 161 kV/13.8 kV substation north of the UPF would provide electrical power to the UPF. Underground electric utility construction would be utilized. Auxiliary electrical power would be provided for safety and operational support utilizing hydrocarbon burning engine/generator sets.

Table 3.2.2.1-2 lists the operations requirement, number of operations workers, and the expected waste generation for the proposed UPF.

Table 3.2.2.1-2. UPF Annual Operation Requirements and Estimated Waste Volumes.

Requirements	Consumption
Materials/Resource	
Annual Electrical energy (MWh/year)	168,000
Peak electrical demand (MWe)*	18.4
Natural gas (yd^3)*	894,000
Water (gal)	105,000,000
Plant footprint (acres)	8
Employment	
Workers*	600
Hands-On Radiation Workers	315
Waste Category	
Low-level	
Liquid (gal)	476
Solid (yd^3)	5,943
Mixed Low-level	
Liquid (gal)	679
Solid (yd^3)	81
Hazardous (tons)	12
Nonhazardous (Sanitary) (tons)	9,337

* See Section 5.6.1.8 for a discussion of greenhouse gas emissions associated with operations.
Source: B&W 2006a, NNSA 2008, Jackson 2008.

3.2.2.2 *Complex Command Center*

An additional action proposed in this alternative is the Complex Command Center (CCC), which would house equipment and personnel for the plant shift superintendent (PSS), Fire Department, and Emergency Operations Center (EOC). Approximately 50,000 square feet of enclosed facility space would be required to accommodate operational needs. The facility would include office space for 60 Fire Department personnel, 120 EOC personnel, and up to 12 PSS Personnel; 15,000 square feet of pull through garage space; redundant emergency power supply connections and/or supplemental dedicated emergency generators; records storage and processing areas; modern training and conference facilities; shower and changing facilities; specialized equipment storage; food service areas; janitorial closets; separate mechanical and electrical equipment rooms; and telecommunication rooms. The facility would have a dedicated loading dock with automated dock leveler and electric motor actuated overhead rollup door access to the building, to safely support delivery of supplies, equipment, and material. The facility would be located on the east end of Y-12 as shown on Figure 3.2.2-2.

The CCC would be a one-story structure located in a previously developed area. Construction of the CCC would employ approximately 50 construction workers. The project would require excavation within the Y-12 industrial area for utility/communication lines. Excavation locations would be selected such that known CERCLA remediation areas of concern are avoided.

Approximately 7 acres of land would be disturbed for the CCC. Once operational, the facility would not increase water use or generate additional wastes at Y-12, as this facility would replace existing facilities that perform these functions.

This is part of the NNSA modernization initiative at Y-12 that would result in upgrading existing facilities and constructing new facilities. DOE/NNSA would use its authority under Section 161(g) of the *Atomic Energy Act* to transfer Federal property to a private development corporation. This private corporation would develop and construct the facility on the transferred property in support of the NNSA mission under the *Atomic Energy Act*. After construction, the facility would be leased by NNSA's management and operating (M&O) contractor to support the NNSA mission and operated in accordance with the management and operation contract at Y-12.

3.2.3 Alternative 3 – Upgrade in-Place Alternative

Under this alternative, NNSA would continue the No Action Alternative and upgrade the existing EU and nonnuclear processing facilities to contemporary environmental, safety, and security standards to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations. Under this alternative there would be no UPF and the current high- security area would not be reduced. This alternative would, however, include construction of a new CCC (as discussed in Section 3.2.2.2).

The upgrade projects proposed would be internal modifications to the existing facilities and would improve worker health and safety, enable the conversion of legacy SNM to long term storage forms, and extend the life of existing facilities. For continued operations in the existing facilities, major investments would be required for roof replacements; structural upgrades; heating, ventilating, and air conditioning (HVAC) replacements; and fire protection system replacement/upgrades. The projects would improve airflow controls between clean, buffer, and contamination zones; upgrade internal electrical distribution systems; and upgrade a number of building structures to comply with current natural phenomena criteria (B&W 2004a).

Upgrades would be performed over a 10-year construction period, following issuance of the ROD for this SWEIS. This would enable NNSA to spread out the capital costs associated with the upgrades, and minimize disruption of operations.

Conventional construction techniques would be used for upgrade projects. Under this alternative, a preliminary schedule for the project indicates that site preparation would begin in 2010, with upgrades complete in approximately 2020. Upgrade activities would be performed in a manner that assures protection of the environment during the construction phase. Techniques would be used to minimize the generation of debris that would require disposal. Disposal of debris would be made in accordance with waste management requirements in properly permitted disposal facilities. Throughout the upgrade construction process, stormwater management techniques, such as silt fences and runoff diversion ditches, would be used to prevent erosion and potential water pollutants from being washed from the construction site during rainfall events.

Natural Phenomena: Structural. The current authorization basis for many of the EU buildings has been designated as PC 2, which means these buildings must maintain occupant safety and continued operations with minimum interruption. An assessment of the structural adequacy of the buildings indicates they do not meet current codes and standards related to natural phenomena (NP) events (e.g., tornados and earthquakes) required for a PC 2 designation. If the buildings are intended to operate an additional 50 years, they would require structural upgrades to bring the buildings into compliance (B&W 2004a).

Fire Protection. The existing fire protection systems for many of the EU buildings are primarily piping systems operating under the Code of Record in effect at the time of installation. These codes have changed significantly over the years, and if the life of a facility is intended to be extended any significant length of time, the systems may need to be upgraded to meet current codes and standards if exemptions for continued operations are denied. Upgrades would likely require total replacement of the current systems. Replacements would be required for sprinkler systems, riser replacements, and underground supply line upgrades (B&W 2004a).

Utilities Replacement/Upgrades: Mechanical Systems. HVAC systems have an expected life in the range of 25 to 30 years. Many of the systems serving the EU building are beyond or are approaching the end of their useful life and are in need of replacement. The majority of the HEPA filters are located in antiquated systems. These systems also do not include test sections that allow the systems to be tested without removal of the prefilters. This arrangement subjects the filter change crews to added exposures compared to currently available filters with test sections. The continued long term operations of existing facilities would require these filter systems to be replaced (B&W 2004a).

Roofing. A majority of the existing roofs for the EU buildings would need to be replaced (B&W 2004a).

Table 3.2.3-1 lists the construction requirements associated with the upgrades and Table 3.2.3-2 lists operation requirements, number of operation workers, and the expected waste generation for the upgraded facilities.

Table 3.2.3-1. Construction Requirements and Estimated Waste Volumes for Upgrading Existing Uranium Processing Facilities.

Requirements	Consumption
Materials/Resource	
Electrical energy use (MWh)*	350,000
Concrete (yd^{3})	No change from current
Steel (tons)	No change from current
Liquid fuel and lube oil (gal)*	No change from current
Water (gal/day)	4.2 million
Aggregate (yd^3)	No change from current
Land (acre)/Laydown Area	2 acres/<7 acres
Employment	
Total employment (worker years)	1,000
Peak employment (workers)	300
Construction period (years)	10
Waste Category	
Low-level	
Liquid (gal)	0
Solid (yd^3)	0
Mixed Low-level	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (tons)	0
Nonhazardous (Sanitary) (tons)	400

Note: "No change from current" represents estimated 2006 usage.
* See Section 5.6.1.8 for a discussion of greenhouse gas emissions associated with construction.
Source: B&W 2006a, NNSA 2008, Jackson 2008.

Table 3.2.3-2. Operation Requirements and Estimated Waste Volumes for Upgraded Uranium Processing Facilities.

Requirements	Consumption
Materials/Resource	
Electrical energy (MWh)	350,000
Liquid fuel (gal)	No change from current
Natural gas (yd^3)	No change from current
Water (gal/day)	4.2 million
Plant footprint (square feet)	5.3 million
Employment (workers)	6,500 (includes all contractors)
Waste Category	
Low-level	
Liquid (gal)	713
Solid (yd^3)	9,405
Mixed Low-level	
Liquid (gal)	1,096
Solid (yd^3)	126
Hazardous (tons)	12
Nonhazardous (Sanitary) (tons)	10,374

Note: "No change from current" represents estimated 2006 usage.
* See Section 5.6.1.8 for a discussion of greenhouse gas emissions associated with operations.
Source: B&W 2006a, NNSA 2008, Jackson 2008.

3.2.4 Alternative 4 – Capability-sized UPF Alternative

Under Alternative 4, NNSA would maintain a basic manufacturing capability to conduct surveillance, produce and dismantle secondaries and cases, as well as laboratory and experimental capabilities to support the stockpile. NNSA would reduce the baseline throughput of facilities to a throughput of approximately 50 to 80 secondaries and cases per year (compared to 125 secondaries and cases per year for the UPF Alternative). To support this alternative, Y-12 would build a smaller UPF (approximately 350,000 square feet) compared to the UPF described under Alternative 2 (388,000 square feet) Although the UPF for Alternative 4 would be approximately 10 percent smaller than the UPF described for Alternative 2, the construction requirements shown in Table 3.2.2.1-1 are representative of the construction requirements for this alternative. In addition, this alternative would include construction of a new CCC (as discussed in Section 3.2.2.2). As discussed in Section 3.6, Alternative 4 is the preferred alternative.

The reduction in workload would reduce the number of employees, waste generation amounts, infrastructure needs, and the total worker dose. Estimates of these levels appear in Table 3.2.4-1. Safeguard and security expenditures would remain at current levels, and other operations conducted at Y-12, such as the storage of HEU and dismantlement of secondaries and cases, would be expected to remain at current levels, consistent with the expected levels described in the No Action Alternative in Section 3.3.

Table 3.2.4-1. Annual Operation Requirements and Estimated Waste Volumes for the Capability-sized UPF Alternative Compared to the No Action Alternative.

Requirements	No Action Alternative	Capability-sized UPF Alternative[a]
Electrical Energy Use (MWe)*	360-480	220-290
Water Use (million gallons/year)	2,000	1,200
Y-12 Site Employment (workers)	6,500	3,900
Steam Plant Generation (billion pounds)*	1.5	0.9
Normal Radiological/Uranium Air Emissions (Curie)	0.01	0.006
Total No. of Y-12 Monitored Workers*	2,400	1,825
Average Individual Worker Dose (mrem)	20.6	10.3
Collective Worker Dose (person-rem)	49.4	18.8
Waste Category		
Low-level Waste		
Liquid (gal)	713	428
Solid (yd^3)	9,405	5,643
Mixed Low-level Waste		
Liquid (gal)	1,096	640
Solid (yd^3)	126	76
Hazardous (tons)	12	7.2
Nonhazardous Sanitary (tons)	10,374	6,224

Source: NNSA 2008, B&W 2009a, Jackson 2008.
a – For a 50 percent reduction in production, this alternative estimated a 40 percent reduction in infrastructure requirements, personnel requirements, emissions, and waste generation. Average worker dose would remain approximately the same, but a reduced workforce would reduce total worker dose
* See Section 5.6.1.8 for a discussion of greenhouse gas emissions associated with operations.

3.2.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Similar to Alternative 4, under a No Net Production/Capability-sized UPF Alternative, NNSA would maintain the capability to conduct surveillance and produce and dismantle secondaries and cases. NNSA would reduce the baseline throughput of facilities to a throughput of approximately 10 secondaries and cases per year (compared to 125 secondaries and cases per year for the UPF Alternative), which would support surveillance operations and a limited Life Extension Program (LEP) workload; however, this alternative, would not support adding new types or increased numbers of secondaries and cases to the stockpile. This alternative would involve an even further reduction of production throughput at Y-12 compared to Alternative 4. To support this alternative, Y-12 would build a smaller UPF (approximately 350,000 square feet) compared to the UPF described under Alternative 2 (388,000 square feet). Although the UPF for Alternative 5 would be approximately 10 percent smaller than the UPF described for Alternative 2, the construction requirements shown in Table 3.2.2.1-1 are representative of the construction requirements for this alternative. Section 1.4.6 provides a summary of the major differences among the UPF throughputs assessed. In addition, this alternative would include construction of a new CCC (as discussed in Section 3.2.2.2). Table 3.2.5-1 presents the operational information for the Y-12 No Net Production/Capability-sized UPF Alternative.

Table 3.2.5-1. Annual Operational Requirements for the No Net Production/ Capability-sized UPF Alternative Compared to the No Action Alternative.

Requirements	No Action Alternative	No Net Production/ Capability-sized UPF Alternative
Electrical Energy Use (MWe)*	360-480	200-260
Water Use (million gallons/year)	2,000	1,080
Y-12 Site Employment (workers)	6,500	3,400
Steam Plant Generation (billion pounds)*	1.5	0.8
Normal Radiological/Uranium Air Emissions (Curie)	0.01	0.005
Total No. of Y-12 Monitored Workers*	2,400	1,600
Average Individual Worker Dose (mrem)	20.6	10.3
Collective Worker Dose (person-rem)	49.4	16.5
Waste Category		
Low-level Waste		
Liquid (gal)	713	403
Solid (yd^3)	9,405	5,314
Mixed Low-level Waste		
Liquid (gal)	1,096	619
Solid (yd^3)	126	71
Hazardous (tons)	12	7.2
Nonhazardous Sanitary (tons)	10,374	5,705

* See Section 5.6.1.8 for a discussion of greenhouse gas emissions associated with operations
Source: NNSA 2008, B&W 2009a, Jackson 2008.

For either Alternative 4 or Alternative 5, although many of the current facilities at Y-12 would be operated at a reduced throughput, NNSA would need to maintain them in a “ready-to-use” state in the event changes were directed by the President. This means unused capacity would be exercised periodically and standard preventative maintenance and minimal corrective maintenance would be performed on all equipment that could be required for future needs. The related effects on other plant operations of this alternative would include a reduction in utility usage and waste generation and a reduction in staffing.

3.3 POTENTIAL FUTURE Y-12 MODERNIZATION PROJECTS

While the action alternatives in this SWEIS have progressed to the conceptual design level, other facilities considered for Y-12 modernization are still in the early planning phase, do not have conceptual design data to analyze at this time, and are not ripe for decision making. This section addresses several potential future facilities that may be considered as part of the integrated modernization efforts. These potential facilities may change as modernization plans are developed. These potential new facilities are summarized in Table 3.3-1. None of the potential future modernization projects listed in Table 3.3-1 are included in the No Action Alternative or the action alternatives for this Y-12 SWEIS. If ever proposed, these projects would be covered by future NEPA reviews.

Table 3.3-1. Summary of Potential Future Modernization Projects.

New Modernization Facilities	Scope
Consolidated Manufacturing Complex (CMC)	Approximately 350,000 square foot facility which would cost approximately $400-600 million and be constructed after 2018. The CMC would contain the metallurgical operations and support functions required for the production of depleted uranium components. Specialized metallurgical operations would include casting, rolling, and forming of cast and wrought depleted uranium and wrought uranium-niobium alloys. The CMC would also contain the chemical processes, fabrication operations, and support functions associated with the production of LiH and LiD components. Specialized operations include LiCl powder production, Li metal production, salt production, forming, machining, inspection, and chemical recovery of lithium compounds from retired and rejected components. Ancillary facilities include deuterium production and tank farms for holding process chemicals. The CMC would also house general manufacturing capabilities.
Materials Handling and Maintenance Facility	Approximately 50,000 square feet of facilities which would cost approximately $15-25 million and be constructed after 2018. Would be used for the storage of non-SNM materials, as well as maintenance activities.
Laboratory/ Technology Development Upgrade	This project would replace the current Plant Laboratory and relocate Technology Development with a new facility or reuse the Assembly Building.

Note: Li - lithium, LiCl - lithium chloride; LiD - lithium deuteride; LiH - lithium hydride.
Source: Brumley 2005.

3.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED CONSIDERATION

For this SWEIS, the following alternatives were considered but eliminated from detailed study for the reasons stated.

Stop Weapons Activities/Transfer Y-12 Missions to Another Site/Clean-Up Y-12/Fund Social Programs. During the public scoping period for the SWEIS, many members of the public stated that NNSA should analyze shutting down all weapons activities at Y-12, transferring Y-12 missions to another site, clean-up the site, and/or use the money saved for social programs. DOE/NNSA has considered these suggestions in previous programmatic NEPA documents, specifically the Complex Transformation SPEIS (NNSA 2008), *Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (SSM PEIS) (DOE 1996a), and the *Storage and Disposition of Weapons-Usable Fissile Material PEIS* (DOE 1996b). NNSA recognizes that Y-12 has unique capabilities and diverse roles supporting a variety of national programs, and that there is an essential near-term need to manage and maintain the safety and stability of the existing nuclear materials inventory. In December 2008, NNSA affirmed the decision to maintain the uranium missions at Y-12. Until relieved of its mission to support the enduring nuclear weapons stockpile by the President and Congress, NNSA must maintain its national security operations at Y-12. Accordingly, to propose shutting down or transferring the Y-12 nuclear weapons activities within the timeframe of the SWEIS (i.e., next 10 years) would be an unreasonable alternative.

Alternate Site Locations for the UPF. As described in Section 3.2.2, and shown on Figure 3.2.2-2, the proposed UPF would be located adjacent to the HEUMF, at a site just west of the HEUMF. In the 2001 Y-12 SWEIS, DOE evaluated alternative locations for the HEUMF, and in the ROD DOE decided to construct the HEUMF at the Y-12 West Portal Parking Lot Site (67 FR 11296, March 13, 2002). Construction of the HEUMF was initiated in 2005 and completed in 2008. The facility is scheduled to start full-scale operations in 2010. Locating a UPF adjacent to the HEUMF is consistent with the analysis performed in support of the 2001 Y-12 SWEIS, the Complex Transformation SPEIS, RODs based on these documents, and the Y-12 Modernization Plan. Siting a UPF at a location other than adjacent to the HEUMF would not allow for the operational efficiencies and reduced security footprint.

Alternative site locations were explored as part of the planning for the UPF. The main reasons why the UPF, if built, would be collocated with the HEUMF are as follows: (1) collocation maximizes the efficiency and minimizes the costs of feed and product material flows between the two facilities; (2) collocation improves the security posture by reducing the size of the Protected Area to 10 percent of the existing footprint and reduces the operational cost of the security force required to meet the latest graded security posture; and (3) collocation minimizes the number of employees who must enter the Protected Area, thus improving the productivity of workers assigned to non-SNM activities that are currently located in the Protected Area. As a result of these significant advantages, alternatives that would not result in the collocation of the proposed UPF and the HEUMF are not considered reasonable site alternatives for the UPF.

Consolidate ORNL Special Nuclear Material to Y-12. During the public scoping period for the SWEIS, a suggestion was made that DOE should consolidate all SNM from ORNL to Y-12. SNM from ORNL is not used at Y-12 and NNSA does not have programmatic responsibility for the SNM at ORNL. The scope of the Y-12 SWEIS is limited to alternatives related to operations at Y-12, for which NNSA has programmatic responsibility. There is no need to develop a proposal or assess an alternative to consolidate SNM from ORNL to Y-12. This issue is beyond the scope of this SWEIS.

Comprehensive Land Use Planning for ORR. During the public scoping period for the SWEIS, suggestions were made that DOE should develop a comprehensive land use plan for ORR, and that the SWEIS should include an analysis of land use for ORR, including alternatives that would transfer lands to the private sector. The scope of the Y-12 SWEIS is limited to alternatives related to operations at Y-12, for which NNSA has programmatic responsibility. The NNSA does not have programmatic responsibility for other areas of ORR and has no need to develop a proposal or assess any alternatives related to ORR land use planning or land transfers. These issues are beyond the scope of this SWEIS. With respect to lands associated with Y-12 specifically, as discussed in this SWEIS, the land requirements at Y-12 will generally remain unchanged. While some changes to land use will occur as a result of modernization projects, Y-12 will continue to require security and emergency response buffers that preclude release of any real estate for public use. Chapter 6 of this SWEIS addresses land use cumulative impacts.

Other Miscellaneous Out of Scope Suggestions. During the public scoping period for the SWEIS, various suggestions were made regarding alternatives and analyses that NNSA has determined were beyond the scope of the Y-12 SWEIS. Some of the suggested alternatives included replacing Y-12 with an auto plant, storing equipment for the Tennessee Valley Authority at Y-12, and replacing weapons with the Reliable Replacement Warhead. NNSA determined that these suggested alternatives would not meet the purpose and need for action and were beyond the scope of the Y-12 SWEIS. Some of the suggested analyses included a socioeconomic analysis of the cost to the community of hosting a weapons' manufacturing facility and an assessment of intentional destructive acts. Although a socioeconomic analysis of the cost to the community of hosting a weapons' manufacturing facility is beyond the scope of the SWEIS, NNSA has prepared a classified appendix to this SWEIS which analyzes intentional destructive acts (see Appendix E, Section E.2.1.4).

3.5 COMPARISON OF POTENTIAL ENVIRONMENTAL IMPACTS

This comparison of potential environmental impacts is based on the information in Chapter 4, Affected Environment, and analyses in Chapter 5, Environmental Consequences. Its purpose is to present the impacts of the alternatives in comparative form. Table 3.5-1 (located at the end of this chapter) presents the comparison summary of the environmental impacts for construction and operation associated with the No Action Alternative and the action alternatives evaluated in this SWEIS. The following sections summarize the potential impacts by resource area.

3.5.1 Land Use

Construction. With the exception of land disturbance associated with projects that have been addressed in previous NEPA documents (e.g., *Alternate Financed Facility EA*, *Potable Water Supply Upgrade EA*), no new facilities or major upgrades to existing facilities would occur under the No Action Alternative and no new land disturbance would result. Construction of the UPF and CCC under the UPF Alternative would affect approximately 42 acres of previously disturbed land (35 acres for the UPF and 7 acres for the CCC). The Upgrade in-Place Alternative would consist of internal modifications to existing facilities and 7 acres for the CCC. Under both the Capability-sized UPF and No Net Production/Capability-sized UPF alternatives, construction of the UPF and CCC would affect about 39 acres of previously disturbed land (32 acres for the UPF and 7 acres for the CCC). Overall, there would be no appreciable land use impacts or changes beyond those described for the No Action Alternative. Impacts on land use adjacent to Y-12 are not expected.

Operation. While specific land usage within Y-12 may change, the overall industrial use classification would likely remain the same for all alternatives. Under the UPF, Capability-sized UPF, and No Net Production/Capability-sized UPF alternatives, about 8 acres of previously disturbed land would be used for the UPF and 7 acres for the CCC. For the Upgrade in-Place Alternative, 7 acres would be used for the CCC. Because Y-12 would continue to require security and emergency response buffers, real estate associated with eliminating excess facilities would likely not be released for public use and there would be no local land use benefits. All of the alternatives would be consistent with current land use plans, classifications, and policies. Impacts on land use adjacent to Y-12 are not expected.

3.5.2 Visual Resources

Construction. Under all alternatives, although there would be some reduction in the density of industrial facilities, Y-12 would still remain a highly developed area with an industrial appearance, and there would be no change to the Visual Resource Management (VRM) Class IV, which is used to describe a highly developed area. Construction of the UPF (alternatives 2, 4, and 5) and CCC (alternatives 2, 3, 4, and 5) would use cranes that would create short-term visual impacts, but would not be out of character for an industrial site such as Y-12. The construction lay-down area, temporary parking, and temporary construction office trailers would also be typical for an industrial site. The Upgrade in-Place Alternative would consist mainly of internal modifications to existing facilities and construction of the CCC and would create short-term visual impacts, but would not be out of character for an industrial site such as Y-12.

Operation. Under all alternatives, Y-12 would remain a highly developed area with an industrial appearance, and no change to the VRM classification would be expected. All of the alternatives that include a UPF would allow the Protected Area at Y-12 to be reduced from approximately 150 acres to as little as 15 acres and would result in some reduction in industrial density.

3.5.3 Site Infrastructure

Construction. Construction activities under the No Action Alternative would cause minimal changes to the energy use and other infrastructure requirements (i.e., steam, industrial gases, etc) at the site. As Y-12 continues to downsize and become more efficient, trends indicate that energy usage and most other infrastructure requirements are decreasing by approximately 2 to 5 percent per year. This is expected to continue. During construction, the UPF Alternative or the minimum UPF would require a peak of approximately 2.2 MW per month of electric power, which is less than five percent of the current electrical energy usage at Y-12, and less than one percent of available capacity. Water requirements would be less than 1 percent of current site usage. Construction of either the Capability-sized UPF Alternative or No Net Production/Capability-sized UPF Alternative would require about 90 percent of the electrical power as construction of the full UPF. The peak electrical energy requirement is estimated to be 1.9 MW per month and water usage 3.6 million gallons. These would be less than 1 percent of current site usage. Construction activities associated with the Upgrade in-Place Alternative would have negligible energy and infrastructure requirements.

Operation. Under the No Action Alternative, Y-12 energy usage and other infrastructure requirements (i.e., steam, industrial gases, etc) should continue to decrease by approximately 2 to 5 percent per year as Y-12 continues to downsize and become more efficient. During operation, the UPF would require approximately 14,000 MWh per month of electric power, which is less than 5 percent of available capacity. Compared to the No Action Alternative, the UPF would decrease water demands by more efficient water usage. Steam usage would be reduced by 10 percent as inefficient facilities are closed. Operation of the CCC under any of the action alternatives would not increase water use. Operations associated with the Upgrade in-Place Alternative would not significantly change infrastructure demands beyond the demands of the No Action Alternative, although efficiency improvements associated with the upgrades should lead to some minor decreases in demand, albeit not on the same order as those that could be achieved with new construction. Under the Capability-sized UPF Alternative, electricity and water usage would be about 60 percent of present usage due to the reduced operations (relative to current) and smaller physical size of the facility. Implementation of the No Net Production/Capability-sized UPF Alternative would result in electricity and water usage being about 55 percent of present usage due to the reduced operations (relative to current) and smaller physical size of the facility. The reductions associated with the smaller-sized UPF would be in addition to the decreasing energy use and infrastructure demands at Y-12 under the No Action Alternative. The existing EU operations account for less than five percent of the energy and infrastructure usage at Y-12.

3.5.4 Traffic and Transportation

Construction. Construction activities under the No Action Alternative would not cause any significant change to the current workforce of approximately 6,500 workers. The Level-of-Service (LOS) on area roads would not change under the No Action Alternative. Under the UPF Alternative, construction-related traffic would add a maximum of 950 worker vehicles per day to support construction of the UPF and CCC during the peak year of construction. This increase would be similar to the increase that was experienced during construction of the HEUMF, which did not change the LOS on area roads. The Upgrade in-Place Alternative would add a maximum of 300 worker vehicles per day and would not change the LOS on area roads. Construction of either the Capability-sized UPF Alternative or the No Net Production/Capability-sized UPF Alternative would add a maximum of 850 worker vehicles per day to support construction during the peak year of construction. This increase would be less than the increase that resulted from the HEUMF construction, which did not change the LOS on area roads. There would be no radiological transportation impacts related to construction for any of the alternatives.

Operation. Under the No Action Alternative and the Upgrade in-Place Alternative, the Y-12 workforce is expected to remain relatively stable at approximately 6,500 workers. Consequently, the LOS on area roads would not change under the No Action Alternative. Operation of the UPF would result in a small decrease in workforce (approximately 11 percent) due to more efficient operations, and would not affect the LOS on area roads. Operation of the CCC, which is part of all of the action alternatives, would not add any new workers to the site and would not affect traffic or transportation. The Capability-sized UPF Alternative and the No Net Production/Capability-sized UPF Alternative would reduce traffic at Y-12 by approximately 40 to 48 percent based on potential reductions in the workforce. This reduction would have a minimally beneficial impact on traffic and transportation. During operations under all alternatives, transportation of radiological materials (EU, TRU waste and LLW) would occur, resulting in radiological impacts on transportation workers and the public. For all alternatives, the radiological impacts and potential risks of transportation would be small, e.g., less than one latent cancer fatality per year. Radiological materials and waste transportation impacts would include routine and accidental doses of radioactivity. The one-time relocation of HEU to a new UPF would result in less than one fatality. The Capability-sized UPF Alternative and the No Net Production/Capability-sized UPF Alternative would reduce radiological impacts associated with transportation of materials by about 25 percent and 95 percent, respectively.

3.5.5 Geology and Soils

Construction. With the exception of land disturbance associated with projects that have been addressed in previous NEPA documents, no new facilities or major upgrades to existing facilities would occur under the No Action Alternative. No new land disturbance or impact to geology and soils would result. Potential land disturbance associated with the construction of the UPF and CCC would be approximately 42 acres of previously disturbed land. The Capability-sized UPF Alternative and the No Net Production/Capability-sized UPF Alternative would result in disturbance of about 39 acres of previously disturbed land. Construction of the new facilities would result in a potential increase in soil erosion from the lay-down area and new parking lot. Appropriate mitigation, including detention basins, runoff control ditches, silt fences, and protection of stockpiled soils would minimize soil erosion and impacts. No impacts on undisturbed geological resources are expected. The Upgrade in-Place Alternative would consist of internal modifications to existing facilities and would only affect previously disturbed geological resources or soils for construction of the CCC.

Operation. Under all alternatives, minor soil erosion impacts are expected, but detention basins, runoff control ditches, and cell design components would minimize impacts. Neither a UPF, under alternatives 2, 4 and 5, nor the CCC, under any of the action alternatives would impact geology or soils during operation because of site design and engineered control measures.

3.5.6 Air Quality and Noise

3.5.6.1 *Air Quality*

Construction. Under the No Action Alternative, there would be no significant new construction and no changes in air quality or noise are expected. All criteria pollutant concentrations are expected to remain below the national and Tennessee Department of Environment and Conservation (TDEC) standards, with the exception of the 8-hour ozone levels and fine particulate matter ($PM_{2.5}$), which exceed standards throughout the region. Construction of a UPF and CCC would result in temporary increases in air quality impacts from construction equipment, trucks, and employee vehicles. Exhaust emissions from these sources would result in releases of sulfur dioxide, nitrogen oxide, particulate matter, total suspended particulates, diesel particulate emissions, and carbon monoxide. Additionally, construction of a UPF and CCC would result in small fugitive dust impacts in the construction area. Effective control measures commonly used to reduce fugitive dust emissions include wet suppression, wind speed reduction using barriers, reduced vehicle speed, and chemical stabilization. The temporary increases in pollutant emissions due to construction activities are too small to result in exceeding the National Ambient Air Quality Standards (NAAQS) or TDEC standards beyond the Y-12 boundary. Therefore, air quality impacts resulting from construction under the UPF, Capability-sized UPF, and No Net Production/Capability-sized UPF alternatives would be small. The Upgrade in-Place Alternative, which would involve internal upgrades to existing facilities and construction of the CCC, would have minimal impact on air quality at Y-12. Temporary increases in impact on air quality from construction equipment, trucks, and employee vehicles would be much less than the UPF, Capability-sized UPF, or No Net Production/Capability-sized UPF alternatives, presented above, due to the significantly smaller workforce required for the Upgrades. There would be no radiological air impacts associated with construction under any of the action alternatives.

Operation. Under the No Action Alternative, emissions associated with the new steam plant are expected to be significantly lower for total particulate matter, sulfur dioxide, and nitrogen oxides. All criteria pollutant concentrations are expected to remain below the national and TDEC standards, with the exception of the 8-hour ozone levels and $PM_{2.5}$, which exceed standards throughout the region. For the UPF, Capability-sized UPF, and No Net Production/Capability-sized UPF alternatives, no significant new quantities of criteria or toxic pollutants would be generated from the new facilities (UPF and CCC). The heating requirements for any of the UPF alternatives would reduce the level of emissions compared to the No Action or Upgrade in-Place Alternatives. Any releases of nitrogen and argon, that are used to maintain inert atmospheres for glovebox operations, would be less than current releases from existing operations. No new hazardous air emissions would result under any of the UPF alternatives. For the Upgrade in-Place Alternative, no change to air quality impacts beyond those presented for the No Action Alternative would result because there would be no significant change in the operating requirements of the facilities. For the Capability-sized UPF and No Net Production/Capability-sized UPF alternatives, operations would be reduced compared to the other alternatives, as would emissions from the Y-12 Steam Plant, but likely not significantly enough to have a meaningful positive effect on air quality, which would remain well within NAAQS for all criteria pollutants, with the exception of the 8-hour ozone levels and $PM_{2.5}$, which exceed standards throughout the region. Reduction in EU operations are also expected to result in the reduction of carcinogenic Hazardous Air Pollutants (HAPs); however, the maximum concentrations of these HAPs are small and do not have significant impacts.

With respect to greenhouse gas emissions, because of the reduced level of operations and reduction in size of the operational footprint at Y-12, the Capability-sized UPF and No Net Production/Capability-sized UPF alternatives would have significantly lower carbon dioxide (CO_2) emissions than the No Action, UPF, and Upgrade in-Place Alternatives. However, even the highest levels of CO_2 emissions (No Action and Upgrade in-Place alternatives) would be relatively small (much less than one percent) compared to the state-wide CO_2 emissions in Tennessee.

Radiological air impacts under the No Action Alternative are expected to remain at or about current levels, i.e., 0.15 millirem per year to the maximally exposed individual (MEI), which is well below the annual dose limit of 10 mrem/yr under the National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61 Subpart H). Statistically, an annual dose of 0.015 mrem would result in a latent cancer fatality (LCF) risk of 9.0×10^{-8}. Radiological air impacts from Y-12 would result in a dose of 1.5 person-rem to the population living within 50 miles of Y-12, which would result in 0.0009 LCFs annually. Under normal operations, radiological airborne emissions under the Upgrade in-Place Alternative would be no greater than radiological airborne emissions from the existing EU facilities, and would likely be less due to the incorporation of newer technology into the facility design; however, because of the unavailability of design data, they are assumed to be the same as those from the No Action Alternative.

NNSA has estimated that uranium emissions from the UPF would be reduced by approximately 30 percent compared to the No Action Alternative. Under the Capability-sized UPF Alternative and the No Net Production/Capability-sized UPF Alternative, activities that release radiological emissions would be reduced, resulting in lower emission levels relative to the No Action Alternative. NNSA estimates that uranium emissions would decrease by approximately 40 percent for the Capability-sized UPF Alternative and approximately 50 percent for the No Net Production/Capability-sized UPF Alternative.

3.5.6.2 *Noise*

Construction. Under the No Action Alternative, no significant construction would result and no change in noise impacts would be expected. For the UPF, Capability-sized UPF, No Net Production/Capability-sized UPF alternatives, the onsite and offsite acoustical environments at Y-12 may be impacted during construction. Construction activities would generate noise produced by heavy construction equipment, trucks, power tools, and percussion from pile drivers, hammers, and dropped objects. In addition, traffic and construction noise is expected to increase during construction onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site. The levels of noise would be representative of levels at large-scale building sites. The proposed site for a UPF is approximately 1,700 feet from the Y-12 boundary, and peak attenuated noise levels from construction would be below background noise levels at offsite locations within the city of Oak Ridge. For the Upgrade in-Place Alternative, construction activities would cause less noise impacts than the UPF alternatives because construction would take place at the CCC site and within existing facilities, and the proposed CCC site and existing facilities are slightly farther from the site boundary than the proposed UPF site.

Operation. Major noise emission sources within Y-12 include various industrial facilities, equipment and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most Y-12 industrial facilities are at a sufficient distance from the site boundary so noise levels at the boundary from these sources would not be distinguishable from background noise levels. Implementation of any alternative would not change these operational noise impacts.

3.5.7 Water Resources

3.5.7.1 *Surface Water*

Construction. Under the No Action Alternative, annual surface water usage at Y-12 would remain within the current range (about 2 billion gallons). A number of contaminants are present and monitored in East Fork Poplar Creek (EFPC). Levels of mercury do remain above ambient water quality criteria in the EFPC. Nickel levels were well below the Tennessee General Water Quality Criteria. The Upper East Fork Poplar Creek (UEFPC) contains most of the known and potential sources of surface water contamination. Surface water contaminants in UEFPC include metals (particularly mercury and uranium), organics, and radionuclides (especially uranium isotopes). Environmental restoration activities would continue to address surface water contamination sources and, over time, would be expected to improve the quality of water in both

EFPC and Bear Creek, the two surface water bodies most directly impacted by activities at Y-12. Y-12 surface water withdrawals and discharges would not increase substantially during construction under any of the action alternatives. Construction water requirements are very small and would not substantially raise the average daily water use for Y-12. During construction, stormwater control and erosion control measures would be implemented to minimize soil erosion and transport to EFPC. Contaminated wastewater would be collected and disposed of in accordance with applicable regulations. The proposed UPF and CCC sites and the existing Uranium Facilities are not located within either the 100-year or 500-year floodplains.

Operation. Under the No Action, UPF, and Upgrade in-Place alternatives, surface water usage at Y-12 would remain at approximately 2 billion gallons per year. The UPF Alternative would reduce water demands at the site to 1.3 billion gallons per year because EU operations would be phased out in the inefficient existing facilities once the UPF becomes operational and the CCC (under all of the action alternatives) would consolidate ongoing functions from numerous separate facilities. It is not anticipated that operations under the UPF or Upgrade in-Place alternatives would impact surface water quality beyond impacts described for the No Action Alternative. The reduced operations associated with the Capability-sized UPF Alternative would reduce water use at Y-12 to approximately 1.2 billion gallons per year. The reduced operations associated with the No Net Production/Capability-sized UPF Alternative would reduce water use at Y-12 to approximately 1.08 billion gallons per year.

Under the Capability-sized UPF and No Net Production/Capability-sized UPF alternatives, reduction of EU operations would reduce releases of uranium and other contaminants to surface waters. Under all alternatives, routine operations would be expected to result in no adverse impacts on surface water resources or surface water quality because all discharges would be maintained to comply with National Pollution Discharge Elimination System (NPDES) permit limits and minimized by appropriate mitigation measures.

3.5.7.2 *Groundwater*

Construction. Water for all of the alternatives would be taken from the Clinch River, with no plans for withdrawal from groundwater resources. All process, utility, and sanitary wastewater would be treated prior to discharge in accordance with applicable permits. All water for construction of the UPF, Upgrade in-Place, Capability-sized UPF, or No Net Production/Capability-sized UPF alternatives would be taken from the Clinch River as part of the normal water uses at Y-12. Some groundwater may be extracted during construction activities at the CCC and a UPF site to remove water from excavations. Appropriate construction techniques would be implemented to minimize the seepage of groundwater into excavation sites. No impact on groundwater (direction or flow rate) would be expected from constructing a UPF or the CCC. Based on the results of constructing the HEUMF, groundwater extracted from excavations at a UPF or the CCC site is not expected to be contaminated. Minimal impacts on groundwater quality are expected because extracted groundwater would be collected and treated in onsite treatment facilities to meet the discharge limits of the NPDES permit prior to release to surface water.

Operation. Under all of the alternatives, water for Y-12 operations would be taken from the Clinch River. All process, utility, and sanitary wastewater would be treated prior to discharge in accordance with applicable permits. No groundwater would be used for operations of facilities. No plans exist for routine withdrawal from groundwater resources.

3.5.8 Ecological Resources

Ecological resources at Y-12 include terrestrial and aquatic resources, threatened and endangered (T&E) species and other special status species, and floodplains and wetlands.

Construction. Under the No Action Alternative, no impacts on ecological resources are expected because any construction activities would occur in areas where site clearing and past construction have occurred. Construction of a UPF under alternatives 2, 4, or 5 would not impact ecological resources because a UPF would be sited on land that is currently used as a parking lot. Construction of the CCC would not affect ecological resources because the proposed site is in a previously disturbed industrial area. Mercury and polychlorinated biphenyl (PCB) levels in EFPC fish have historically been elevated relative to those fish in uncontaminated reference streams. Fish are monitored regularly in EFPC for these contaminants. Appropriate stormwater management techniques would be used during construction activities under all of the action alternatives to prevent pollutants from entering local waterways. No impacts on ecological resources from the Upgrade in-Place Alternative are expected because modifications would be internal to existing facilities. Moreover, all areas associated with the Upgrade in-Place Alternative have been previously disturbed and do not contain habitat sufficient to support ecological resources.

Operation. Under the No Action Alternative, continued minor impacts on terrestrial resources are expected due to operation noise and human activities. Operation under the UPF, Upgrade in-Place, Capability-sized UPF, or No Net Production/Capability-sized UPF alternatives would not impact biological resources because these activities would be located in previously disturbed or heavily industrialized portions of Y-12 that do not contain habitat sufficient to support a biologically diverse species mix. Although the Capability-sized UPF and No Net Production/ Capability-sized UPF alternatives would reduce EU operations, Y-12 would continue to operate, the site would remain heavily industrialized, and no change to ecological resources would be expected. Although the gray bat (*Myotis grisescens*), a Federally-listed endangered animal species is known to occur at Oak Ridge Reservation, no critical habitat for threatened or endangered species is known to exist at Y-12. NNSA will consult with the U.S. Fish and Wildlife Service, pursuant to Section 7 of the Endangered Species Act to ensure proposed actions would not impact Federally-listed threatened or endangered species.

3.5.9 Cultural Resources

Y-12 currently has no buildings in the National Register of Historic Places but does have a proposed historic district of buildings associated with the Manhattan Project. Preservation of cultural resources at Y-12, including the buildings in this proposed historic district, would continue under all alternatives. None of the alternatives would impact significant cultural resources at Y-12.

3.5.10 Socioeconomics

Construction. There would be no appreciable changes in the Region of Influence (ROI) socioeconomic characteristics over the 10-year planning period under the No Action Alternative. The construction of the UPF under Alternative 2 or a smaller UPF under the Capability-sized UPF or No Net Production/Capability-sized UPF alternatives would have a similar impact on the socioeconomic characteristics of Y-12 and the ROI as the recently-completed HEUMF construction. The UPF (under Alternative 2) and CCC would require approximately 950 workers during the peak year of construction. A total of 3,990 additional jobs (950 direct and 3,040 indirect) would be created in the ROI during the peak year of construction. The Capability-sized UPF Alternative or No Net Production/Capability-sized UPF Alternative (including the CCC) would require approximately 850 workers during the peak year of construction. A total of 3,570 jobs (850 direct and 2,720 indirect) would be created in the ROI during the peak year of construction. The total new jobs would represent an increase of less than 1 percent in ROI employment. The number of direct jobs at Y-12 could increase by approximately 14 percent during the peak year of construction. Overall, these changes would be temporary, lasting only the duration of the 3-year construction period of the CCC and 6-year construction period of a UPF. The Upgrade in-Place Alternative would have a peak construction workforce of 300 workers and generate a total of 1,560 jobs (300 direct and 1,260 indirect) in the ROI. The existing ROI labor force is sufficient to accommodate the labor requirements and no change to the level of community services provided in the ROI is expected.

Operation. Under the No Action Alternative and Upgrade in-Place Alternative, the operational workforce at Y-12 is expected to remain stable. Upon completion of the UPF construction (approximately 2016), the operational workforce for the UPF would be expected to be smaller than the existing EU workforce due to efficiencies associated with the new facility. NNSA estimates that the total number of EU workers should decrease to approximately 950, which is a reduction of approximately 350 workers compared to the current EU workforce. The consolidation of the Protected Area from 150 acres to 15 acres is also expected to reduce the security forces at Y-12 by approximately 400 workers. Coupled together, the total workforce reduction should be approximately 750 workers, which is approximately 11 percent of the total Y-12 workforce. These reductions are expected to be met through normal attrition/retirements, as about 50 percent of the work force at Y-12 is eligible to retire within the next 5 years. The change from baseline Y-12 employment would be minor and no noticeable impacts on ROI employment, income, population, housing, or community services would be expected. Under the Upgrade in-Place Alternative, operation of facilities would not result in any change in workforce requirements since existing workers would staff the facilities. Under the Capability-sized Alternative, the workforce at Y-12 could decrease to approximately 3,900 jobs, a reduction of approximately 40 percent compared to the No Action Alternative baseline. Combined with the indirect jobs that would be lost (10,900), under the Capability-sized UPF Alternative the ROI employment would be reduced by about 4.6 to 5.5 percent. Under the No Net Production/Capability-sized UPF Alternative, NNSA estimates that the site employment would decrease to approximately 3,400 workers. This would represent a decrease of approximately 3,100 jobs; a reduction of approximately 48 percent compared to the No Action Alternative baseline. Combined with the indirect jobs that would be lost (13,020) the ROI employment would be reduced by approximately 5.5 percent. Under alternatives 4 and 5, although some EU operations would be reduced, the NNSA would continue to maintain the safety and security for nuclear materials or other hazardous materials. The reduction in the workforce would likely be met through normal attrition/retirements.

3.5.11 Environmental Justice

Construction. The short-term socioeconomic impacts during any construction activities would be positive and not result in any disproportionately high and adverse effects on minority populations, low-income, or American Indian populations. With respect to human health, occupational impacts during construction would be expected (see Health and Safety, Section 5.12 of the SWEIS), but would not be significant. Therefore, no disproportionately high and adverse effects on minority populations, low-income, or American Indian populations would be expected.

Operation. None of the proposed alternatives would pose significant health risks to the public and radiological emissions would remain below the annual dose limit of 10 mrem (the maximum MEI dose is 0.4 mrem/yr). Results from ORR ambient air monitoring program show that the hypothetical effective dose equivalent (EDE) received within the Scarboro Community (an urban minority community that is the closest community to an ORR boundary) is typically similar to, or lower than, other monitoring stations of Y-12. There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole.

3.5.12 Health and Safety

Construction. There are occupational hazards associated with any construction activity. During construction, the UPF, Capability-sized UPF, and No Net Production/Capability-sized UPF alternatives would have the highest potential for occupational injuries due to the fact that construction of a UPF would require the largest construction workforce. For the total construction duration, approximately 2,900 worker-years would be required to construct the UPF or Capability-sized UPF; statistically, approximately 49 recordable cases of injuries per year may be expected during the peak years of construction. All other alternatives would be expected to result in less than 75 recordable cases of injuries during the construction period. No radiological impacts are expected from construction activities for any of the alternatives.

Operation. During normal operations, radiological impacts on workers and the public would occur. Under the No Action Alternative, impacts are expected to be similar to the impacts that are currently occurring. All radiation doses from normal operations would be well below regulatory standards and would have no statistically significant impact on the health and safety of either workers or the public. Statistically, for all alternatives, radiological impacts would be expected to cause less than one latent cancer fatality (LCF) to the 50-mile population surrounding Y-12. The No Net Production/Capability-sized UPF Alternative would result in the lowest uranium releases to the environment, which would translate into the lowest dose to the public. Under the Capability-sized UPF Alternative the dose to the public would be about 50 percent lower than those alternatives.

Under the No Action Alternative, worker dose would not change significantly. The Y-12 total worker dose in 2007 was approximately 49.4 person-rem, which equates to an average dose of 20.6 mrem for all Y-12 employees. This dose is well below regulatory limits and limits imposed by DOE Orders. For the UPF Alternative, the dose to workers would be reduced by about 60 percent to 21.1 person-rem. Under the Capability-sized UPF Alternative, worker dose would be reduced to approximately 18.8 person-rem and under the No Net Production/Capability-sized UPF Alternative worker dose would be reduced to approximately 16.5 person-rem. Under all alternatives, less than one LCF to the workforce would be expected annually.

3.5.13 Waste Management

Under all alternatives, Y-12 would continue to generate and manage wastes, including low-level radioactive waste (LLW), mixed LLW, hazardous waste, and sanitary/industrial (nonhazardous) waste. During construction, the action alternatives would each result in small quantities of wastes being generated. These amounts of additional waste would be well within the capability of the existing Y-12 waste management processes and facilities to handle. Waste generation under the Upgrade in-Place Alternative would be the same as the No Action Alternative. The UPF, Capability-sized UPF, and No Net Production/Capability-sized UPF alternatives would result in progressively lower generation of the volume of all classes of waste at Y-12. Under any of the alternatives, the waste management treatment and disposal capabilities at Y-12 would be adequate to handle wastes generated by operations.

3.5.14 Facility Accidents

Radiological. Potential impacts from accidents were estimated using computer modeling for a variety of initiating events, including fires, explosions, and earthquakes. For all alternatives, the accident with the highest potential consequences to the offsite population is the aircraft crash into the EU facilities. Approximately 0.4 LCFs in the offsite population could result from such an accident in the absence of mitigation. An MEI would receive a maximum dose of 0.3 rem. Statistically, this MEI would have a $2x10^{-4}$ chance of developing a LCF, or about 1 in 5,000. This accident has a probability of occurring approximately once every 100,000 years. When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be $4.4x10^{-7}$, or about 1 in 2.3 million. For the population, the LCF risk would be $4x10^{-4}$, or about 1 in 2,500.

The UPF, Capability-sized UPF, and No Net Production/Capability-sized UPF alternatives would decrease the overall Y-12 facility accident risks discussed above. This is because many of the operations and materials in the existing Y-12 nuclear facilities would be consolidated into a UPF, reducing the accident risks associated with those older facilities. However, detailed design descriptions for a UPF are not available. Without these detailed descriptions, the reduction in accident risks cannot be quantified. New facilities such as the UPF would be constructed to current building standards and would be designed and built to withstand anticipated seismic accelerations and thus would prevent any significant earthquake damage. These new facilities would not experience significant damage from earthquakes and other external initiators. Also, controls would be incorporated into the design of new Y-12 facilities to reduce the frequency and consequence of internally initiated accidents. Therefore, the risks presented above for the current Y-12 facilities (both individually and additive) would be conservative for a UPF.

Nonradiological. The impacts associated with the potential release of the most hazardous chemicals used at Y-12 were modeled to determine whether any impacts could extend beyond the site boundaries. Based upon those modeling results, it was determined that no chemical impacts would cause adverse health impacts beyond the site boundary. In any event, emergency preparedness procedures would be employed to minimize potential impacts.

Most of the accidents analyzed in this SWEIS do not vary by alternative because the same facilities are potentially involved in the accidents and subsequent consequences. However, the construction and use of a UPF under either Alternative 2, 4, or 5 would replace existing facilities that were originally designed for other purposes with facilities that incorporate modern features to prevent the occurrence of accidents, as well as mitigate any accident consequences. Due to the design and facility construction, a UPF is expected to reduce the likelihood and severity of many accidents associated with the EU mission; however, the decreased risk cannot be quantified until specific safety analysis documents are prepared. Such documents would be prepared during detailed design activities, if the decision is made to proceed with any one of the alternatives that include a UPF.

The Y-12 Emergency Management Program incorporates all the planning, preparedness, response, recovery, and readiness assurance elements necessary to protect onsite personnel, the public, the environment, and property in case of credible emergencies involving Y-12 facilities, activities, or operations. Provisions are in place for Y-12 personnel to interface and coordinate with Federal, state, and local agencies and with those organizations responsible for offsite emergency response. In the event of an emergency at Y-12, a number of resources are available for mitigation, re-entry, and recovery activities associated with the response.

3.5.15 Intentional Destructive Acts

NNSA has prepared a classified appendix to this SWEIS that evaluates the potential impacts of malevolent, terrorist, or intentional destructive acts. Substantive details of terrorist attack scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Appendix E (Section E.2.14) discusses the methodology used to evaluate potential impacts associated with a terrorist threat and the methodology by which NNSA assesses the vulnerability of its sites to terrorist threats and then designs its response systems. As discussed in that section, NNSA's strategy for the mitigation of environmental impacts resulting from intentional destructive acts, has three distinct components: (1) prevent or deter successful attacks; (2) plan and provide timely and adequate response to emergency situations; and (3) progressive recovery through long term response in the form of monitoring, remediation, and support for affected communities and their environment.

The classified appendix evaluates several scenarios involving intentional destructive acts for alternatives at Y-12 and calculates consequences to the noninvolved worker, maximally exposed individual, and population in terms of physical injuries, radiation doses, and LCFs. In general, the potential consequences of intentional destructive acts are highly dependent upon distance to the site boundary and size of the surrounding population—the closer and higher the surrounding population, the higher the consequences. In addition, it is generally easier and more cost-effective to protect new facilities, as new security features can be incorporated into their design. In other words, protection forces needed to defend new facilities may be smaller due to the inherent security features of a new facility. New facilities can, as a result of design features, better prevent attacks and reduce the impacts of attacks.

3.6 PREFERRED ALTERNATIVE

The CEQ regulations require an agency to identify its preferred alternative to fulfill its statutory mission, if one or more exists, in a Draft EIS (40 CFR Part 1502.14[e]). Based on considerations of environmental, economic, technical, and other factors, the preferred alternative is Alternative 4, the Capability-sized UPF Alternative. The benefits of executing the Capability-sized UPF Alternative include reliable, long term, consolidated EU processing capability for the nuclear security enterprise with modern technologies and facilities; improved security posture for SNM; improved health and safety for workers; and a highly attractive return on investment. While operational today, the reliability of the existing facilities will continue to erode because of aging facilities and equipment. The UPF would replace multiple aging facilities with a modern facility that would be synergistic with the new HEUMF to provide a robust SNM capability and improve responsiveness, agility, and efficiency of operations (B&W 2004a).

With the consolidation of SNM operations, incorporation of integral security systems, and the 90 percent reduction of the Protected Area, the security posture would be greatly improved under the Capability-sized UPF Alternative. The use of engineered controls to reduce reliance on administrative controls and personal protection equipment to protect workers would improve worker health and safety. In addition, use of new technologies and processes may eliminate the need for some hazardous materials, reduce emissions, and minimize wastes. Cost savings and cost avoidance as a result of the Capability-sized UPF would include the following:

- Savings from consolidation related to right-sizing of facilities/footprint, more efficient operations, and simplification of SNM movement;
- Operating and maintenance cost reductions of approximately 33 percent from current operations;
- Reducing the number of workers required to access the Protected Area, which would improve the productivity of workers assigned to non-SNM activities that are currently located in the Protected Area. By reducing the size of the PIDAS, it is forecast that approximately 600 employees would not have to enter the PIDAS. It is conceivable that a 20 percent efficiency in non-SNM operations could be realized by not being encumbered with access requirements and restrictions of the PIDAS. Projects that support non-SNM operations would be less expensive because of improved productivity. The life cycle cost analysis predicts an average annual savings over the UPF 50-year facility life of $205 million in FY 2007 dollars;

- Reducing the footprint of the PIDAS protected area by 90 percent (from 150 acres to 15 acres), which would allow better concentration of the protective force over a smaller area. It is expected that the average annual security costs over the 50 year facility life could be reduced by $32 million in FY 2007 dollars (B&W 2004a).

Significant improvements in cost and operational efficiency would be expected from a new Capability-sized UPF. These improvements would include the expectation that new, reliable equipment would be installed, greatly reducing the need for major corrective maintenance (e.g., less than half of the existing casting furnaces are normally available because of reliability problems). In addition, security improvements would be an integral part of the new facility, reducing the number of redundant personnel (e.g., two-person rule) currently required and improving the mass limitation on the items worked in an area. New facilities built within the Material Access Areas (MAAs) such as lunchrooms, break rooms, and rest rooms, are expected to greatly increase efficiencies over the current practice of multiple entries and exits daily into the MAAs. It is also expected that the inventory cycle would be greatly reduced because of more effective means of real-time inventory controls. A more efficient facility layout is expected to decrease material handling steps, including structurally, physically, and operationally integrated material lock-up facilities (B&W 2004a).

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative.

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Land Use	Land uses at Y-12 would be compatible with surrounding areas and with land use plans. No change to existing land uses or total acreage of Y-12.	Potential land disturbance of approximately 42 acres of previously disturbed land during construction of the CCC and a UPF. Land uses at Y-12 would remain compatible with surrounding areas and with the land use plans. No impacts on offsite land use.	Upgrading existing EU facilities and construction of the CCC would not alter existing land uses at Y-12 nor affect offsite land use.	Potential land disturbance of approximately 39 acres of previously disturbed land during construction of the CCC and a UPF. Land uses at Y-12 would remain compatible with surrounding areas and with the land use plans. No impacts on offsite land use
Visual Resources	Y-12 would remain a highly developed area with an industrial appearance, with no change to VRM classification.	Cranes would create short-term visual impacts during construction of the CCC and the UPF. UPF would reduce Protected Area from 150 acres to 15 acres, resulting in minor industrial density reduction, but no change to VRM classification.	Construction of the CCC would result in temporary visual impacts due to use of cranes. Otherwise, the visual impacts would be the same as No Action Alternative	Cranes would create short-term visual impacts during construction of the CCC and a UPF. UPF would reduce Protected Area from 150 acres to 15 acres, resulting in minor industrial density reduction, but no change to VRM classification.
Site Infrastructure	As Y-12 continues to downsize, trends indicate that energy usage and most other infrastructure requirements will reduce by 2-5% per year.	No increased demand on site infrastructure. Would use less than 5% of available electrical capacity and less than 1% of current site water usage. Reduces steam usage by at least 10% as inefficient facilities are closed.	Same as No Action Alternative.	Under the Capability-sized UPF Alternative, electricity and water usage would be about 60% of present usage. Implementation of the No Net Production/ Capability-sized Alternative would result in electricity and water usage being about 55% of present.

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative (*continued*).

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Traffic and Transportation	No significant change to the current workforce of approximately 6,500 workers, therefore, Level-of-Service (LOS) on area roads would not change. The impacts associated with radiological transportation would be insignificant (i.e., much less than one latent cancer fatality [LCF] annually).	Construction-related traffic would add maximum of 950 worker vehicles per day. Increased traffic would be similar to the HEUMF construction, which has not changed LOS on area roads. Operational impact on Y-12 traffic would be a minor reduction but would not affect LOS on area roads. The impacts associated with radiological transportation would be insignificant (i.e., much less than one latent cancer fatality [LCF] annually).	Construction-related traffic would add maximum of 300 worker vehicles per day. Increased traffic would be less than HEUMF construction, which has not changed LOS on area roads. Operational impacts on Y-12 traffic would be the same as the No Action Alternative. The impacts associated with radiological transportation would be insignificant (i.e., much less than one latent cancer fatality [LCF] annually).	Construction-related traffic would add maximum of 850 worker vehicles per day. Increased traffic would be similar to the HEUMF construction, which has not changed LOS on area roads. Reduction of operational workforce by approximately 2,600–3,100 workers would not change LOS on area roads under either alternative. Impacts from transportation of radiological materials under the Capability-sized Alternative would be approximately one-fourth as much as the impacts from the No Action Alternative; and for the No Net Production/Capability-sized Alternative approximately one-twentieth as much.
Geology and Soils	No significant disturbance or impact to geology and soils.	Construction of the UPF and CCC would disturb approximately 42 acres of previously disturbed land. Appropriate mitigation measures would minimize soil erosion and impacts.	Construction of the CCC would disturb about 7 acres of previously disturbed land. Appropriate mitigation measures would minimize soil erosion and impacts.	Construction of the CCC and a UPF would disturb about 39 acres of previously disturbed land. Appropriate mitigation measures would minimize soil erosion and impacts.

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative (*continued*).

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Air Quality and Noise	Steam Plant would continue to be primary source of criteria pollutants. All criteria pollutant concentrations expected would remain below national and TDEC standards, except 8-hour ozone and $PM_{2.5}$, which exceed standards throughout the region. Greenhouse gases would be less than 0.12 percent of the statewide CO_2 emissions in Tennessee. Radiological air impacts from Y-12 are expected to remain at or about current levels, i.e., 0.15 millirem/year (mrem/yr) to the maximally exposed individual (MEI), which is well below the annual dose limit of 10 mrem/yr under the National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61 Subpart H). The dose to the population living within 50 miles of Y-12.would be 1.5 person-rem. **Noise:** Most Y-12 facilities at sufficient distance from the Site boundary so noise levels are not distinguishable from background noise levels.	Temporary increases in pollutants would result from construction equipment, trucks, and employee vehicles; emissions would be less than one-half of regulatory thresholds for all criteria pollutants. Reduces toxic pollutants generated during operations. Greenhouse gases would be less than 0.12 percent of the statewide CO_2 emissions in Tennessee. Reduces radiological air impacts compared to the No Action Alternative as follows: MEI: 0.1 mrem/yr; Population: 1.0 person-rem. **Noise:** Construction activities and additional traffic would generate temporary increase in noise; noise levels would be representative of large-scale building sites. Noise levels would be below background noise levels at offsite locations within the city of Oak Ridge.	During construction of the CCC, there would be some temporary increases in pollutants but these would be much less than similar emissions under the UPF Alternative. Operational emissions would be the same as the No Action Alternative. Radiological air impacts are expected to be the same as the No Action Alternative. Greenhouse gases would be less than 0.12 percent of the statewide CO_2 emissions in Tennessee. **Noise:** Minor additional noise impacts because construction would take place at the CCC site and within facilities that are slightly farther from site boundary than UPF site.	Temporary increases in pollutants would result from construction equipment, trucks, and employee vehicles; emissions would be less than one-half of regulatory thresholds for all criteria pollutants. No significant new quantities of criteria or toxic pollutants would be generated during operations. Greenhouse gases would be less than 0.07 percent of the statewide CO_2 emissions in Tennessee. Reduces radiological air impacts compared to the No Action Alternative as follows: MEI: 0.08-0.09 mrem/yr; Population: 0.8-1.0 person-rem. **Noise:** Construction activities and additional traffic associated with a UPF and the CCC would generate temporary increase in noise; noise levels would be representative of large-scale building sites. Noise levels would be below background noise levels at offsite locations within the city of Oak Ridge.

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative (*continued*).

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Water Resources	Water usage: 2 billion gallons per year. Discharges within NPDES requirements. Ongoing stormwater runoff and erosion control management. No impact to groundwater.	Same as No Action Alternative, plus increased water usage of approximately 4 million gallons per year during construction of the UPF.	Water requirements during construction would not raise the average annual water use for Y-12 or cause any appreciable water resource impacts or changes beyond those described for the No Action Alternative. Operations impacts would be the same as No Action Alternative.	Increased water usage of approximately 3.6 million gallons during construction of the Capability-sized UPF and CCC. Operational water use for the Y-12 Site is expected to be reduced to approximately 1.2 billion gallons per year under the Capability-sized UPF Alternative. Increased water usage of approximately 3.6 million gallons during construction of the No Net Production/Capability-sized UPF and the CCC. Operational water use for the Y-12 Site is expected to be reduced to approximately 1.08 billion gallons per year under the No Net Production/ Capability-sized UPF Alternative.

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative (*continued*).

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Ecological Resources	Site is highly developed, consisting mainly of disturbed habitat. Wildlife diversity is low (mostly species associated with areas of human development. Continued minor impacts on terrestrial resources due to operations and human activities. No federally-listed or state-listed threatened or endangered species are known to be present at Y-12 Site.	Construction of the UPF and CCC would not impact ecological resources because new facilities would be sited on previously disturbed land. Operations would not impact ecological resources because activities would be located in heavily industrialized portions of Y-12. No federally-listed or state-listed threatened or endangered species are known to be present at Y-12 Site.	No impacts on ecological resources because construction activities would consist mostly of internal building modifications and the CCC in areas previously disturbed that do not contain habitat sufficient to support ecological resources. No federally-listed or state-listed threatened or endangered species are known to be present at Y-12 Site.	Construction of a UPF and the CCC would not impact ecological resources because new facilities would be sited on previously disturbed land. Operations would not impact ecological resources because activities would be located in heavily industrialized portions of Y-12. No federally-listed or state-listed threatened or endangered species are known to be present at Y-12 Site.
Cultural Resources	Y-12 currently has a proposed National Register Historic District of historic buildings associated with the Manhattan Project that are eligible for listing in the National Register of Historic Places. Preservation of cultural resources at Y-12, including the buildings in this proposed historic district, would continue under all alternatives. None of the alternatives would impact significant cultural resources at Y-12.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative (*continued*).

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Socioeconomics	Operational workforce at Y-12 expected to remain stable with no significant increase or decreases. No appreciable changes in the regional socioeconomic characteristics over the 10-year planning period.	950 workers would be employed during the peak year of construction. This would result in a total of 3,990 jobs (950 direct and 3,040 indirect) created in the ROI, which would increase employment less than 2%. There would be an expected 11% decrease in operational workforce due to more efficient operations in UPF and reduced security area. These decreases in employment are not expected to change the regional socioeconomic characteristics.	300 workers would be employed during the peak year of construction. Total of 1,560 jobs (300 direct and 1,260 indirect) would be created in the ROI, which would increase employment less than 1%. Impact of operations would be the same as No Action.	About 850 construction workers during peak year of construction of a UPF and the CCC. About 2,720 indirect jobs would be created. Operation of the Capability-sized UPF would result in a decrease of approximately 2,600 jobs (about 40% of current). About 10,900 indirect jobs would be lost, representing a 4.6% total job loss for the ROI. Operation of the No Net Production/Capability-sized UPF would result in a decrease of about 3,100 workers (48% of current workforce). ROI indirect employment would decrease by about 13,020 resulting in a 5.5% decrease in jobs in the ROI. These decreases in employment are not expected to change the regional socioeconomic characteristics.

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative (*continued*).

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Environmental Justice	No significant health risks to the public. Radiological dose to the MEI would remain well below the annual dose limit of 10 mrem. Results from the monitoring program and modeling show that the maximum exposed individual would not be located in a minority or low-income population area. No special circumstances that would result in greater impact on minority, low-income, or American Indian populations than population as a whole.	Reduced impacts compared to No Action. Accident risks would decrease compared to No Action because many of the operations and materials in the existing Y-12 nuclear facilities would be consolidated into the UPF, reducing the accident risks associated with those older facilities.	Same as No Action Alternative.	Reduced impacts compared to No Action Accident risks would decrease compared to No Action because many of the operations and materials in the existing Y-12 nuclear facilities would be consolidated into the UPF, reducing the accident risks associated with those older facilities.

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative (*continued*).

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Health and Safety	All radiation doses from normal operations would be below regulatory standards with no statistically significant impact on the health and safety of workers or public. Dose from air emissions: MEI: 0.15 mrem/yr ($9.0{\times}10^{-8}$ LCFs). Population: 1.5 person-rem/yr (0.0009 LCFs). Dose from liquid effluents: MEI: 0.006 mrem per year ($4.0{\times}10^{-9}$LCFs) Population:6.3 person-rem/yr (0.004 LCFs). Dose to Workers : 49.4 person-rem/yr (0.03 LCFs).	All radiation doses from normal operations would be below regulatory standards with no statistically significant impact on the health and safety of workers or public. Dose from air emissions: MEI: 0.1 mrem/yr ($6.0{\times}10^{-8}$ LCFs). Population: 1.0 person-rem/yr (0.0006 LCFs). Dose from liquid effluents would be same as No Action Alternative. Dose to Workers : 21.1 person-rem/yr (0.013 LCFs).	Same as No Action Alternative.	All radiation doses from normal operations would be below regulatory standards with no statistically significant impact on the health and safety of workers or public. **Capability-sized UPF** Dose from air emissions: MEI: 0.09 mrem/yr (5.0×10^{-8} LCFs). Population: 1.0 person-rem/yr (0.0005 LCFs). Dose to Workers : 18.8 person-rem/yr (0.01 LCFs). **No Net Production/Capability-sized UPF** Dose from air emissions: MEI: 0.08 mrem/yr (4.0×10^{-8} LCFs). Population: 0.8 person-rem/yr (0.0005 LCFs). Dose to Workers : 16.5 person-rem/yr (0.009 LCFs) For both the Capability-sized UPF and the No Net Production/Capability-sized UPF, the dose from liquid effluents would be same as No Action Alternative.

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative (*continued*).

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Waste Management (Operational Waste Volumes)	Expected volume of waste generation: LLW liquid: 713gal LLW solid: 9,405 yd^3 Mixed LLW liquid: 1,096 gal Mixed LLW solid: 126 yd^3 Hazardous: 12 tons Nonhazardous: 10,374 tons	Expected volume of waste generation: LLW liquid: 476 gal LLW solid: 5,943 yd^3 Mixed LLW liquid: 679 gal Mixed LLW solid: 81 yd^3 Hazardous: 12 tons Nonhazardous: 9,337 tons	Expected volume of waste generation: LLW liquid: 713 gal LLW solid: 9,405 yd^3 Mixed LLW liquid: 1,096 gal Mixed LLW solid: 126 yd^3 Hazardous: 12 tons Nonhazardous: 10,374 tons	Expected volume of waste generation: **Capability-sized UPF:** LLW liquid: 428 gal LLW solid: 5,643 yd^3 Mixed LLW liquid: 640 gal Mixed LLW solid: 76 yd^3 Hazardous: 7.2 tons Nonhazardous: 6,224 tons **No Net Production/Capability-sized UPF:** LLW liquid: 403 gal LLW solid: 5,314 yd^3 Mixed LLW liquid: 619 gal Mixed LLW solid: 71 yd^3 Hazardous: 7.2 tons Nonhazardous: 5,705 tons

Table 3.5-1. Comparison of Environmental Impacts and Parameters Among No Action Alternative, UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/Capability-sized UPF Alternative (*continued*).

Site / Environmental Component	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized and No Net Production/Capability-sized UPF Alternatives
Facility Accidents	The, bounding accident with the most severe consequences would be an aircraft crash into the EU facilities. Approximately 0.4 LCFs in the offsite population could result. MEI dose: 0.3 rem MEI LCF risk: $2x10^{-4}$ chance of developing a LCF, or about 1 in 5,000. When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be $4.4x10^{-7}$, or about 1 in 2.3 million. For the population, the LCF risk would be $4x10^{-4}$, or about 1 in 2,500.	No greater impacts than the No Action Alternative. Accident risks would decrease compared to No Action because many of the operations and materials in the existing Y-12 nuclear facilities would be consolidated into the UPF, reducing the accident risks associated with those older facilities.	No greater impacts than the No Action Alternative. Accident risks would likely decrease compared to No Action because the existing EU facilities would be upgraded to contemporary environmental, safety, and security standards to the extent possible.	Accident risks would decrease compared to No Action because many of the operations and materials in the existing Y-12 nuclear facilities would be consolidated into the UPF, reducing the accident risks associated with those older facilities.

Note: The dose-to-LCF conversion factor is based on 6×10^{-4} LCFs per person-rem.

CHAPTER 4: AFFECTED ENVIRONMENT

Chapter 4, Affected Environment, provides the context for understanding the environmental consequences described in Chapter 5. The affected environment serves as a baseline from which any environmental changes that would result from implementing the alternatives can be evaluated. The baseline conditions are the currently existing conditions. The affected environment at the Y-12 National Security Complex (Y-12) is described for the following resource areas: land, visual, site infrastructure, transportation, geology and soils, air quality and noise, water, ecological, cultural and paleontological, socioeconomics, environmental justice, occupational and public health and safety, and waste management.

4.0 INTRODUCTION

In accordance with the Council on Environmental Quality (CEQ), *National Environmental Policy Act* (NEPA) implementing regulations (40 *Code of Federal Regulations* [CFR] Parts 1500 through 1508) for preparing an Environmental Impact Statement (EIS), the affected environment is "interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." The affected environment descriptions in this chapter provide the context for understanding the environmental consequences described in Chapter 5. They serve as a reference from which any environmental changes that could result from implementing the alternatives can be evaluated. The existing conditions for each environmental resource area were determined for ongoing operations from information provided in previous environmental studies and other reports and databases.

This Site-Wide EIS (SWEIS) evaluates the environmental impacts of the alternatives within defined regions of influence. The regions of influence are specific to the type of effect evaluated and encompass geographic areas within which any significant impact would be expected to occur. For example, human health risks to the general public from exposure to airborne contaminant emissions are assessed for an area within a 50-mile radius of the center of the Y-12 site. Brief descriptions of the regions of influence are provided in Table 4-1. Descriptions of the methodology used to evaluate impacts are presented in Appendix E of this SWEIS.

Table 4-1. General Regions of Influence for the Affected Environment.

Environmental Resource	Region of Influence
Land resources	ORR, Y-12 and the areas immediately adjacent to Y-12
Visual resources	ORR, Y-12 and the areas immediately adjacent to Y-12
Site infrastructure	ORR, Y-12
Geology and soils	ORR, Y-12, and nearby offsite areas
Water resources	On-site and adjacent surface water bodies and groundwater
Air quality	Y-12 and nearby offsite areas within local air quality control region where significant air quality impacts could occur and Class I areas within 50 miles
Noise	Y-12, nearby offsite areas, access routes to Y-12, and transportation corridors
Ecological resources	Y-12 and adjacent areas

Table 4-1. General Regions of Influence for the Affected Environment (*continued*).

Environmental Resource	Region of Influence
Cultural resources	The area within Y-12 and adjacent to the site boundary
Socioeconomics	The counties where approximately 90 percent of site employees reside
Human health and Safety	Y-12, offsite areas within 50 miles of Y-12, and the transportation corridors between Y-12 and other sites where worker and general population radiation, radionuclide, and hazardous chemical exposures could occur
Environmental justice	The minority and low-income populations within 50 miles of Y-12
Waste management and pollution prevention	Y-12
Environmental restoration	Y-12

Source: original

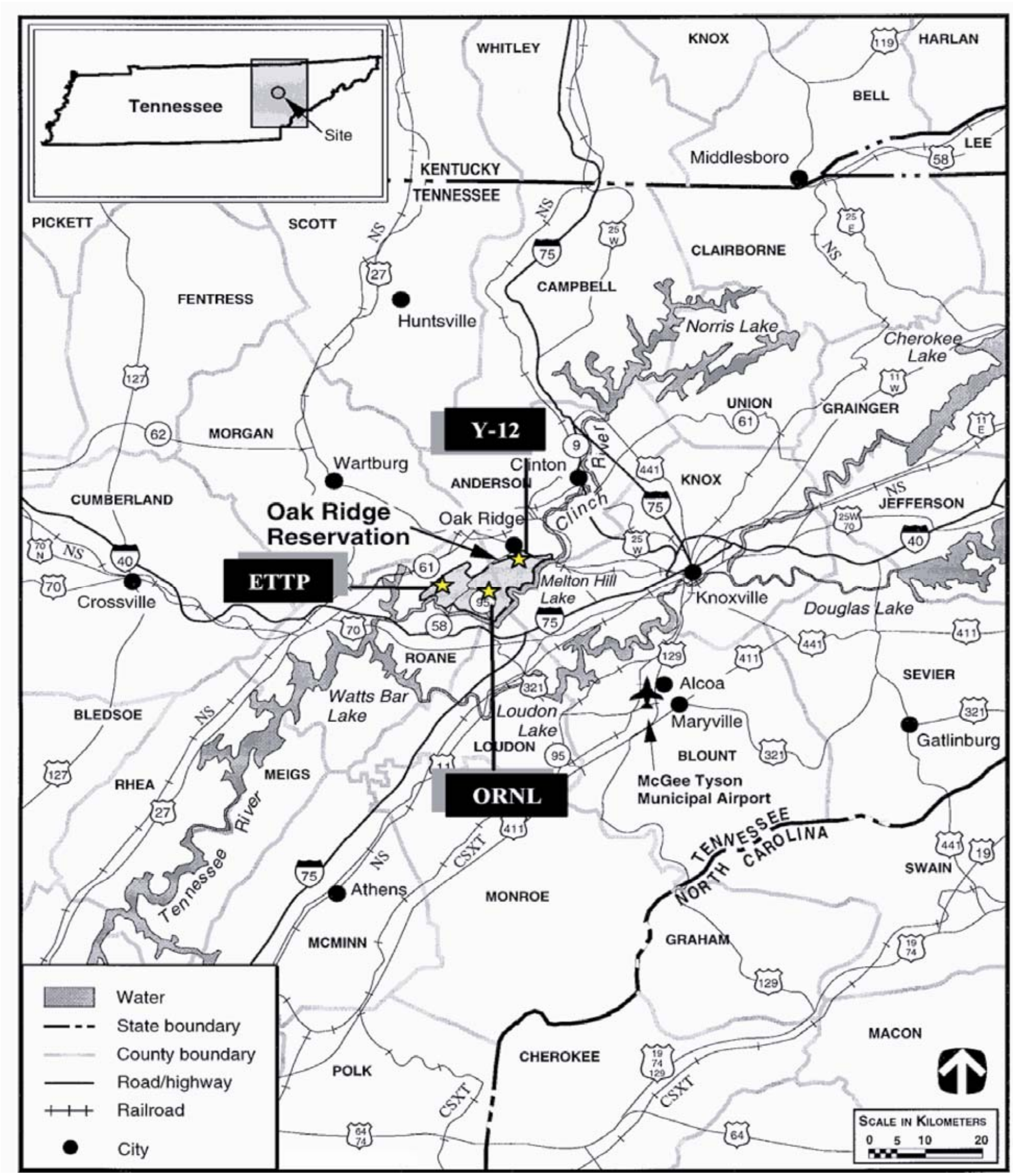
4.1 LAND RESOURCES

The Oak Ridge Reservation (ORR) was established in 1943 as one of the three original Manhattan Project sites, and includes Y-12, the Oak Ridge National Laboratory (ORNL), and the East Tennessee Technology Park (ETTP). ORR consists of approximately 35,000 acres and is located mostly within the corporate limits of the city of Oak Ridge; however, the city limits end 608 acres west of ETTP.

The city of Oak Ridge lies within the Great Valley of Eastern Tennessee between the Cumberland and Great Smoky Mountains and is bordered on two sides by the Clinch River. The Cumberland Mountains are 10 miles to the northwest; and the Great Smoky Mountains are 32 miles to the southeast. The location of ORR, principal facilities, and surrounding areas is presented in Figure 4.1-1.

Lands bordering ORR and Y-12 are predominantly rural and are used primarily for residences, small farms, forest land, and pasture land. The city of Oak Ridge, Tennessee, has a typical urban mix of residential, public, commercial, and industrial land uses. It also includes almost all of ORR. The residential section of Oak Ridge forms the northern boundary of ORR. There are four residential areas along the northern boundary of ORR, several of which have houses located within 98 feet of the site boundary.

Current Land Use at ORR. The U.S. Department of Energy (DOE) classifies land use on ORR into five categories: Institutional/Research, Industrial, Mixed Industrial, Institutional/Environmental Laboratory, and Mixed Research/Future Initiatives. Development on ORR accounts for about 35 percent of the total acreage, leaving approximately 65 percent of ORR undeveloped. Land bordering ORR is predominately rural, with agricultural and forest land being predominant (YSO 2007). About 15 percent of ORR is contaminated by hazardous and radioactive materials, including waste sites or remediation areas (TDEC 2005a). This legacy of contamination is being cleaned up to levels that comply with current laws, particularly the

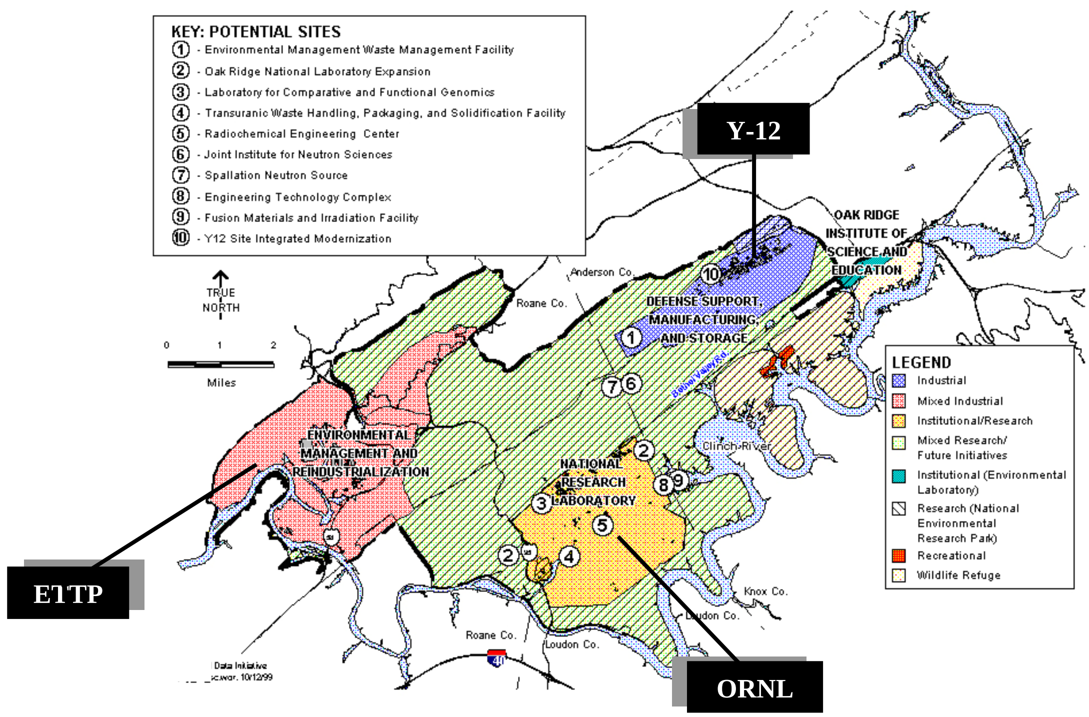


Source: DOE 2001a.

Figure 4.1-1. Location of the Oak Ridge Reservation, Principal Facilities, and Surrounding Areas.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Industrial and mixed industrial areas of the site include ORNL, Y-12, and the ETTP. The institutional/research category applies to land occupied by central research facilities at ORNL and the Natural and Accelerated Bioremediation Field Research Center in Bear Creek Valley near Y-12. The institutional/environmental laboratory category includes the Oak Ridge Institute for Science and Education. Land within the mixed research/future initiative category includes land that is used or available for use in field research and land reserved for future DOE initiatives.

The largest of the mixed industrial uses is biological and ecological research in the Oak Ridge National Environmental Research Park, which is on 20,000 acres. The National Environmental Research Park, established in 1980, is used by the nation's scientific community as an outdoor laboratory for environmental science research on the impact of human activities on the eastern deciduous forest ecosystem. In 2005, DOE and the State of Tennessee completed arrangements to place approximately 3,000 acres of land on ORR into a conservation easement that will be managed by the State of Tennessee in accordance with state laws regarding natural areas and wildlife management areas (TDEC 2006). The land located on the western end of ORR has served as an undeveloped buffer for the former K-25 uranium facility. The agreement preserves both East and West Black Oak Ridge and McKinley Ridge for conservation and public recreation. Additional details on land use plans at the site are provided in the *Oak Ridge National Laboratory Land and Facilities Plan* (ORNL 2002). Most mixed research and future initiatives areas are forested. Undeveloped forested lands on ORR are managed for multiple uses and the sustained yield of quality timber products. Figure 4.1-2 shows the research and forested areas within ORR.



Source: ORNL 2002.

Figure 4.1-2. Current and Future Land Use at ORR.

Two major firearm ranges, along with their surface danger zones or buffer areas, encompass approximately 2,500 acres on ORR. The range areas, which are located at the south side of Bear Creek Road about 5 miles west of Y-12, extend from the DOE ORR boundary on the west to Highway 95 on the east and from Bear Creek Road on the north to the Clinch River on the south.

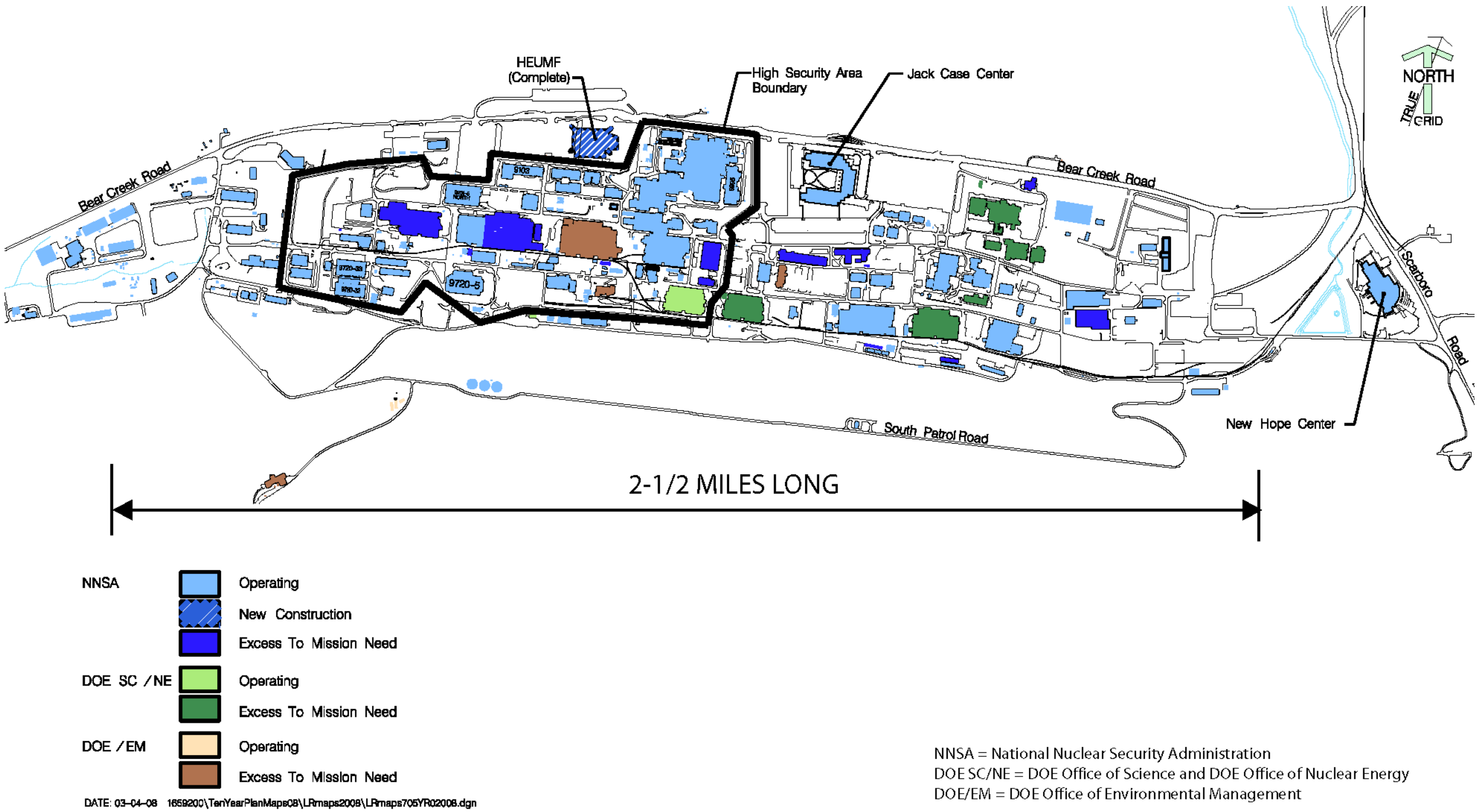
The eastern portion of the site is operated by DOE's Transportation Safeguards Division Southeastern Courier Section and consists of four individual live-fire ranges and associated support facilities. The western portion of the range site, formerly operated by Lockheed Martin Energy Systems (LMES), is currently operated for DOE by Wackenhut Services International (effective January 10, 2000) as a Central Training Facility and consists of an indoor range, five outdoor ranges, a shooting tower, three live-fire facilities, and assorted tactical facilities.

Federal statutes require each state, tribal, or local government to protect its citizens from releases of hazardous materials (40 CFR Parts 301, 302, 304, and 355). Emergency planning zones spanning 5 miles are defined around ORNL, ETTP, and Y-12. Each zone is then subdivided into emergency planning sectors, with each defined by easily recognizable terrain features (DOE 2001a). Although ORR is generally not open to the public, opportunities for public use of numerous facilities and land areas do exist. For example, DOE has granted a license for hunting on ORR.

Y-12. The main area of Y-12 is largely developed and encompasses approximately 800 acres, nearly 600 of which are considered a protected area and are enclosed by perimeter security fences. The main site, which has restricted access, is roughly 2.5 miles in length and 0.5 miles wide. The Y-12 Site Map is presented in Figure 4.1-3.

The eastern portion of Y-12 is occupied by Lake Reality and the former New Hope Pond (now closed), maintenance facilities, office space, training facilities, change houses, and former ORNL Biology Division facilities. The far western portion of Y-12 consists primarily of waste management facilities and construction contractor support areas. The central and west-central portions of Y-12 encompass the high-security portion, which supports core National Nuclear Security Administration (NNSA) missions. There are a few small wetlands within the Y-12 fenced boundary. Land outside the SWEIS area includes buffer for the Walker Branch watershed long term research area and other environmental research sites.

At the start of fiscal year (FY) 2008, real property included over 393 facilities in various states of utilization that total approximately 5.8 million square feet of NNSA-owned space and leased space. While NNSA is the site landlord and is responsible for approximately 75 percent of the floor space, other DOE program offices have responsibility for the remaining 25 percent. DOE's Offices of Science (SC) and Nuclear Energy (NE) is responsible for 21 buildings containing approximately 1.3 million square feet of space and DOE's Office of Environmental Management (DOE-EM) owns approximately 0.6 million square feet (NNSA 2008a). Within the next 5 years, the current and projected excess DOE and NNSA footprint on the Y-12 will total over 2.6 million square feet. Of this total, over 2 million square feet of NNSA, DOE-SC, DOE-NE, and DOE-EM is excess today (NNSA 2008a).



Source: NNSA 2008a.

Figure 4.1-3. Y-12 Site Map.

4.2 VISUAL RESOURCES

The landscape at ORR is characterized by a series of ridges and valleys that trend in a northeast-to-southwest direction. The vegetation is dominated by deciduous forest mixed with some coniferous forest. Most of the original open field areas on the site have been planted in shortleaf and loblolly pine, although smaller areas have been planted in a variety of deciduous and coniferous trees. The viewshed, which is the extent of the area that may be viewed from ORR, consists mainly of rural land. The city of Oak Ridge is the only adjoining urban area. Viewpoints affected by DOE facilities are primarily associated with the public access roadways, the Clinch River/Melton Hill Lake, and the bluffs on the opposite side of the Clinch River. Views are limited by the hilly terrain, heavy vegetation, and generally hazy atmospheric conditions. Some partial views of the city of Oak Ridge Water Treatment Plant facilities, located at Y-12, can be seen from the urban areas of the city of Oak Ridge.

Y-12 is situated in Bear Creek Valley at the eastern boundary of ORR. It is bounded by Pine Ridge to the north and Chestnut Ridge to the south. The area surrounding Y-12 consists of a mixture of wooded and undeveloped areas. Facilities at Y-12 are brightly lit at night, making them especially visible. Structures at Y-12 are mostly low profile, reaching heights of three stories or less, and built in the 1940s of masonry and concrete. The tallest structure is the meteorological tower erected in 1985 located on the west end of the Complex. There was also an east tower constructed in 1985, which has since been removed. Today the New Hope construction site is located where the east tower once was. The west tower is located on a slight rise across from the intersection of Old Bear Creek Road and Bear Creek Road. Although this tower only reaches a height of 197 feet, it is actually higher in elevation than the east tower was. The west tower is used to measure and collect meteorological data for ETTP databases. There are no visible daytime plumes over Y-12 (DOE 2001a).

The Scarboro Community is the closest developed area to Y-12 (approximately 0.6 mile), and is located to the north of Y-12. However, as a result of their separation by Pine Ridge, Y-12 is not visible from the Scarboro Community (DOE 2001a).

For the purpose of rating the scenic quality of Y-12 and surrounding areas, the Bureau of Land Management's (BLM) Visual Resource Management (VRM) Classification System was used. Although this classification system is designed for undeveloped and open land managed by BLM, this is one of the only systems of its kind available for the analysis of visual resource management and planning activities. Currently, there is no BLM classification for Y-12; however, the level of development at Y-12 is consistent with VRM Class IV which is used to describe a highly developed area. Most of the land surrounding the Y-12 site would be consistent with VRM Class II and III (i.e., left to its natural state with little to moderate changes).

4.3 SITE INFRASTRUCTURE

An extensive network of existing infrastructure supports Y-12 facilities and activities. Site infrastructure available at Y-12 includes an extensive road and railroad system; electric power provided by the Tennessee Valley Authority (TVA); natural gas supplied by the East Tennessee Natural Gas Company, and Sigcorp Energy Services; steam; raw, treated, demineralized, and chilled water; sanitary sewer; industrial gases; and telecommunications. These systems are described in the sections that follow.

4.3.1 Roads and Railroads

The Y-12 Site contains 65 miles of roads ranging from well-maintained paved roads to remote, seldom-used roads that provide occasional access. Primary roads serving Y-12 include Tennessee State Routes (TSRs) 58, 62, 95, and 170 (Bethel Valley Road) and Bear Creek Road. Except for Bethel Valley and Bear Creek roads, all are public roads. In addition, Y-12 is located within 50 miles of three interstate highways, I-40, I-75, and I-81. A 4-mile rail spur from the CSX main line east of the city of Oak Ridge serves Y-12. There are approximately 70 acres of parking lots on the Y-12 site. Figure 4.3.1-1 shows the road network around Y-12.

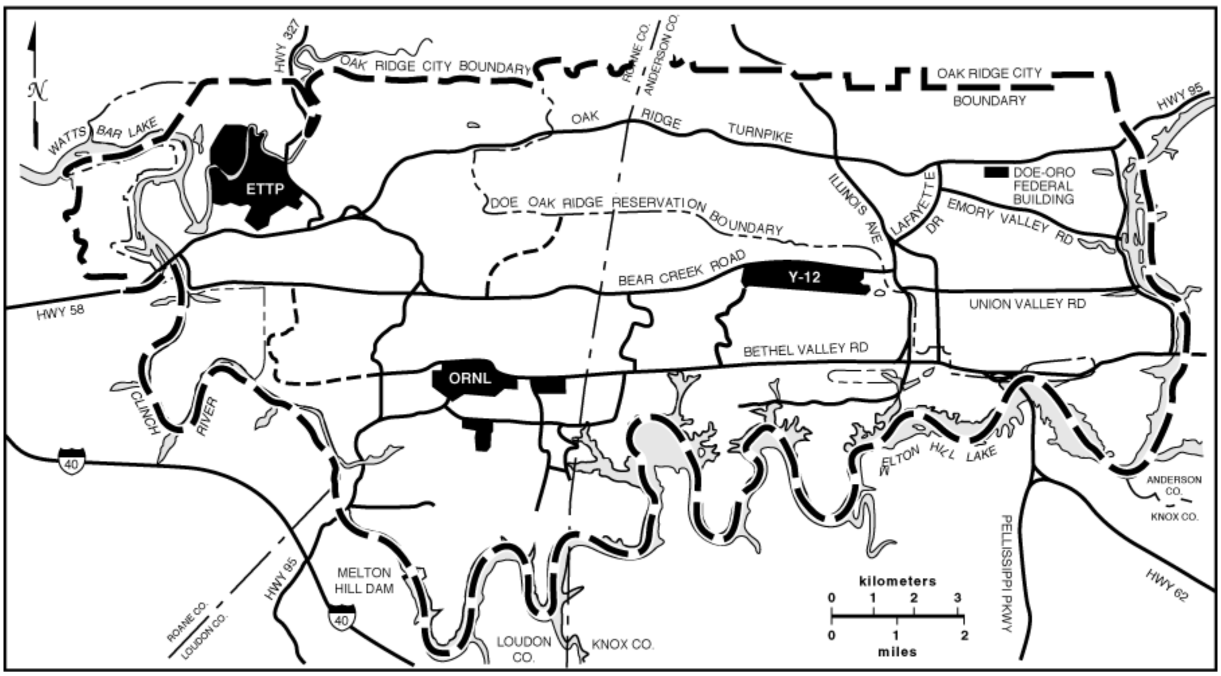


Figure 4.3.1-1. Road Network around Y-12.

4.3.2 Electrical Power

Electric power is supplied by TVA. Within Y-12, power is transmitted to the major distribution systems by three 161-kilovolts (kV) overhead radial feeder lines. There are eleven 13.8-kV distribution systems that range in size from 20 megavolt amperes (MVA) to 50 MVA, and reduce the 161 kV to 13.8 kV and distribute that power to unit substations located at facilities throughout Y-12. Each distribution system consists of a high-voltage outdoor transformer with indoor switchgear, 15-kV feeder cables, power distribution transformers, and auxiliary substation equipment. In total, the 13.8-kV distribution systems include approximately 30 miles of overhead lines, 10 miles of underground cable, and 740 pole- and pad-mounted transformers (B&W 2002).

At Y-12, the average monthly power usage is less than approximately 30 to 40 megawatts (MW). The available capacity, approximately 430 MW, greatly exceeds current demands. This is due to the fact that the original uses of Y-12 required a large, robust electrical system to support the uranium enrichment mission. The change in mission, from uranium enrichment to weapons manufacturing and subsequent evolution to the current missions, has greatly reduced Y-12's electrical needs (B&W 2002).

Y-12 also has a significant emergency and standby power generator system. The emergency power system provides backup power to critical safety-related loads, such as the emergency egress lighting systems and the fire alarm system. The standby power system provides backup power to loads that are less critical and not safety-related, but that nevertheless are extremely important to Y-12's mission, such as security systems and mission-related process systems. The emergency and standby power generator system is composed of 37 fixed generator systems and 11 portable generator systems. The combined capacity of the emergency and standby power generator system is 2.6 MW (B&W 2002).

4.3.3 Natural Gas

Sigcorp Energy Services supplies natural gas to ORR and Y-12. Natural gas, which is used for furnaces, the Y-12 Steam Plant, and laboratories, is supplied via a pipeline from the East Tennessee Natural Gas Company at "C" Station located south of Bethel Valley Road near the eastern end of Y-12. A 14-inch, 125-pounds per square inch gauge (psig) line is routed from "C" Station to the southwest corner of the Y-12 perimeter fence. From this point, an 8-inch line feeds the steam plant and a 6-inch branch line serves the process buildings and laboratories on the eastern end of Y-12. The western end of Y-12 is served by 4-inch and 2-inch headers that are fed from the steam plant line. Two pressure-reducing stations reduce the gas pressure from 125 pounds per square inch gauge (psig) to 25 psig and 35 psig, respectively. The gas pressure is further reduced and the flow metered at each use point (B&W 2002).

4.3.4 Steam

Steam is vital to the operation of Y-12. It is the primary source of building heat, both for personnel comfort and for freeze protection for critical services such as fire protection systems during the winter months. Steam is also necessary to support the production mission. Heating and process steam is supplied from a Y-12 Steam Plant, originally built in 1955 and upgraded and modernized several times since then. The Steam Plant operates 24 hours per day, 365 days per year. It includes four coal-fired boilers, each of which is rated at 200,000 pounds per hour at 500 degrees Fahrenheit (ºF) and 235 psig. Steam is distributed throughout the plant at 235 psig through main headers ranging in size from 2 to 18 inches in diameter. Condensate is collected and returned to the Steam Plant using a similar network of pipes; a majority of the returned condensate is used as feed to the demineralized water system. Gross steam produced at Y-12 is approximately 1.5 billion pounds per year. As part of the Steam Plant Life Extension Project – Steam Plant Replacement, Y-12 prepared an Environmental Assessment (EA) and issued a Finding of No Significant Impact. In 2007, NNSA made a decision to begin design and construction of a new steam plant. The new plant will use natural-gas-fired package boilers with new burner technology instead of coal, creating much cleaner emissions. Currently, the steam plant is under construction and is scheduled to be completed in September 2010.

Each boiler is capable of firing on either pulverized coal or natural gas and includes two coal pulverizers and four burners. Coal for the Steam Plant is purchased regionally, delivered by truck, and stored in a bermed area near the Steam Plant. Runoff from the coal pile is collected and treated in the Steam Plant Wastewater Treatment Facility prior to discharge to the sanitary sewer system (B&W 2002).

4.3.5 Water

Raw water for ORR is obtained from the Clinch River south of the eastern end of Y-12 and pumped to the water treatment plant located on the ridge northeast of Y-12. Ownership and operation of the treated water system was transferred from DOE to the city of Oak Ridge in April 2000. The water treatment plant can deliver water to two water storage reservoirs at a potential rate of 24 million gallons per day. Water from the reservoirs is distributed to the Y-12 Plant, ORNL, and the city of Oak Ridge. Separate underground piping systems provide distribution of raw and treated water within Y-12. Raw water is routed to Y-12 by two lines: a 16-inch main from the booster station, installed in 1943, and an 18-inch main from the 24-inch filtration plant feed line. The raw water system has approximately five miles of pipes with diameters ranging from 4 inch to 18 inch. The primary use of the raw water is to maintain a minimum flow of 7 million gallons per day in the East Fork Poplar Creek (EFPC). Treated water is routed to Y-12 by three lines: one 24-inch main and two 16-inch mains. The total treated water system contains approximately 19 miles of pipe ranging in size from 1 to 24 inches in diameter. The treated water system supplies water for fire protection, process operations, sanitary sewerage requirements, and boiler feed at the steam plant. Treated water usage at Y-12 averages 4.2 million gallons per day or 1,538 million gallons per year.

The NNSA recently completed an EA for the Y-12 Potable Water System Upgrade (DOE/EA-1548) (DOE 2006a) (see Section 1.7.2). The NNSA proposes to upgrade the Y-12 potable water system by installing two new elevated water tanks, a pumping station, and system supply lines north of Bear Creek Road; inspecting the remaining original cast iron potable water distribution lines and repairing or replacing them if necessary; inspecting the original water (potable, process, and fire) supply lines to individual buildings expected to remain in use past 2010 and replacing them where necessary; replacing approximately 40 obsolete fire hydrants; installing backflow prevention, and converting to dry pipe or isolating approximately 85 existing fire suppression loops in order to prevent cross contamination from propylene glycol sprinkler systems. The proposed action would allow Y-12 to (1) upgrade the fire protection system's backflow protection for known cross connections and maintain proper chlorine residual in the system; (2) control and monitor water coming into the Y-12 distribution system to ensure adequate water flow and pressure to support current and future Y-12 operational needs; and (3) address deferred maintenance and ensure continued system reliability by inspecting, evaluating, and repairing or replacing deteriorated cast iron water mains and building feeds and obsolete fire hydrants.

Demineralized water is used to support various processes at Y-12 that require high-purity water. A central system located in and adjacent to Building 9404-18 serves the entire plant through a distribution piping system. This system consists of feedwater storage, carbon filters, demineralizers, a deaerator, and demineralized water storage tanks. The primary source of feedwater is condensate return, which is cooled and stored in two storage tanks of 13,000-gallon and 30,000-gallon capacity. The secondary source of feedwater is softened water from the steam plant. Feedwater from the storage tanks is filtered, demineralized, deaerated, and stored until needed.

4.3.6 Sanitary Sewer

The Y-12 Site's sanitary sewer system was first installed in 1943 and expanded as the plant grew. Sewage from most buildings flows to an 18-inch sewer main that leaves the east end of the plant near Lake Realty and connects to the city main near the intersection of Bear Creek Road and Scarboro Road. The current system capacity is approximately 1.5 million gallons per day. The average daily flow has been approximately 750,000 gallons per day (B&W 2002).

4.3.7 Chilled Water

The chilled water systems were renovated and upgraded during the mid-1990s. Most chillers that were more than 20 years old were replaced, and the newer chillers were inspected and renovated to eliminate the use of chlorofluorocarbons and to restore the chillers to optimal mechanical condition (B&W 2002).

4.3.8 Industrial Gases

Industrial gases include compressed air, liquid nitrogen, liquid oxygen, liquid argon, helium, and hydrogen.

Compressed air is supplied by three different systems that use compressors and associated air-drying equipment located throughout Y-12. The high-pressure (110 psig) instrument air system serves specific production buildings in the west end of Y-12. The low-pressure (100 psig) system also serves the production facilities in addition to serving the production support buildings and ORNL facilities located at Y-12. The Y-12 air system (90 psig) serves those areas where air quality is not a concern. All three systems are supplied from the same set of compressors and are different only in the operating pressure and the cleanliness of the piping systems (i.e., the Y-12 air piping system contains legacy oil and moisture from previous operations).

Liquid nitrogen is normally delivered to Y-12 by trailer truck. The Y-12 nitrogen supply system consists of five liquid-nitrogen storage tanks, a bank of atmospheric vaporizers, a steam-to-nitrogen vaporizer, and hot-water vaporizers. Nitrogen is delivered to all production facilities and laboratories at 90 psig through a network of 2-inch, 3-inch, and 4-inch pipes. Y-12 uses approximately 190 million standard cubic feet (scf) of liquid nitrogen annually.

Liquid oxygen is delivered to Y-12 by trailer truck. The oxygen supply system consists of one 914,460-scf vacuum-insulated storage tank for liquid oxygen. Oxygen is generated by passing the liquid oxygen through two banks of atmospheric vaporizers that have a capacity of 5,800 scf per hour, or 4.1 million scf per month. The gas pressure is reduced to 90 psig, metered, and distributed to production facilities through a 2-inch overhead pipeline. Y-12 uses approximately 3.1 million scf of liquid oxygen annually (B&W 2002).

Liquid argon also is delivered to Y-12 by trailer truck. The Y-12 argon system consists of five vacuum-insulated liquid storage tanks and 12 atmospheric fin-type vaporizers. The storage tanks have a combined capacity of 30,737 gallons equivalent to approximately 3.4 million scf of gas. Gas is distributed to production areas and laboratories through a network of 2-inch and 3-inch pipes. Y-12 uses approximately 30 million scf of liquid argon annually (B&W 2002).

Y-12 receives and stores high-purity helium at 3,000 psig in a jumbo tube trailer. The helium facility includes a jumbo tube trailer with a capacity of 160,000 scf. In addition, 36,000 scf of helium at 1,800 psig is stored in a tube trailer and serves as emergency standby. The cylinder filling facility also houses the high pressure reducing station. Helium gas is distributed throughout Y-12 at 90 psig through a 2-inch overhead pipeline. Y-12 uses approximately 1.6 million scf of helium annually (B&W 2002).

The hydrogen supply at Y-12 consists of multi-cylinder tube trailers in open concrete block stalls. Four trailers are used on a rotating basis: one is in service, one is in ready standby, one is in emergency standby, and one is being refilled. Each trailer has a capacity of approximately 30,000 scf, providing a total capacity of 90,000 scf. Stored gas is pressurized at 2,000 psig. A two-stage pressure-reducing station delivers 50 psig gas through a meter. The hydrogen gas is then distributed through a 2-inch overhead pipeline to Y-12 and laboratory facilities. Y-12 uses approximately 0.3 million scf of hydrogen annually (B&W 2002).

4.3.9 Telecommunications

The four basic telecommunications systems within Y-12 are the Oak Ridge Federal Integrated Communications Network, the Cable Television Network (CATV), the unclassified Y-12 Intrasite Network, and the Y-12 Defense Programs Network (Y-12 DPNet). The Oak Ridge Federal Integrated Communications Network consists of copper cable distributed throughout Y-12 and within all its buildings; this network is used for telephone, FAX, and special data and alarm circuits and is operated by USWest. The CATV network consists of coaxial cable that is run to selected sites within Y-12. This network has the ability to send and/or receive video among the Oak Ridge plants, buildings at a given site, and some off-site locations. The unclassified Y-12 Intrasite Network consists of a fiber-optic backbone network with connectivity to most buildings within Y-12; this network uses routed Ethernet service to separate Internet protocol sub-nets for each building. The Y-12 DPNet is the Classified Services Network and presently consists of a coaxial broadband network and a fiber-optic backbone network with fiber-optic connectivity to most buildings within the protected areas of Y-12.

4.4 TRANSPORTATION AND TRAFFIC

Y-12 is located within 50 miles of three interstate highways: I-40, I-75, and I-81. Interstate 40, an east-west highway, extends from North Carolina to California. Interstate 75 is a north-south highway extending from Michigan to Florida. Interstate 81 is a north-south interstate extending from New York to Tennessee. Interstate 81 connects with I-40 east of Knoxville, and I-40 and

I-75 connect west of Knoxville near the city of Oak Ridge. In addition, TSRs 61, 162, and US25W at Clinton serve Y-12 transportation needs off-site (DOE 2001a). Primary roads on ORR serving Y-12 include TSRs 95, 58, 62, and 170 (Bethel Valley Road). Traffic on Bear Creek Road, north of Y-12, flows in an east-west direction and connects Scarboro Road on the east end of the plant with TSRs 95 and 58. Bear Creek Road has restricted access around Y-12 and is not a public thoroughfare. Bethel Valley Road is also closed to public access. The daily traffic numbers for various public roads at ORR are given in Table 4.4.1–1.

4.4.1 Transportation of Materials and Waste

Various chemicals and other materials being used for Y-12 operations are transported by truck using the above-addressed roads (TSRs 58, 62, 95, and 170; I-40, I-75 and I-81). Low level waste (LLW), hazardous waste, and municipal and solid wastes are generated by Y-12 operations. LLW is stored on-site in temporary storage facilities until eventual disposal off-site at a DOE or commercial site.

Table 4.4.1-1. Existing Average Daily Traffic Counts on ORR Serving Y-12.

Road	To	From	Average Daily Traffic Vehicles/day
TSR 58	TSR 95	I-40	13,970
TSR 95	TSR 62	TSR 58	25,150
TSR 62	TSR 170	N/A	31,620
TSR 170 (Bethel Valley Road)	TSR 62	N/A	9,350

Source: TDOT 2005.

4.5 GEOLOGY AND SOILS

4.5.1 Physiography

ORR lies in the Valley and Ridge Physiographic Province of eastern Tennessee. The topography consists of alternating valleys and ridges that have a northeast-southwest trend, with most ORR facilities occupying the valleys. In general, the ridges consist of resistant siltstone, sandstone, and dolomite units, and the valleys, which resulted from stream erosion along fault traces, consist of less-resistant shales and shale-rich carbonates (DOE 2001a).

The topography within ORR ranges from a low of 750 feet above mean sea level (AMSL) along the Clinch River to a high of 1,260 feet AMSL along Pine Ridge. Within ORR, the topographic relief between the valley floors and ridge crests is generally about 300 to 350 feet (DOE 2001a).

4.5.2 Geology

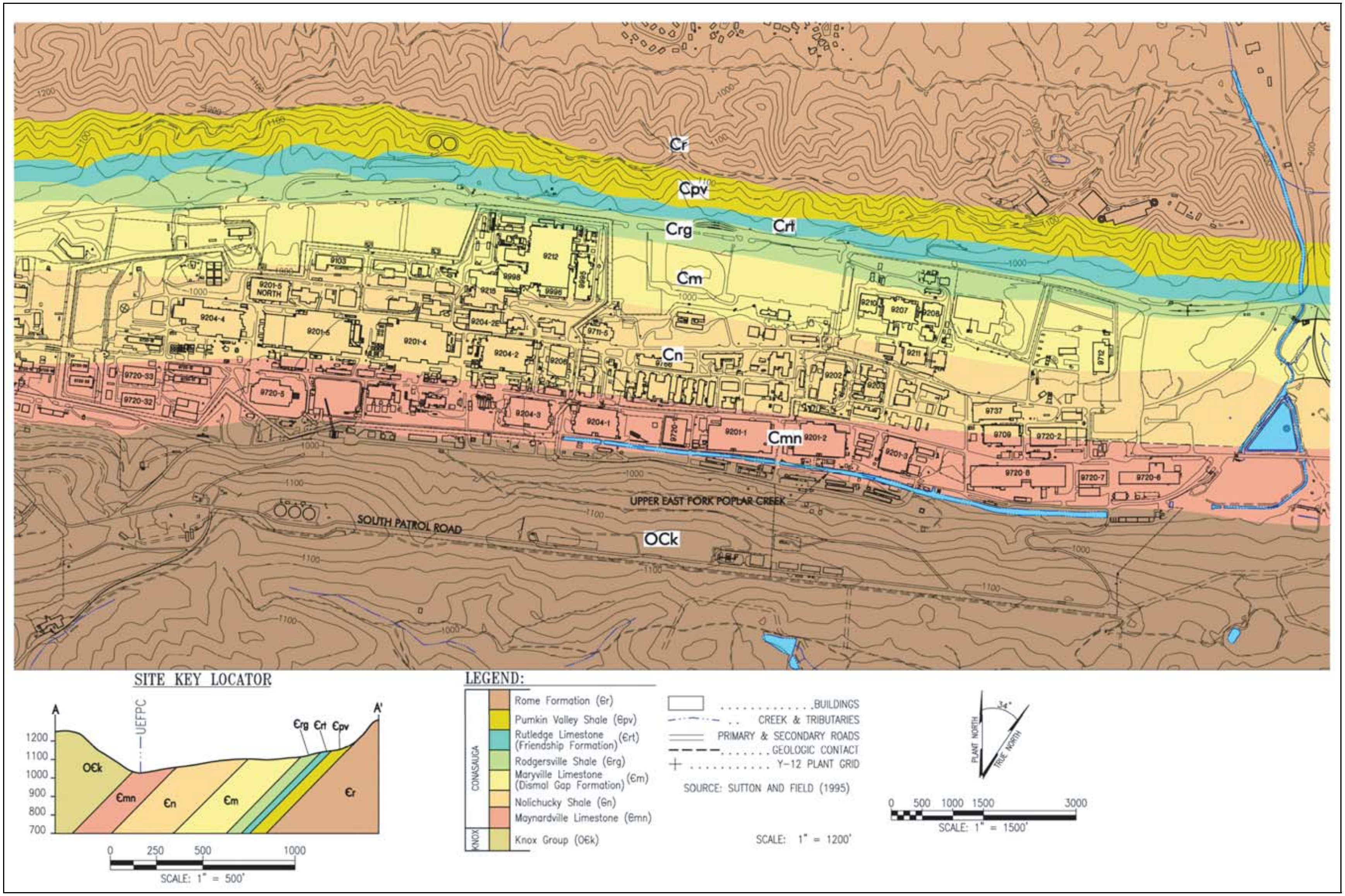
Several geologic formations are present in ORR area. A geologic map and stratigraphic column of the area are shown in Figures 4.5.2-1 and 4.5.2-2, respectively. The Rome Formation, which is present north of Y-12 and forms Pine Ridge, consists of massive to thinly bedded sandstones interbedded with minor amounts of thinly bedded, silty mudstones, shales, and dolomites. In ORR area, the stratigraphic thickness of the Rome Formation is uncertain because of the displacement caused by the White Oak Mountain Thrust Fault. White Oak Mountain

Thrust Fault and other major faults are displayed in Figure 4.5.2-3. The Conasauga Group, which underlies Bear Creek Valley, consists primarily of calcareous shales, siltstone, and limestone. The Knox Group, which is present immediately south of Y-12, can be divided into five formations of dolomite and limestone. All five formations have been identified at ORR. The Knox Group, which underlies Chestnut Ridge, is estimated to be approximately 2,400 feet thick. The Knox Group weathers to a thick, orange-red, clay residuum that consists of abundant chert and contains karst features (DOE 2001a).

Y-12 is located within Bear Creek Valley, which is underlain by Middle to Late Cambrian strata of the Conasauga Group (see Figure 4.5.2–1). The Conasauga Group consists primarily of highly fractured and jointed shale, siltstone, calcareous siltstone, and limestone in the site area. The upper part of the group is mainly limestone, while the lower part consists mostly of shale (LMER 1999a). This group can be divided into six discrete formations, which are, in ascending order, the Pumpkin Valley Shale, the Rutledge Limestone, the Rogersville Shale, the Maryville Limestone, the Nolichucky Shale, and the Maynardville Limestone. The thickness of each of these formations varies throughout the Conasauga Group.

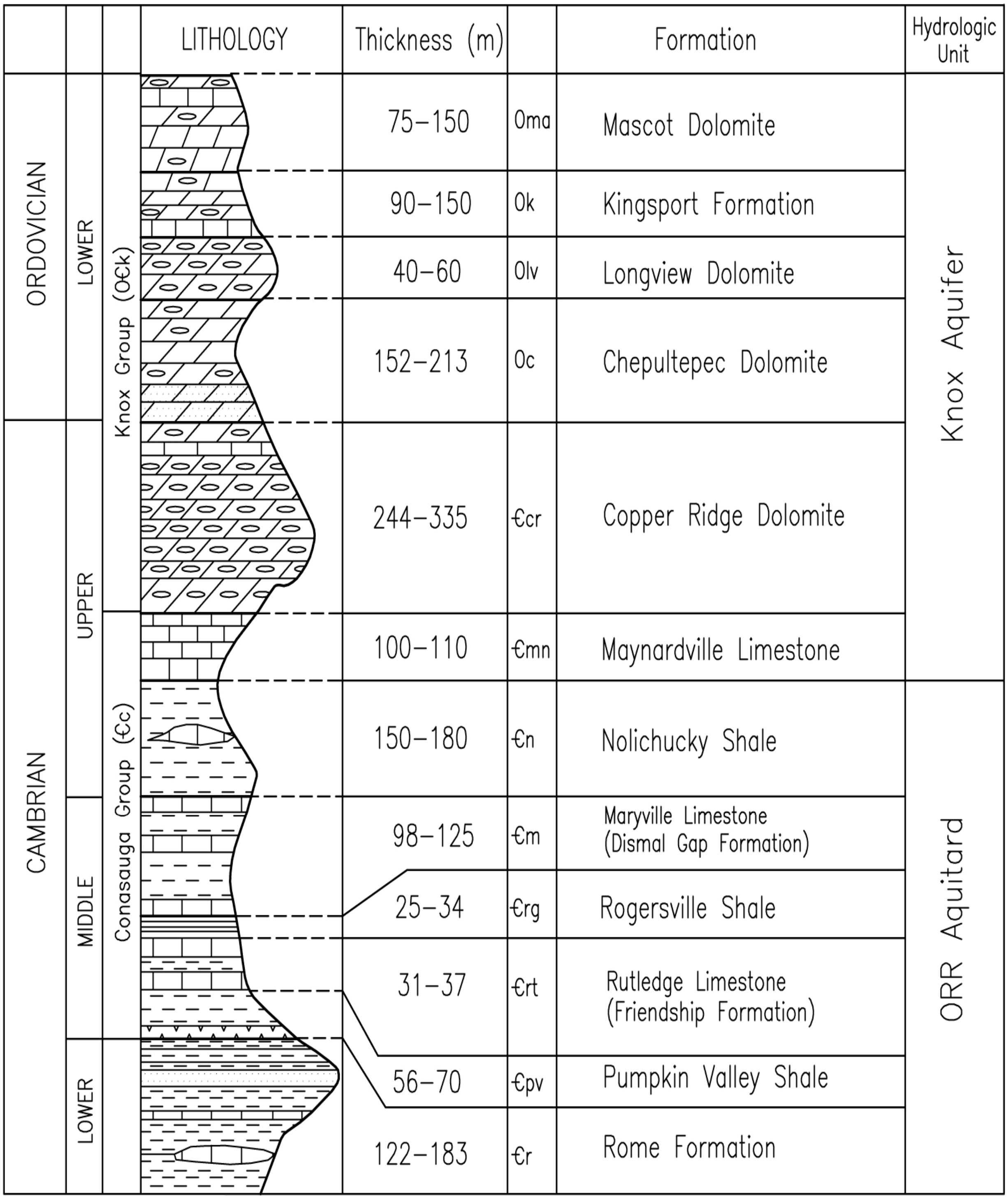
Y-12 is situated on carbonate bedrock such that groundwater flow and contaminant transport are controlled by solution conduits in the bedrock. These karst features, including large fractures, cavities, and conduits, are most widespread in the Maynardville Limestone and the Knox Group. These cavities and conduits are often connected and typically found at depths greater than approximately 1,000 feet (DOE 2001a).

Karst features are dissolutional features occurring in carbonate bedrock. Karst features represent a spectrum ranging from minor solutional enlargement of fractures to conduit flowpaths to caves large enough for a person to walk into. Numerous surface indications of karst development have been identified at ORR (Figure 4.5.2-3). Surface evidence of karst development includes sinking streams (swallets) and overflow swallets, karst and overflow springs, accessible caves, and numerous sinkholes of varying size. In general, karst appears most developed in association with the Knox Group carbonate bedrock, as the highest density of sinkholes occurs in this group (DOE 2001a).



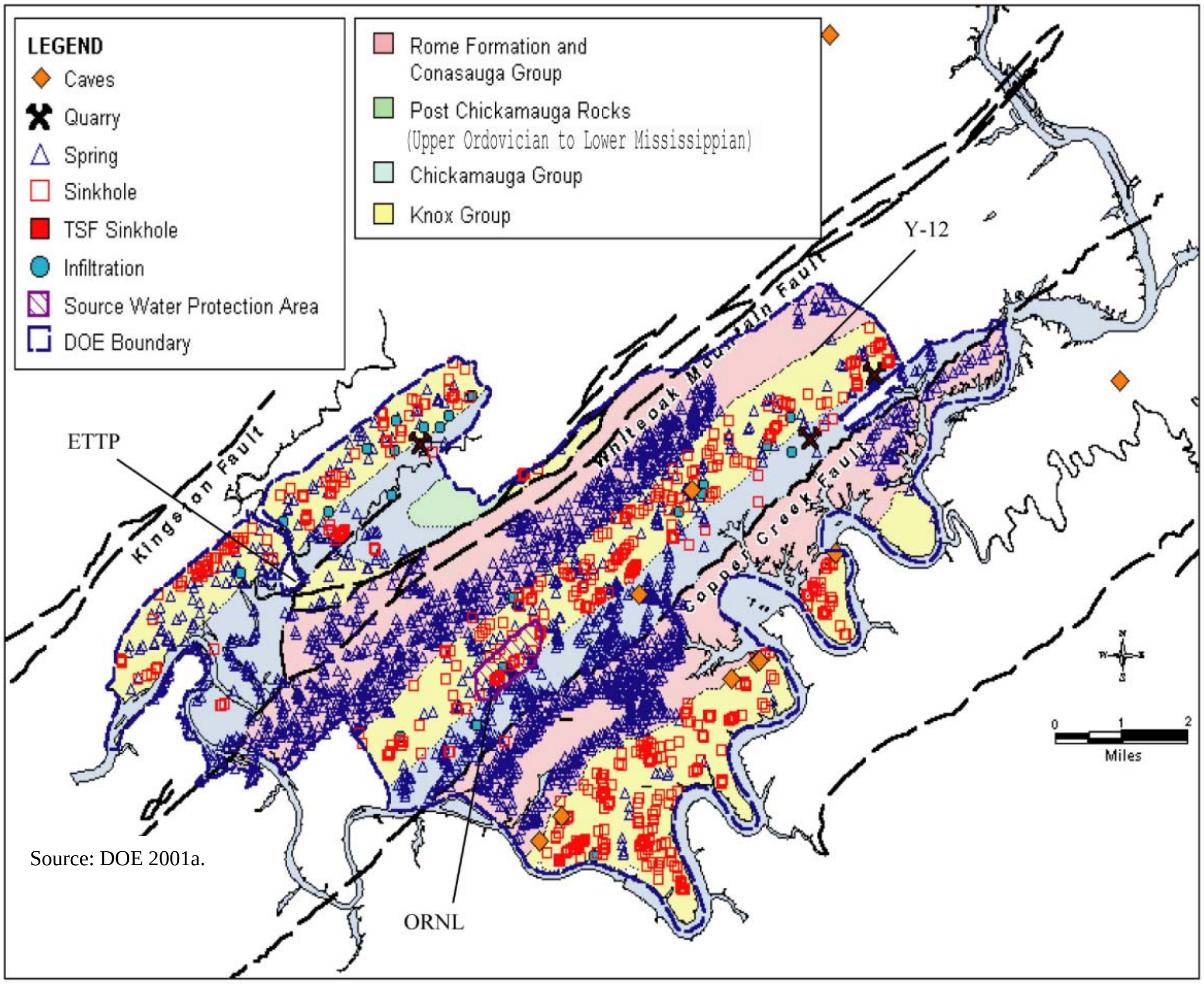
Source: DOE 2001a.

Figure 4.5.2-1. Generalized Bedrock Map for Y-12.



Source: DOE 2001a.

Figure 4.5.2-2. Generalized Stratigraphic Column in the Y-12 Characterization Area.



Source: LMER 1999a

Figure 4.5.2-3. Geology and Karst Features.

Y-12 is located in the Upper East Fork Poplar Creek (UEFPC) watershed. Unconsolidated materials overlying bedrock in the UEFPC watershed include alluvium (stream-laid deposits), colluvium (material transported downslope), man-made fill, fine-grained residuum from the weathering of the bedrock, saprolite (a transitional mixture of fine-grained residuum and bedrock remains), and weathered bedrock. The overall thickness of these materials in the Y-12 area is typically less than 40 feet. In the undeveloped areas of Y-12, the saprolite retains primary texture features of the unweathered bedrock including fractures.

4.5.3 Seismology

The Oak Ridge area lies in seismic zones 1 and 2 of the Uniform Building Code, indicating that minor to moderate damage could typically be expected from an earthquake. Y-12 is cut by many inactive faults formed during the late Paleozoic Era and there is no evidence of capable faults in the immediate area of Oak Ridge, as defined by 10 CFR Part 100 (surface movement within the past 35,000 years or movement of a recurring nature within the past 500,000 years). The nearest capable faults are approximately 300 miles west of ORR in the New Madrid Fault zone (DOE

2005i)). Since the New Madrid earthquakes of 1811 to 1812, at least 26 other earthquakes with a Modified Mercalli intensity (see Table 4.5.3-1), herein referred to as intensity, of III to VI have been felt in the Oak Ridge area, the majority of these having occurred in the Valley and Ridge Province. The Charleston, South Carolina, earthquake of 1886 had an intensity of VI at Oak Ridge, and an earthquake centered in Giles County, Virginia, in 1886 produced an intensity of IV to V at Oak Ridge. One of the closest seismic events to ORR occurred in 1930; its epicenter was 5 miles from ORR (DOE 2001a).

Table 4.5.3-1. The Modified Mercalli Intensity Scale of 1931, With Approximate Correlations to Richter Scale and Maximum Ground Acceleration.[a]

Modified Mercalli Intensity[b]	Observed Effects of Earthquake	Approximate Richter Magnitude[c]	Maximum Ground Acceleration[d]
I	Usually not felt	<2	negligible
II	Felt by persons at rest, on upper floors or favorably placed	2-3	<0.003 g
III	Felt indoors; hanging objects swing; vibration like passing of light truck occurs; might not be recognized as earthquake	3	0.003 to 0.007 g
IV	Felt noticeably by persons indoors, especially in upper floors; vibration occurs like passing of heavy truck; jolting sensation; standing automobiles rock; windows, dishes, and doors rattle; wooden walls and frames may creak	4	0.007 to 0.015 g
V	Felt by nearly everyone; sleepers awaken; liquids disturbed and may spill; some dishes break; small unstable objects are displaced or upset; doors swing; shutters and pictures move; pendulum clocks stop or start	4	0.015 to 0.03 g
VI	Felt by all; many are frightened; persons walk unsteadily; windows and dishes break; objects fall off shelves and pictures fall off walls; furniture moves or overturns; weak masonry cracks; small bells ring; trees and bushes shake	5	0.03 to 0.09 g
VII	Difficult to stand; noticed by car drivers; furniture breaks; damage moderate in well built ordinary structures; poor quality masonry cracks and breaks; chimneys break at roof lines; loose bricks, stones, and tiles fall; waves appear on ponds and water is turbid with mud; small earthslides, large bells ring	6	0.07 to 0.22 g
VIII	Automobile steering affected; some walls fall; twisting and falling of chimneys, stacks, and towers; frame houses shift if on unsecured foundations; damage slight in specially designed structures, considerable in ordinary substantial buildings; changes in flow of wells or springs; cracks appear in wet ground and steep slopes	6	0.15 to 0.3 g
IX	General panic; masonry heavily damaged or destroyed; foundations damaged; serious damage to frame structures, dams and reservoirs; underground pipes break; conspicuous ground cracks	7	0.3 to 0.7g
X	Most masonry and frame structures destroyed; some well built wooden structures and bridges destroyed; serious damage to dams and dikes; large landslides; rails bent	8	0.45 to 1.5 g
XI	Rails bent greatly; underground pipelines completely out of service	9	0.5 to 3 g
XII	Damage nearly total; large rock masses displaced; objects thrown into air; lines of sight distorted	9	0.5 to 7 g

Source: NEIC 2005.
a – This table illustrates the approximate correlation between the Modified Mercalli intensity scale, the Richter scale, and maximum ground acceleration.
b – Intensity is a unit less expression of observed effects.
c – Magnitude is an exponential function of seismic wave amplitude, related to the energy released.
d – Acceleration is expressed in relation to the earth's acceleration due to earth's gravity (g).

This earthquake in 1930 had an estimated intensity of VII at the epicenter and an approximate intensity of V to VI in the Oak Ridge area. Maximum horizontal ground surface accelerations of 0.06 to 0.30 due to gravity at ORR are estimated to result from an earthquake that could occur once every 500 to 2,000 years.

An earthquake that occurred in 1973 in Maryville, Tennessee, 21 miles southeast of ORR, had an estimated intensity of V to VI in the Oak Ridge area (DOE 2001a). In 1987, a significant earthquake occurred approximately 30 miles from ORR with an intensity of VI. In addition, since 1995, two earthquakes with an intensity of III and two earthquakes with an intensity of V occurred within 100 miles of ORR (NEIC 2005). In 1998, one earthquake that had an intensity of III occurred approximately 1.9 miles from ORR. There have been 13 earthquakes in the last 160 years that, at their epicenter, produced an intensity of VI, and one of intensity VII within 100 miles of ORR (NEIC 2005).

4.5.4 Soils

Y-12 is located in Bear Creek Valley at the eastern boundary of ORR. Bear Creek Valley lies on well- to moderately well-drained soils underlain by shale, siltstone, and silty limestone. Developed portions of the valley are designated as urban land. Soil erosion from past land uses has ranged from slight to severe. Erosion potential is very high in those areas that have been eroded in the past with slopes greater than 25 percent. Erosion potential is lowest in the nearly flat-lying permeable soils that have a loamy texture. Additionally, shrink-swell potential is low to moderate and the soils are generally acceptable for standard construction techniques (DOE 2001a).

Y-12 lies on soils of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskinghum associations (DOE 2001a). Due to extensive cut-and-fill grading during the construction of Y-12, very few areas within the UEFPC watershed have a sequence of natural soil horizons. Soil erosion due to past land use has ranged from slight to severe. Finer textured soils of the Armuchee-Montevallo-Hamblen association have been designated as prime farmland when drained (DOE 2001a).

Sediment Sampling. Historical data have shown that mercury, polychlorinated biphenyls (PCBs), and isotopes of uranium are present at detectable levels in sediment. Therefore, as a best management practice, Y-12 maintains an annual sampling program to determine whether these constituents are accumulating in the sediments of EFPC and Bear Creek as a result of Y-12 discharges. The monitoring results indicate that the radiological levels, including isotopes of uranium and thorium, have not significantly changed in the past five years (DOE 2008).

In 2004, the Tennessee Department of the Environment and Conservation (TDEC) Environmental Monitoring and Compliance Program sampled sediments at 34 sites, 11 of which were located on the Clinch River and two on the Tennessee River. The other 21 sites were located on tributaries of the Clinch River draining from ORR; these are considered “exit pathways.” None were on a stream, such as White Oak Creek or Poplar Creek that has already been identified as contaminated and currently monitored by DOE. Samples were analyzed for organic, inorganic, and radiological contaminants. The results were compared with standards, known as Preliminary Remediation Goals, established for ORR based on guidance from the U.S. Environmental Protection Agency (EPA). These standards were used because there are no regulatory guidelines for sediment quality, either at the state or federal level. The sediments met the standards for recreational use, meaning that people can safely engage in activities such as fishing, hiking, and playing at these locations (TDEC 2005a).

4.6 CLIMATE, AIR QUALITY, AND NOISE

4.6.1 Climate

The City of Oak Ridge lies in a valley between the Cumberland and Great Smoky Mountain ranges and is bordered on two sides by the Clinch River. The Cumberland Mountains are located about 10 miles to the northwest; and the Great Smoky Mountains are 32 miles to the southeast (DOE 2005a). The Region of Influence (ROI) specific to air quality is primarily the Bear Creek Valley for Y-12. This valley is bordered by ridges that generally confine facility emissions to the valley between the ridges.

The climate of the region may be broadly classified as humid subtropical and is characterized by significant temperature changes between summer and winter. The average temperature for the Oak Ridge area during 2006 was 59.5°F compared with a 30 year mean temperature (1976–2005) of 57.9°F. The coldest month is usually January, with temperatures averaging about 36.1°F. July tends to be the warmest month, with average temperatures of 77.5° F (DOE 2008).

Average annual precipitation in the Oak Ridge area for the 30 year period from 1976 to 2005 was 54.1 inches, including about 10.8 inches of snowfall. Total rainfall during 2006, measured at the Oak Ridge meteorological tower, was 48.6 inches, and total 2006 snowfall was 3.5 inches. This marks the third consecutive year with below-normal precipitation (DOE 2008).

In 2007 wind speeds at ORNL Tower C (MT2) measured at 32.8 feet above ground level averaged 2.7 miles per hour. This value increased to about 6.5 miles per hour for winds at 328 feet above the ground (about the height of local ridgetops). The local ridge-and-valley terrain reduces average wind speeds at valley bottoms, resulting in frequent periods of nearly calm conditions, particularly during clear, early morning hours (DOE 2008).

Detailed information on the climate of the Oak Ridge area is available in *Oak Ridge Reservation Physical Characteristics and Natural Resources* (DOE 2008).

4.6.2 Air Quality

Air quality laws and regulations have been established to protect the public from harmful effects of air pollution. These rules take several forms. In some cases, the goal is to designate acceptable levels of pollution in ambient air, as in the establishment of ambient air quality standards (AAQSs). Other regulations establish limits on air pollutant emission sources or activities to reduce their impact. Still others establish jurisdictional authority to regulate air pollutant emission sources and enforce laws and regulations.

The following sections provide a general summary of air protection programs and ambient pollutant levels in the environs of Y-12:

- Section 4.6.2.1 highlights the regional air quality and the regulatory authorities that oversee air protection programs.
- Section 4.6.2.2 details Y-12's nonradiological air pollutant sources and emissions and the programs developed to manage these sources.
- Section 4.6.2.3 discusses radiological air quality, providing information on Y-12's effluent monitoring and ambient air sampling programs, radionuclide emission estimates, as well as dose calculations for maximally exposed receptors and the populace.

4.6.2.1 *Regional Air Quality*

As directed by the *Clean Air Act* (CAA) of 1970 (42 *United States Code* [U.S.C.] §7401), EPA has set the National Ambient Air Quality Standards (NAAQS) for several criteria pollutants to protect human health and welfare (40 CFR Part 50). These pollutants include particulate matter with an aerodynamic diameter less than or equal to 10 microns in diameter (PM_{10}), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), lead (Pb), and ozone. In 1997 the EPA finalized new air quality standards for ozone and $PM_{2.5}$ (particles with an aerodynamic diameter less than or equal to 2.5 microns). Despite a series of legal challenges in the U.S. Court of Appeals, in February 2001 the U.S. Supreme Court upheld the NAAQS for $PM_{2.5}$ and ozone. Based on the ambient (outdoor) levels of the criteria pollutants, EPA evaluates individual Air Quality Control Regions (AQCRs) to establish whether or not they satisfy the NAAQS. Areas that satisfy the NAAQS are classified as attainment areas, and areas that exceed the NAAQS for a particular pollutant are classified as non-attainment areas for that pollutant.

ORR is located in Anderson and Roane Counties in the Eastern Tennessee-Southwestern Virginia AQCR 207 and Y-12 is completely within Anderson County. The EPA has designated Anderson County as a basic non-attainment area for the 8-hour ozone standard, as part of the larger Knoxville basic 8-hour ozone non-attainment area that encompasses several counties; and for $PM_{2.5}$ based on a revision to the standards (EPA 2005a). For all other criteria pollutants for which EPA has made attainment designations, existing air quality in the greater Knoxville and Oak Ridge areas is in attainment with the NAAQS.

Nonradiological air quality is defined by the concentration of various pollutants in the atmosphere expressed in units of parts per million (ppm) or in micrograms per cubic meter ($\mu g/m^3$). The standards and limits set by Federal and state regulations are provided in concentrations averaged over incremental time limits (e.g., 30 minutes, 1 hour, 3 hours). The averaging times shown in the tables in this section correspond to the regulatory averaging times for the individual pollutants. Table 4.6.2.1–1 presents the NAAQS and Tennessee State AAQS.

Table 4.6.2.1-1. National and Tennessee Ambient Air Quality Standards.

Pollutant	Averaging Time	NAAQS (μg/m^3)	Tennessee Standard (μg/m^3)
SO_2	Annual[1]	80 (0.030 ppm)	80 (0.030 ppm)
	24-Hour[2]	365 (0.14 ppm)[a]	365 (0.14 ppm)[a]
	3-Hour[2]	1,300 (0.5 ppm)[a]	1,300 (0.5 ppm)[a]
PM_{10}	Annual[1]	none	50
	24-Hour[2]	150[b]	150
$PM_{2.5}$	Annual[1]	15[c]	none
	24-Hour[2]	none	none
Suspended	Annual[1]	none	75
Particulates	24-Hour[2]	none	260
CO	8- Hour[2]	10,000 (9 ppm)[a]	10,000 (9 ppm)[a]
	1- Hour[2]	40,000 (35 ppm)[a]	40,000 (35 ppm)[a]
Ozone	8- Hour[3]	157 (0.08 ppm)[d]	none
	1- Hour[2]	235 (0.12 ppm)[e]	235 (0.12 ppm)[e]
NO_2	Annual[1]	100 (0.053 ppm)	100 (0.05 ppm)
Lead	Rolling 3-Month Average	0.15	none
Lead	Quarter[1]	1.5	1.5
Hydrogen Fluoride	30 days	none	1.2 (1.5 ppm)[a]
	7 days	none	1.6 (2.0 ppm)[a]
	24-Hour	none	2.9 (3.5 ppm)[a]
	12-Hour	none	3.7 (4.5 ppm)[a]

Source: EPA 2007 and DOE 2001a.
Note: New NAAQS for lead, 8-hour ozon, and $PM_{2.5}$ have not been implemented. Newer standards have been promulgated.
Key:
a – Not to be exceeded more than once per year.
annual PM_{10} standard in 2006 (effective December 17, 2006).
b – Not to be exceeded more than once per year on average over 3 years.
c – To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 μg/m^3.
d – To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
e – (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$ 1.
(b) As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact (EAC) Areas.

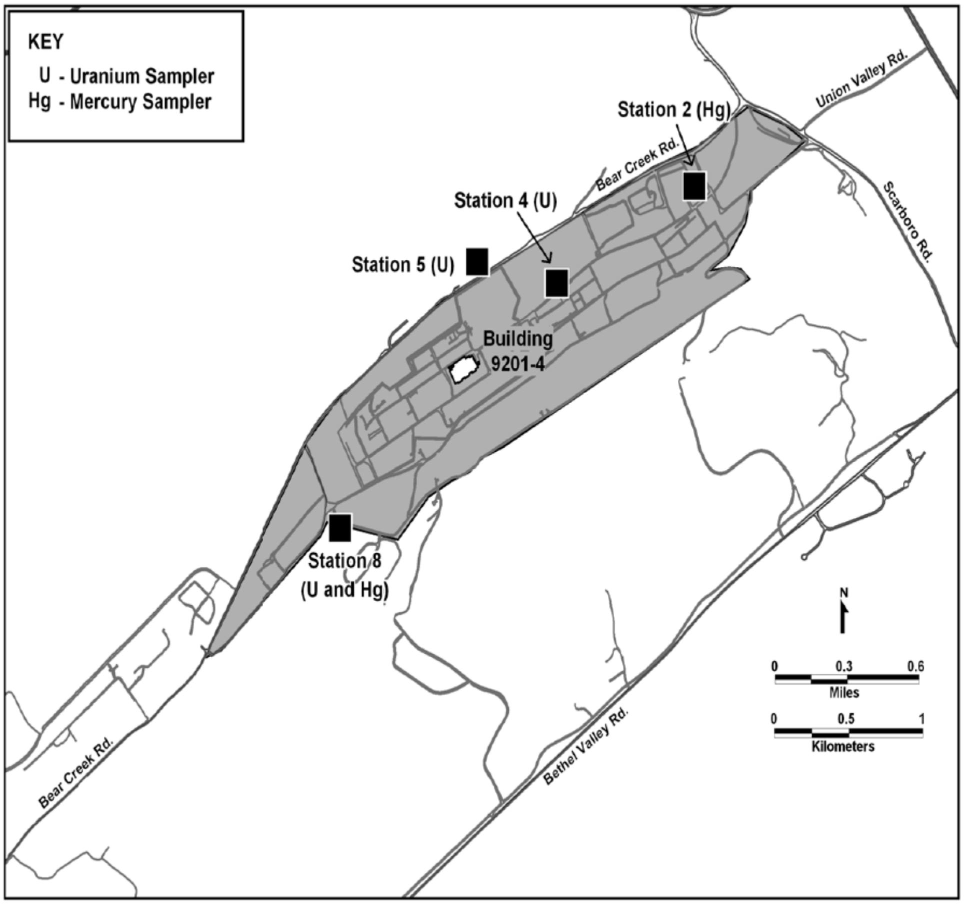
1. Arithmetic mean.
2. Block average.
3. Rolling Average.

μg/m^3 = micrograms per cubic meter
ppm = parts per million
ppb = parts per billion
HF = hydrogen fluoride

4.6.2.2 *Air Quality and Emissions on the Oak Ridge Reservation*

Airborne discharges from DOE Oak Ridge facilities, both radioactive and nonradioactive, are subject to regulation by the EPA, the TDEC Division of Air Pollution Control, and DOE Orders. Y-12 has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne emissions satisfy all regulatory requirements and do not adversely affect ambient air quality. Common air pollution control devices employed on ORR include exhaust gas scrubbers, baghouses, and other exhaust filtration systems designed to remove contaminants from exhaust gases before release to the atmosphere. Process modifications and material substitutions are also made to minimize air emissions. In addition, administrative control plays a role to regulate emissions.

The TDEC performs ambient air monitoring throughout the State of Tennessee and within the vicinity of ORR. The locations of the ambient monitoring stations at Y-12 are shown in Figure 4.6.2.2-1. Concentration of regulated pollutants observed during 1999 at locations near ORR is presented in Table 4.6.2.2-1. As the data indicate, only the 8-hour ozone concentrations exceed the standards, which is typical for all of Anderson County. Sample results show that ORR operations have an insignificant effect on local air quality.



Source: DOE 2008.

Figure 4.6.2.2-1. Locations of Ambient Monitoring Stations at Y-12.

Table 4.6.2.2-1. Tennessee Department of Environment and Conservation Ambient Air Monitoring Data in the Vicinity of Y-12/Oak Ridge Reservation.

Pollutant	Averaging Time	Air Quality standard (μg/m^3)	Measured Concentration (μg/m^3)
SO_2	3-hr	1,300	398[1]
	24-hr	365	47.1[2]
	Annual	80	10.5[2]
PM_{10}	Annual[1]	50	25.4[2]
	24-Hour[2]	150	77[1]

Table 4.6.2.2-1. Tennessee Department of Environment and Conservation Ambient Air Monitoring Data in the Vicinity of Y-12/Oak Ridge Reservation (*continued*).

Pollutant	Averaging Time	Air Quality standard (μg/m^3)	Measured Concentration (μg/m^3)
$PM_{2.5}$	Annual[1]	15	No Data
	24-Hour[2]	65	48.2[1]
CO	1-hr	40,000	12,712
	8-hr	10,000	4,466[2]
Ozone	1-hr	235	225[1]
	8-hr	157	188.4[1]
NO_2	Annual	100	15.1[1]
Lead	Calendar quarterly mean	1.5	0.009[1]
Gaseous Fluorides (as HF)	30-day	1.2	No Data
	7-day	1.6	0.114[1]
	24-hr	2.9	No Data
	12-hr	3.7	No Data

[1] TDEC 2005c.
[2] DOE 2001a.

The release of nonradiological contaminants into the atmosphere at Y-12 occurs as a result of plant production, maintenance, waste management operations, and steam generation. Most process operations are served by ventilation systems (DOE 2008).

In calendar year (CY) 2006, Y-12 implemented complete compliance and reporting activities for its first Major Source (Title V) Operating Air Permit. The permit covers 37 air emission sources and more than 100 air emission points. Other emission sources at Y-12 are categorized as being insignificant and exempt from air permitting. Under the Title V operating permit for the complex, sampling, continuous monitoring, and record keeping of key process parameters are recorded and reported to TDEC in quarterly, semiannual, and annual reports (DOE 2008).

Approximately three-fifths of the permitted air sources release primarily nonradiological contaminants. The remaining two-fifths of the permitted sources process primarily radiological materials. TDEC air permits for the nonradiological sources do not require stack sampling or monitoring except for the opacity and NOx monitors used at the steam plant to ensure compliance with visible emission standards and ozone season emission limits, respectively. For nonradiological sources where direct monitoring of airborne emissions is not required, or is required infrequently, monitoring of key process parameters is done to ensure compliance with all permitted emission limits (DOE 2008).

The primary source of criteria pollutants at Y-12 is the steam plant, where coal and natural gas are burned (DOE 2008). Actual and allowable emissions from the steam plant are shown in Table 4.6.2.2-2; actual emissions are well below allowable emissions.

Table 4.6.2.2-2. Actual vs. Allowable Air Emissions from the Oak Ridge Y-12 Steam Plant, 2007.

Pollutant	Emissions (tons/year)[a]		Percentage of allowable
	Actual	Allowable	
Particulate	28	945	3.0
Sulfur dioxide	2,038	20,803	9.8
Nitrogen oxides[a]	437	5,905	7.4
Nitrogen oxides (ozone season only)	133.5[c]	232	57.5
Volatile organic compounds[b]	2.3	41	5.6
Carbon monoxide[b]	18	543	3.3

Source: DOE 2008.
a – 1 ton = 907.2 kg.
b – When there is no applicable standard or enforceable permit condition for some pollutants, the allowable emissions are based on the maximum actual emissions calculation as defined in Tennessee Department of Environment and Conservation Rule 1200-3-26-.02(2)(d)3 (maximum design capacity for 8760 hr/year). The emissions for both the actual and allowable emissions were calculated based on the latest EPA compilation of air pollutant emission factors. (EPA 1995a and 1998. *Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume 1: Stationary Point and Area Sources.* U.S. Environmental Protection Agency, Research Triangle Park, N.C. January 1995 and September 1998.)
c – Monitored emissions

Air Conformity. Submittal of a State Implementation Plan (SIP) and adherence to the General Conformity Rule are related requirements to ensure the NAAQS are satisfied. The SIP identifies strategies such as emissions budgets, emissions limitations, and emission reduction plans to maintain or improve air quality and enforce the NAAQS. The General Conformity Rule, promulgated by the CAA, requires that the federal government may not engage, support, or provide financial assistance for permit or license, or approve any activity that fails to conform to the SIP.

Conformity is designed to ensure that federal plans, programs, and projects are consistent with the SIP and the local clean air plan, and that they not contribute to air quality degradation that would adversely affect state efforts to attain or maintain the NAAQS. Therefore, rules for conformity are not limited to stationary sources, which require air district permits, but must consider total project emissions (direct and indirect), including emissions from personal and work vehicles, construction equipment, demolition equipment and activities, and non-permitted sources.

The General Conformity evaluation process for a proposed federal action involves two distinct steps: applicability and determination. Applicability is an assessment of whether a proposed action is subject to the Conformity Rule. If the Conformity Rule is applicable for the proposed action, then a Conformity Determination is required.

There are two criteria to assess Applicability. First, do the total direct and indirect emissions for the proposed action in a Non-attainment or maintenance area exceed the 40 CFR Part 51.853 emission thresholds, and second, are the emissions from the proposed action regionally significant (note: 40 CFR Part 51.850 et seq. is adopted by reference in TDEC 1200-3-34-.02). A pollutant emission is considered regionally significant if it represents 10 percent or more of a non-attainment area or maintenance area emission budget for that pollutant (as identified in the SIP).

Conformity is assessed on a pollutant-by-pollutant basis. Threshold emission levels are established for each criteria pollutant based on the attainment or maintenance status of the region of interest. The entire state of Tennessee is located within the ozone transport region. For Anderson County, which is a Subpart 1 non-attainment area for ozone, the emission thresholds for NOx and Volatile Organic Compounds (VOCs) are 100 tons per year each. Anderson County is also a Non-attainment area for $PM_{2.5}$, and the emission threshold for $PM_{2.5}$ and its precursors is 100 tons per year.

Conformity requirements do not apply to continued or recurrent activities such as permit renewals where activities conducted will be similar in scope and operation to activities currently in place. In addition, before emissions can be considered in the conformity evaluation, they must satisfy the definition of reasonably foreseeable as cited in Tennessee Code §200-3-34-.02.

> *Reasonably foreseeable emissions are projected future indirect emissions that are identified at the time the conformity determination is made; the location of such emissions is known and the emissions are quantifiable, as described and documented by the Federal agency based on its own information and after reviewing any information presented to the Federal agency.*

EPA's general conformity guidance clarifies that "reasonably foreseeable" should include both direct and indirect projected future emissions, not just indirect future emissions. The Y-12 National Security Complex must comply with the conformity requirements as promulgated in the CAA and TDEC regulation 1200-3-34-.02. Conformity must consider comprehensive emissions estimates associated with the proposed action, including construction, demolition, vehicular emissions, and stationary sources.

Air Monitoring. With respect to hazardous air pollutants (HAPs), the TDEC, Department of Energy Oversight Division's HAPs Monitoring Program was developed to provide continued independent monitoring of hazardous metals in ambient air at Y-12. Monitoring with high volume air samplers was conducted for arsenic, beryllium, cadmium, total chromium, lead, nickel, and uranium as a metal. Although a number of potential sources that have the potential to emit hazardous metals are located on and around Y-12, the results of the 2004 monitoring conducted by TDEC at Y-12 indicate no apparent elevated levels for HAPs metals of concern. Concentrations for all metals of concern were below guidelines, and/or detection limits of laboratory analysis (TDEC 2005b).

Mercury. Y-12's ambient air monitoring program for mercury was established in 1986 as a best management practice. The objectives of the program are to maintain a database of mercury concentration in ambient air, to track long term spatial and temporal trends in ambient mercury vapor, and to demonstrate protection of the environment and human health from releases of mercury at Y-12 to the atmosphere. Originally, four monitoring stations were operated at Y-12, including two within the former mercury-use area. The two atmospheric mercury monitoring stations currently operating at Y-12, Ambient Air Station No. 2 (AAS2) and Ambient Air Station No. 8 (AAS8), are located near the east and west boundaries of Y-12, respectively. Since their establishment in 1986, AAS2 and AAS8 have monitored mercury in ambient air continuously with the exception of short periods of downtime because of electrical or equipment outages. In addition to the Y-12 monitoring stations, a control or reference site (Rain Gauge No. 2) was operated on Chestnut Ridge in the Walker Branch Watershed for a 20-month period in 1988 and 1989 to establish a reference concentration at that time (DOE 2008).

At the two current monitoring sites, airborne mercury vapor is collected by pulling ambient air through a sampling train consisting of a Teflon filter, a flow-limiting orifice, and an iodated-charcoal sampling trap. The flowlimiting orifice restricts airflow through the sampling train to approximately 1 liter per minute. Actual flow rates are measured weekly in conjunction with trap changeout with a calibrated Gilmont flowmeter. The charcoal in each trap is analyzed for total mercury using cold vapor atomic fluorescence after acid digestion. Average concentration of mercury vapor in the ambient air for each 7-day sampling period is calculated by dividing the total mercury per trap by the volume of air pulled through the charcoal trap during the corresponding 7-day period (DOE 2008).

As reported in previous annual environmental reports, average ambient mercury concentration at the monitoring sites has declined significantly since the late 1980s, with average mercury vapor concentration at AAS8 declining almost tenfold and at AAS2 approximately threefold. Recent average annual concentration at the two boundary stations are comparable to concentrations measured in 1988 and 1989 at the Chestnut Ridge reference site but slightly elevated above concentrations reported for continental background (approximately 0.002 $\mu g/m^3$). Average mercury concentration measured at the AAS2 site during 2006 was 0.0036 $\mu g/m^3$ (Number of samples (N) =51; Standard Error (S.E.) = ±0.0002) and has remained unchanged since year 2002 when it was slightly higher at 0.0040 $\mu g/m^3$. At monitoring station AAS8, located at the west end of Y-12, the average concentration for CY 2006 was 0.0058 $\mu g/m^3$ (N = 52; S.E. = ±0.0004) and represents a slight, but not significant (Student's *t*-test), increase over the average concentration for 2004 and 2005. Though the difference in the average concentration from 2004 to 2006 is not significant, there has been an upward trend in mercury concentration at AAS8 dating back several years. This upward trend may reflect a temporary increase in ambient concentrations at AAS8 because of increased demolition and excavation in the western end of Y-12 as part of the Y-12 infrastructure reduction program. A very large increase in mercury concentration at AAS8 was observed in the late 1980s and was thought to be related to disturbances of mercury contaminated soils and sediments during the Perimeter Intrusion Detection and Assessment System and utility restoration projects in progress then. Mercury concentrations measured at AAS8 should continue to be tracked closely, especially if demolition and excavation occur in the old mercury-use areas of Y-12 as part of infrastructure reduction. Significant increases may warrant the reestablishment of sites within the old mercury-use areas and a reassessment of reference concentrations at the former reference site on Chestnut Ridge. Table 4.6.2.2-3 summarizes the 2006 mercury results and the results from the 1986 through 1988 period for comparison (DOE 2008).

In conclusion, 2006 average mercury concentrations at the two mercury monitoring sites are comparable to reference levels measured for the Chestnut Ridge reference site in 1988 and 1989. Measured concentrations continue to be well below current environmental and occupational health standards for inhalation exposure to mercury vapor; for example, the National Institute for Occupational Safety and Health recommended exposure limit of 50 $\mu g/m^3$ (time weighted average for up to a 10-hour workday, 40-hour work week), the American Conference of

Governmental Industrial Hygienists workplace threshold limit value of 25 μg/m^3 as a time weighted average for a normal 8-hour workday and 40-hour workweek, and the current EPA reference concentration (0.3 μg/m^3) for elemental mercury for daily inhalation exposure without appreciable risk of harmful effects during a lifetime (DOE 2008). Table 4.6.2.2-3 shows the ambient mercury vapor concentration from the results of the Y-12 Ambient Air Monitoring Program (DOE 2008).

Table 4.6.2.2-3. Results for the Y-12 Mercury in Ambient Air Monitoring Program 2006.

	Mercury Vapor Concentration (μg/m^3)			
Ambient air monitoring stations	**2007 Average**	**2007 Maximum**	**2007 Minimum**	**1986–1988[a] Average**
AAS2 (east end of Y-12)	0.0036	0.0066	0.0010	0.010
AAS8 (west end of Y-12)	0.0057	0.0143	0.0017	0.033
Reference Site, Rain Gauge No.2 (1988[b])	N/A	N/A	N/A	0.006
Reference Site, Rain Gauge No.2 (1988[c])	N/A	N/A	N/A	0.005

Source: DOE 2008.
a – Period in late-80s with elevated ambient air Hg levels.
b – Data for period from February 9 through December 31, 1988.
c – Data for period from January 1 through October 31, 1989.

Fluorides. The State of Tennessee regulation 1200-3-3-.01 does not define primary standards (affecting public health) for hydrogen fluoride. However, secondary standards (affecting public welfare, i.e., vegetation, aesthetics) are defined in 1200-3-3-.02 for gaseous fluorides expressed as hydrogen fluoride. In anticipation of the startup of the hydrogen fluoride system during CY 2005, arrangements were made to monitor the community adjacent to Y-12 for the presence of fluorides (DOE 2008).

The monitoring methodology chosen for use is in accordance with the American Society for Testing and Materials (ASTM) Standard D3266, which designates the use of a dual-tape sampler. The time period over which the monitoring occurs is 7 days, and results in a total of 56 samples being generated per week (3 hours per sample, 8 samples per day; 7 days per week). The results represent a composite (seven-day average) and serve to provide background information on the presence of fluorides in the surrounding area. The regulatory secondary standard for the seven-day average is 1.6 μg/m^3. Actual monitoring data indicate a maximum of 0.048 μg/m^3, which means concentrations are more than ten times less than the regulatory standard (DOE 2008).

Ozone-Depleting Substances Phase-Out Efforts. Significant progress has been made in eliminating use of Class I and Class II ozone-depleting substances at Y-12, and a number of projects have been identified to further reduce ozone-depleting substance uses. The *Y-12 Complex Ozone Depleting Substances (ODS) Phase-Out and Management Plan* (Y-12 2003), was issued in 2003 and provides a complete discussion of requirements and compliance activities at Y-12. Y-12 personnel continue to investigate and implement actions to reduce the use of regulated ozone-depleting substances, where possible, replacing them with materials that have less ozone-depleting potential. In 2007, a multi-year project was completed that resulted in the elimination of more than 15,000 pounds of yearly chlorofluorocarbon emissions through a recent change in a manufacturing process. For many years, Freon 113 performed well as a solvent for cleaning metal chips but was also an ozone-depleting substance. The Freon was replaced with a new product, Vertrel, manufactured by DuPont. Since the ODS elimination program began in the early 1990s, Y-12 has eliminated more than 90 percent of its Class I ODSs used in heating, ventilation, and air-conditioning systems (DOE 2008).

Past ODS phase-out and reduction efforts at Y-12 include:

- retrofitting, replacing, or taking out-of-service chillers and air conditioning systems;
- solvent substitutions for uses such as machining, cleaning, and cooling; and
- elimination or conversion of fixed fire protection systems that contained Halon 1301.

Y-12 personnel continue to properly manage refrigerants via programs and actions such as:

- certification of refrigerant recycling and recovery equipment;
- training and EPA certification of refrigerant technicians; and
- procedures for performance of leak checks and for response to equipment leaks.

Infrastructure reduction activities also led to the reduction of ODS materials on-site. All refrigerants and solvents must be removed from equipment prior to disposal. If an ODS is no longer going to be used at Y-12 it is managed as follows:

- excessed to other DOE facilities;
- offered to other government agencies such as the Defense Logistics Agency;
- sold to outside vendors for recycle; or
- properly disposed of (DOE 2008).

4.6.2.3 *Radiological Air Emissions*

The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 occurs almost exclusively as a result of plant production, maintenance, and waste management activities. National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations for radionuclides require continuous emission sampling of major sources (a "major source" is considered to be any emission point that potentially can contribute more than 0.1 milli Roentgen Equivalent Man (mrem) per year effective dose equivalent to an off-site individual). As of January 1, 2006, Y-12 had continuous monitoring capability on a total of 53 stacks, 41 of which were active and twelve of which were temporarily shut down. Stacks US-017 and US-127 were permanently taken out of service in 2005. During 2006, 40 of the 53 stacks suitable for continuous monitoring were judged to be major sources. Sixteen of the stacks with the greatest potential to emit significant amounts of uranium are equipped with alarmed breakthrough detectors, which alert operations personnel to process-upset conditions or to a decline in filtration system efficiencies, allowing investigation and correction of the problem before a significant release occurs (DOE 2008).

Emissions from 50 unmonitored processes, categorized as minor emission sources, are estimated according to calculation methods approved by the EPA. In 2006, there were 16 unmonitored processes operated by Y-12. These are included as minor sources in Y-12 source term (DOE 2008).

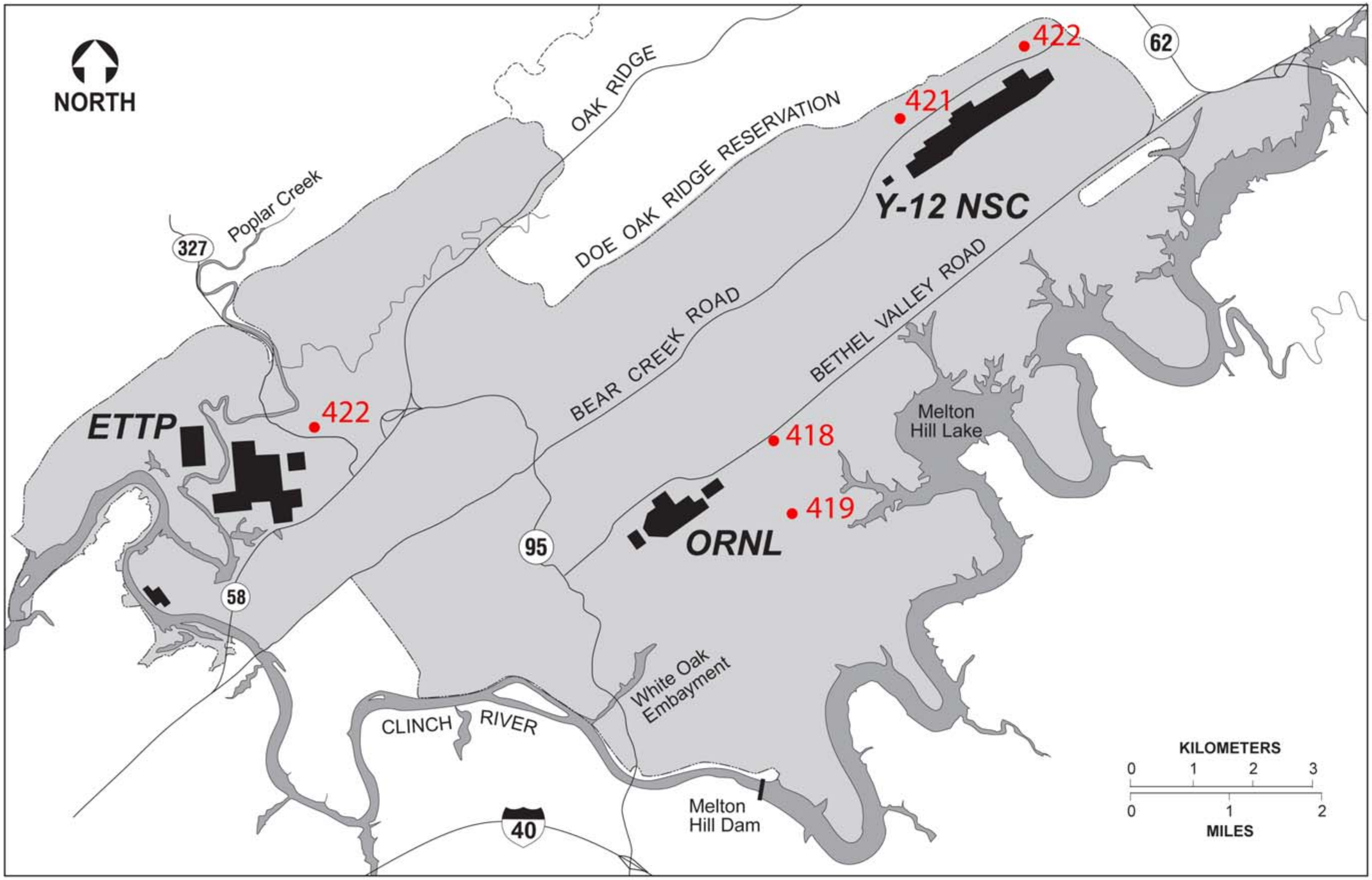
During the year 2006, a change of programmatic responsibility occurred for several facilities located at Y-12 from Bethel Jacobs Company, LLC, (BJC) to B&W Y-12. The change included four minor sources, specifically the Central Pollution Control Facility Lab Hood, the West End Treatment Facility Degasifier and Lab Hood, and the East End Volatile Organic Compound Air Stripper (DOE 2008).

Uranium and other radionuclides are handled in millicurie quantities at facilities within the boundary of Y-12 as part of B&W Y-12 laboratory activities. Twenty-eight minor emission points were identified from laboratory activities at facilities within the boundary of Y-12 as being operated by B&W Y-12. In addition, the B&W Y-12 Analytical Chemistry Organization laboratory is operated in a leased facility that is not within ORR boundary; it is located approximately a mile east of Y-12 on Union Valley Road. The emissions from the Analytical Chemistry Organization Union Valley laboratory are included in Y-12 source term. Two minor emission points were identified at the laboratory. The releases from those emission points are minimal, however, and have a negligible impact on the total Y-12 dose (DOE 2008).

Emissions from Y-12 room ventilation systems are estimated from radiation control data collected on airborne radioactivity concentrations in the work areas. Areas where the monthly average concentration exceeded 10 percent of the DOE derived air concentration worker-protection guidelines are included in the annual emission estimate. In 2006, one emission specifically identified in the stack emissions point, where room ventilation emissions exceeded 10 percent of the guidelines, was identified in Building 9212. However, because the emissions were vented to stack UB-027, its distributions were not considered in exceedance (DOE 2008).

Uranium stack losses were measured continuously on monitored operating process exhaust stacks in 2006. Particulate matter (including uranium) was filtered from the stack emissions. Filters at each location were changed routinely, from one to two times per week, and were analyzed for total uranium. In addition, the sampling probes and tubing were removed quarterly and were washed with nitric acid; the washing was analyzed for total uranium. At the end of the year, the probe-wash data were included in the final calculations in determining total emissions from each stack (DOE 2008).

The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 under the No Action Alternative occurs almost exclusively as a result of Y-12 production, maintenance, and waste management activities. An estimated 0.01 Curies of uranium was released into the atmosphere in 2007 as a result of Y-12 activities (DOE 2008). Figure 4.6.2.3-1 shows the approximate locations of monitoring stations.



Source: DOE 2008.

Figure 4.6.2.3-1. Approximate Locations of the Five ERAMS Air Monitoring Stations.

4.6.3 Noise

Sound level measurements have been recorded at various locations within and near ORR in the process of testing sirens and preparing support documentation for the Atomic Vapor Laser Isotope Separation site. The acoustic environment along the Y-12 site boundary, in rural areas, and at nearby residences away from traffic noise, is typical of a rural location with a Day-Night Average Sound Level (DNL) in the range of 35 to 50 adjusted decibel (dBA). Areas near the Y-12 site within Oak Ridge are typical of a suburban area, with a DNL in the range of 53 to 62 dBA. Traffic is the primary source of noise at the Y-12 site boundary and at residences located near roads. During peak hours, the Y-12 worker traffic is a major contributor to traffic noise levels in the area (DOE 2001a).

Major noise emission sources within Y-12 include various industrial facilities, and equipment and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most Y-12 industrial facilities are at a sufficient distance from the site boundary so that noise levels at the boundary from these sources are not distinguishable from background noise levels. Within the Y-12 site boundary, noise levels from Y-12 mission operations are typical of industrial facilities, ranging from 50 to 70 dBA (DOE 2001a).

The State of Tennessee has not established specific community noise standards applicable to Y-12; however, Anderson County has quantitative noise-limit regulations as shown in Table 4.6.3-1 (DOE 2004).

Table 4.6.3-1. Allowable Noise Level by Zoning District in Anderson County, Tennessee.

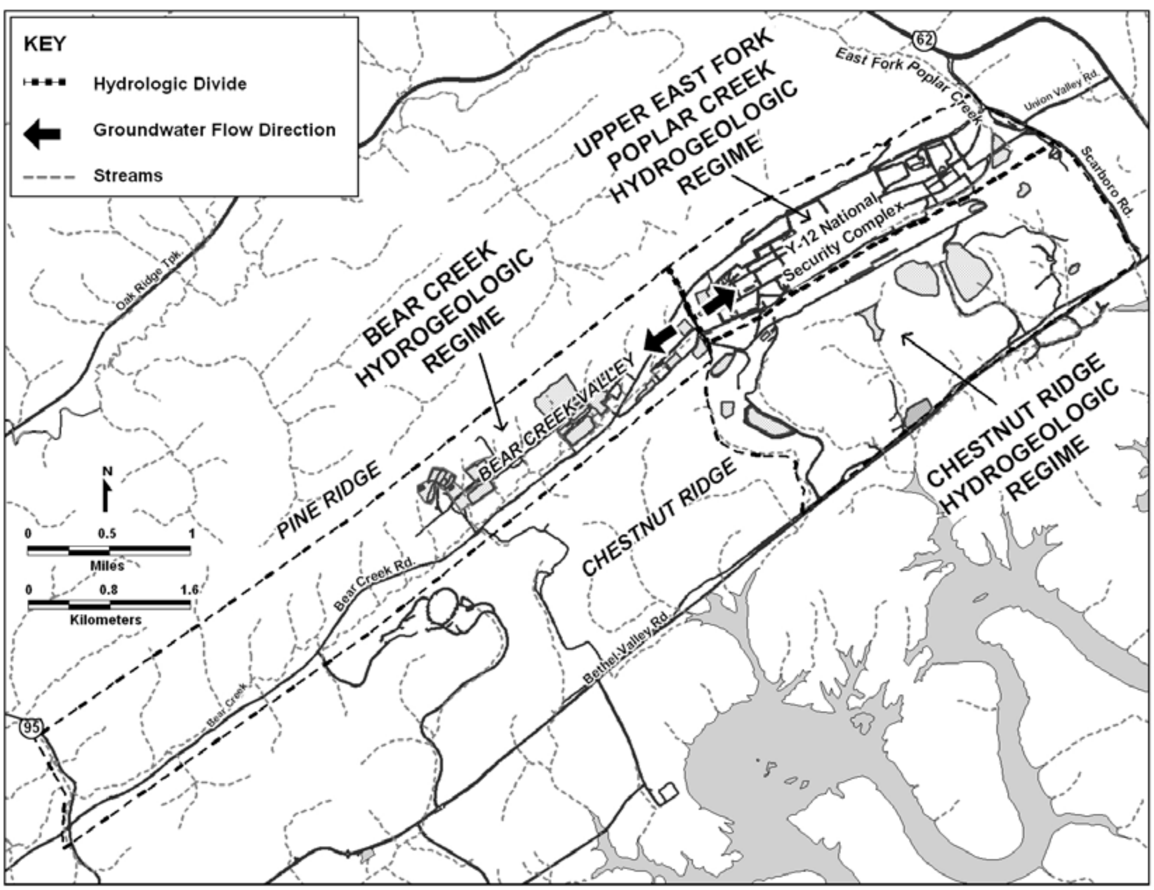
Zoning		Allowable Noise Level (dBA)	
District	**Abbreviation**	**7 a.m. – 10 p.m.**	**10 p.m. – 7 a.m.**
Suburban-residential	R-1	60	55
Rural-residential	A-2	65	60
Agricultural-forest	A-1	65	60
General commercial	C-1	70	65
Light industrial	I-1	70	70
Heavy industrial	I-2	80	80
Floodway	F-1	80	80

Source: DOE 2004.

4.7 WATER RESOURCES

4.7.1 Groundwater

Y-12 is divided into three hydrogeologic regimes, which are delineated by surface water drainage patterns, topography, and groundwater flow characteristics. The regimes are further defined by the waste sites they contain. These regimes include the Bear Creek Hydrogeologic Regime, the UEFPC Hydrogeologic Regime, and the Chestnut Ridge Hydrogeologic Regime (see Figure 4.7.1-1). Most of the Bear Creek and UEFPC regimes are underlain by geologic formations that are part of ORR aquitard (as shown in Figure 4.5.2-1 and Figure 4.5.2-2). The ORR aquitard is comprised of six geologic formations (Nolichucky Shale, Maryville Limestone, Rogersville Shale, Rutledge Limestone, Pumpkin Valley Shale, and Rome Formation) which collectively have low permeability and low transmissivity; water is not easily transmitted through these formations. The northern portion of Bear Creek and UEFPC regimes is underlain by aquitard formations including the Nolichucky Shale, Maryville Limestone, and Rodgersville Shale. The southern portion of Bear Creek and UEFPC regimes is underlain by the Maynardville Limestone, which is part of the Knox Aquifer. The entire Chestnut Ridge regime, which is adjacent and to the south of the Bear Creek and Upper East Fork Poplar Creek regimes, is underlain by the Knox Aquifer. In general, near surface (shallow) groundwater flow follows topography at Y-12. Shallow groundwater flow in the Bear Creek regime and the Upper East Fork regime is divergent from a topographic and groundwater divide located near the western end of Y-12 that defines the boundary between the two regimes. In addition, flow converges on the primary surface streams (Bear Creek and UEFPC) from Pine Ridge and Chestnut Ridge. In the Chestnut Ridge regime, a groundwater divide exists that approximately coincides with the crest of the ridge. Shallow groundwater flow tends to be toward either flank of the ridge, with discharge primarily to surface streams and springs located in Bethel Valley to the south and Bear Creek Valley to the north (DOE 2008).



Source: DOE 2008.

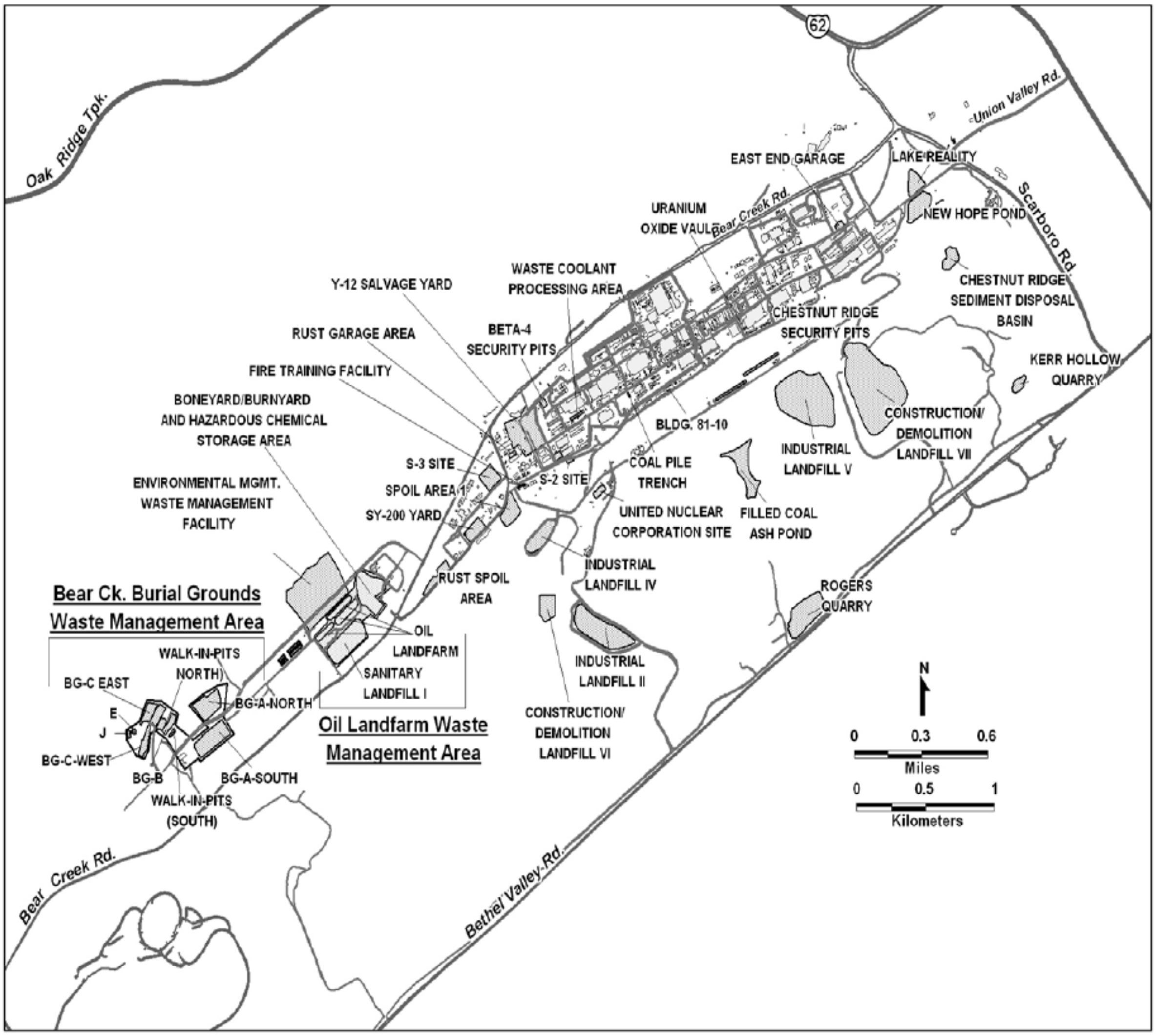
Figure 4.7.1-1. Hydrogeologic Regimes at the Y-12 Complex.

In Bear Creek Valley, groundwater in the intermediate and deep intervals moves predominantly through fractures in ORR aquitards, converging on and then moving through fractures and solution conduits in the Maynardville Limestone. Karst development in the Maynardville Limestone has a significant impact on groundwater flow paths in the shallow and intermediate intervals. In general, groundwater flow parallels the valley and geologic strike. Groundwater flow rates in Bear Creek Valley vary widely; they are very slow within the deep interval of ORR aquitard (< 1 feet per year) but can be quite rapid within solution conduits in the Maynardville Limestone (tens to thousands of feet per day) (DOE 2008). In the UEFPC regime, strike-parallel groundwater flow to the east occurs within the Maynardville Limestone and fractured portions of the ORR aquitard. As shown by groundwater analytical data for VOCs, groundwater and volatile VOCs are moving at depths of almost 500 feet in the Maynardville Limestone. The Maynardville Limestone is the primary groundwater exit pathway on the east end of the Y-12 Complex. The deep fractures and solution channels that constitute flow paths within the Maynardville Limestone appear to be well connected, resulting in contaminant migration for substantial distances off the ORR into Union Valley to the east of the complex (DOE 2008).

The rate of groundwater flow perpendicular to geologic strike from the ORR aquitard to the Maynardville Limestone has been estimated to be very slow below the water table interval (near surface, water-bearing layer consisting of unconsolidated material and shallow bedrock). Most contaminant migration appears to be via surface tributaries to Bear Creek or along below ground utility traces and buried tributaries in the Upper East Fork regime. Extensive volatile organic compound contamination occurs throughout the groundwater system in both the Bear Creek and Upper East Fork regimes. Groundwater flow in the Chestnut Ridge regime is through fractures and solution conduits in the Knox aquifer. Discharge points for intermediate and deep flow are not well known. Groundwater is currently presumed to flow toward Bear Creek Valley to the north and Bethel Valley to the south. Groundwater from intermediate and deep zones may discharge at certain spring locations along the flanks of Chestnut Ridge. Following the crest of the ridge, water table elevations decrease from west to east, demonstrating an overall easterly trend in groundwater flow (DOE 2008).

Groundwater Quality and Monitoring at Y-12. More than 200 sites have been identified at Y-12 that represent known or potential sources of contamination to the environment as a result of past waste management practices. Figure 4.7.1-2 depicts the major facilities considered as known and/or potential contaminant source areas for which groundwater monitoring was performed during CY 2006. Because of that contamination, extensive groundwater monitoring is performed to comply with regulations and DOE orders (DOE 2008).

During CY 2006, routine groundwater monitoring at Y-12 was conducted primarily by two programs, the Y-12 Groundwater Protection Program, managed by B&W Y-12 LLC, and the Water Resources Restoration Program, managed by BJC. Each program is responsible for monitoring groundwater to meet specific compliance requirements. In CY 2006, the Groundwater Protection Program performed monitoring to comply with DOE orders, while the Water Resources Restoration Program performed groundwater monitoring in compliance with CERCLA and the *Resource Conservation and Recovery Act* (RCRA). In addition to the monitoring performed by the Water Resources Restoration Program, BJC monitors groundwater at the solid waste disposal landfills on Chestnut Ridge and the Environmental Management Waste Management Facility (EMWMF), in Bear Creek Valley (DOE 2008).



Source: DOE 2008

Figure 4.7.1-2. Known or potential contaminant sources for which groundwater monitoring was performed on Y-12 during CY 2006.

The Upper East Fork Poplar Creek Groundwater Record of Decision (ROD) project will select a final remedy for groundwater in the UEFPC Characterization Area, which includes the Y-12 Complex. The project objective is to reach a final decision for groundwater remediation for the UEFPC Characterization Area and Union Valley. The selected remedy will be implemented under CERCLA. The project will require the preparation of a remedial investigation/feasibility study, Proposed Plan and ROD for regulatory approval and the preparation of a plant for future monitoring and institutional controls of the area. UEFPC Groundwater ROD project is planned for implementation by the Integrated Facility Disposition Program (DOE 2009).

During FY 2007, the approved Phase 2 ROD for UEFPC project was utilized to support remediation decisions at Y-12 National Security Complex locations that were undergoing modernization. Remediation of the UEFPC Watershed is being conducted in stages using a phased approach. Phase 1 addresses interim actions for remediation of mercury-contaminated soil, sediment, and groundwater discharges that contribute contamination to surface water. The focus of the second phase is remediation of the balance of contaminated soil, scrap, and buried materials within the Y-12 Complex. Decisions regarding final land use and final goals for surface water, groundwater, and soils will be addressed in future decision documents. The Phase 2 ROD was approved by all parties in April 2006. Planning to support building demolition and the Infrastructure Facility Disposition Program was also conducted (DOE 2008).

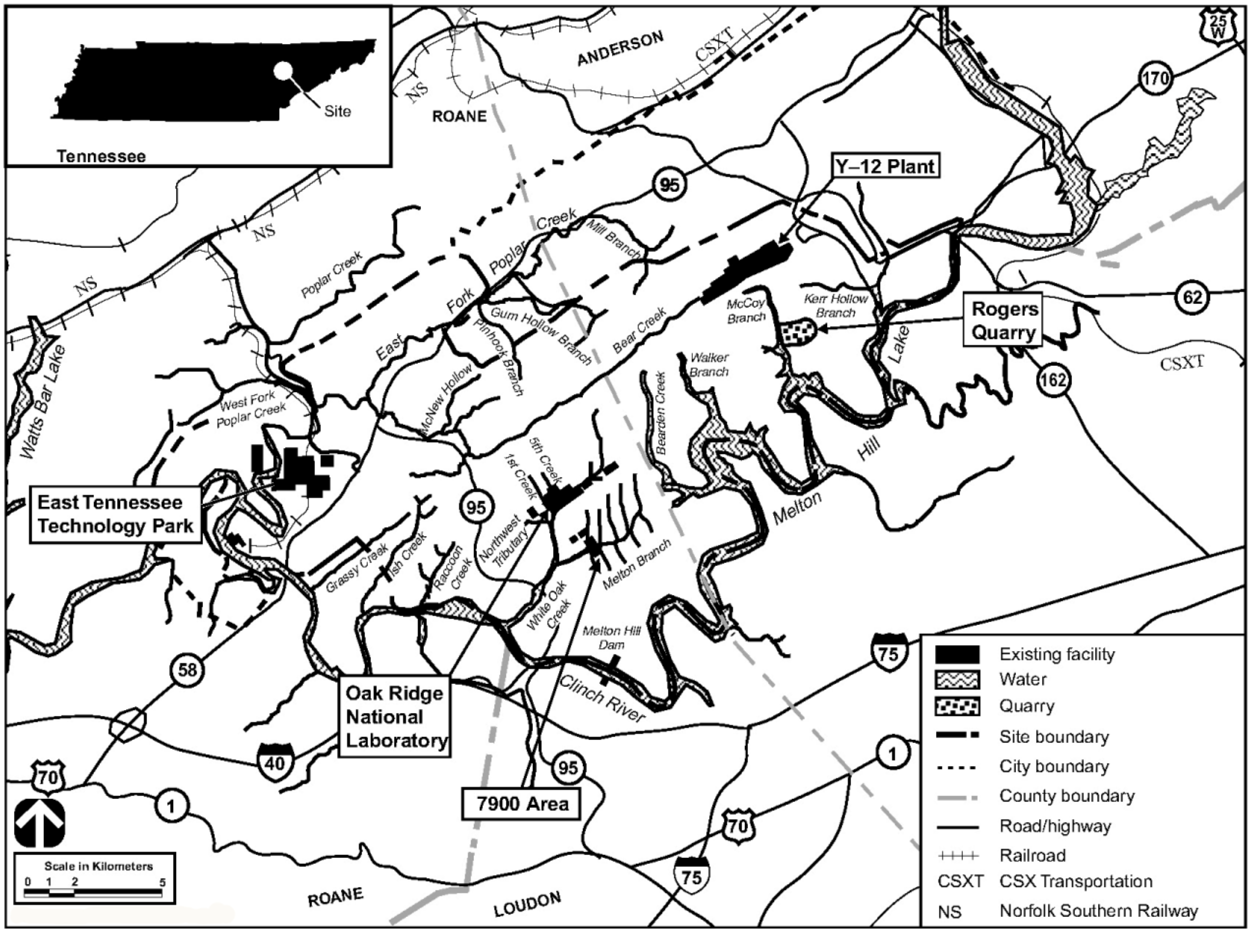
Although the Groundwater Protection Program, the Water Resources Restoration Program, and other projects have differing technical objectives and responsibilities, considerable efforts are made to maintain consistency in groundwater monitoring activities at Y-12. Communication among the programs has been crucial in eliminating any redundancies in monitoring activities. In addition communication and cooperation provides for more consistent and efficient data collection, evaluation, and overall quality. All groundwater monitoring data obtained by all programs are evaluated to provide a comprehensive view of groundwater quality at Y-12 (DOE 2008).

Historical monitoring efforts have shown that four types of contaminants have affected groundwater quality at Y-12: nitrate, volatile organic compounds, metals, and radionuclides. Of those, nitrate and volatile organic compounds are the most widespread. Some radionuclides, particularly uranium and Technetium-99 (99Tc) were found principally in the Bear Creek regime and the western and central portions of the Upper East Fork regime. Trace metals, the least extensive groundwater contaminants, generally occur in a small area of low-pH groundwater at the western end of the complex, near the S-2 and S-3 sites. Historical data have shown that plumes from multiple source units have mixed with one another and that contaminants (other than nitrate and 99Tc) are no longer easily associated with a single source (DOE 2008).

Groundwater Rights and Permits. Because of the abundance of surface water and its proximity to the points of use, very little groundwater is used at Y-12. Industrial and drinking water supplies are taken primarily from surface water sources; however, single-family wells are common in adjacent rural areas not served by the public water supply system. Most of the residential wells in the immediate vicinity of Y-12 are south of the Clinch River (DOE 2000a).

4.7.2 Surface Water

Waters drained from ORR eventually reach the Tennessee River via the Clinch River, which forms the southern and western boundaries of ORR. The ORR lies within the Valley and Ridge Physiographic Province, which is composed of a series of drainage basins or troughs containing many small streams feeding the Clinch River. Surface water at each of the major facilities on ORR drains into a tributary or series of tributaries, streams, or creeks within different watersheds. Each of these watersheds drains into the Clinch River. The largest of the drainage basins is that of Poplar Creek, which receives drainage from a 136-square mile area, including the northwestern sector of ORR. It flows from northeast to south-west, approximately through the center of the ETTP, and discharges directly into the Clinch River (DOE 2008). Figure 4.7.2-1 presents the surface water features in the vicinity of Y-12.



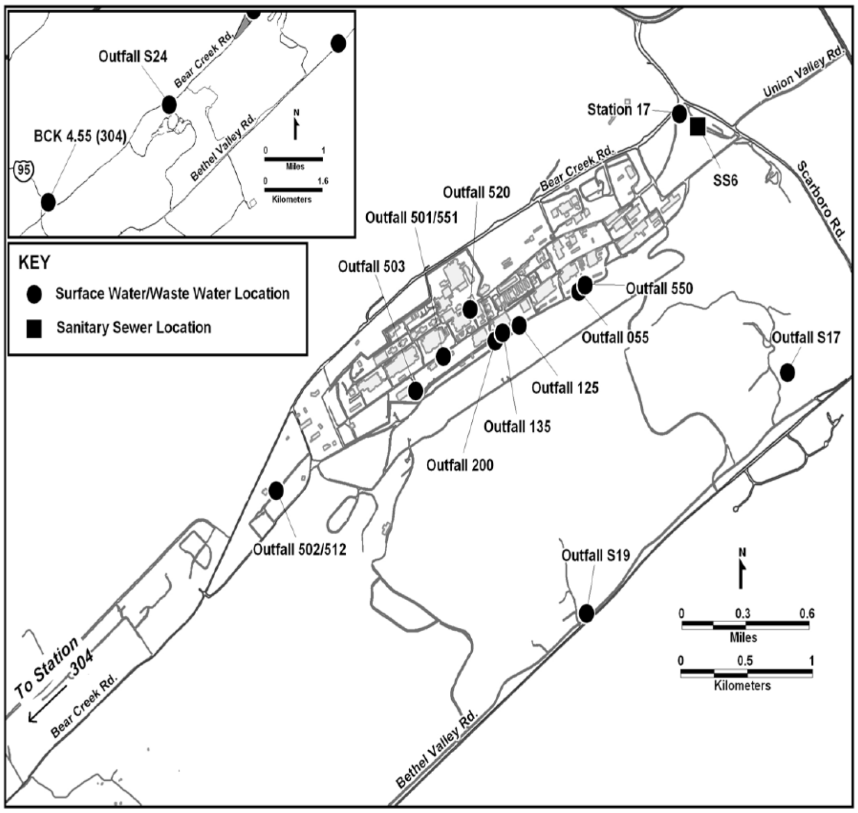
Source: DOE 2005i.

Figure 4.7.2-1. Surface Water Features in the Vicinity of Y-12.

EFPC, which discharges into Poplar Creek east of the ETTP, originates within Y-12 near the former S-3 ponds and flows northeast along the south side of Y-12. Various Y-12 wastewater discharges to the upper reaches of EFPC from the late 1940s to the early 1980s left a legacy of contamination (e.g., mercury, PCBs, uranium) that has been the subject of water quality improvement initiatives over the past two decades. Bear Creek also originates within Y-12 with headwaters near the former S-3 ponds, where the creek flows southwest. Bear Creek is mostly affected by stormwater runoff, groundwater infiltration, and tributaries that drain former waste disposal sites in the Bear Creek Valley Burial Grounds Waste Management Area and the current EMWMF (DOE 2008).

Both the Bethel Valley and Melton Valley portions of ORNL are in the White Oak Creek drainage basin, which has an area of 6.37 square miles. White Oak Creek headwaters originate on Chestnut Ridge, north of ORNL, near the Spallation Neutron Source (SNS) site. At ORNL, the creek flows west along the southern boundary of the developed area and then flows southwesterly through a gap in Haw Ridge to the western portion of Melton Valley, where it forms a confluence with Melton Branch. The waters of White Oak Creek enter White Oak Lake, which is an impoundment formed by White Oak Dam. Water flowing over White Oak Dam enters the Clinch River after passing through the White Oak Creek embayment area (DOE 2008).

Y-12 Liquid Discharges. The current Y-12 National Pollutant Discharge Elimination System (NPDES) permit, issued on March 13, 2006, and effective on May 1, 2006, requires sampling, analysis, and reporting for approximately 65 outfalls. Figure 4.7.2-2 displays major Y-12 NPDES outfalls. The number is subject to change as outfalls are eliminated, consolidated, or added. Currently, Y-12 has outfalls and monitoring points in the following water drainage areas: East Fork Poplar Creek, Bear Creek, and several unnamed tributaries on the south side of Chestnut Ridge. These creeks and tributaries eventually drain to the Clinch River (DOE 2008).



Source: DOE 2008.

Figure 4.7.2-2. Major Y-12 NPDES Outfalls.

Discharges to surface water allowed under the permit include storm drainage, cooling water, cooling tower blowdown, steam condensate, and treated process wastewaters, including effluents from wastewater treatment facilities. Groundwater inflow into sumps in building basements and infiltration to the storm drain system are also permitted for discharge to the creek. The monitoring data collected by the sampling and analysis of permitted discharges are compared with NPDES limits if a limit exists for each parameter. Some parameters, defined as "monitor only," have no specified limits (DOE 2008).

The water quality of surface streams in the vicinity of Y-12 is affected by current and historical legacy operations. Discharges from Y-12 processes flow into EFPC before the water exits Y-12. EFPC eventually flows through the city of Oak Ridge to Poplar Creek and into the Clinch River. Bear Creek water quality is affected by area source runoff and groundwater discharges. The NPDES permit requires regular monitoring and storm water characterization in Bear Creek and several of its tributaries. The effluent limitations contained in the permit are based on the protection of water quality in the receiving streams. The permit emphasizes storm water runoff and biological, toxicological, and radiological monitoring. Some of the requirements in the new permit and the status of compliance are as follows:

- chlorine limitations based on water quality criteria at three outfalls located near the headwaters of EFPC (monitoring ongoing); new dechlorination facilities are being constructed;
- reduction of the measurement frequency for pH and chlorine at EFPC outfalls with addition of requirement for measurements in stream at the Station 17 location;
- implementation of a storm water pollution prevention plan requiring sampling and characterization of storm water, and sampling of stream baseload sediment at four instream EFPC locations;
- requirement for an annual storm water monitoring report, an annual report of the Biological Monitoring and Abatement Program (BMAP) data, and twice annual letter report to update BMAP progress; all submitted to TDEC;
- a requirement to manage the flow of EFPC such that a minimum flow of 7 million gallons per day is guaranteed by adding raw water from the Clinch River to the headwaters of EFPC; and
- whole effluent toxicity testing limitation for the three outfalls headwaters of EFPC.

Radiological data for surface waters were well below the allowable DCGs. The total mass of uranium and associated Curies released from Y-12 at the easternmost monitoring station, Station 17 on UEFPC was 0.073 Curies in 2003 and 0.036 Curies in 2007 (Table 4.7.2-1) (DOE 2008).

Table 4.7.2-1. Release of Uranium from Y-12 to the Offsite Environment as a Liquid Effluent, 2003 to 2007.

Year	Quantity released	
	Ci[a]	kg
	Station 17	
2003	0.073	167
2004	0.067	161
2005	0.043	93
2006	0.050	131
2007	0.036	70

Source: DOE 2008.
Bq = Becquerel
a – 1 Ci = 3.7E + 10 Bq

A notice of appeal of certain permit limits was filed by NNSA in April 2006. The permit limits for mercury at several outfalls, PCBs at outfall 200, and toxicity limits at three outfalls were appealed because legacy contamination is addressed under CERCLA. Chlorine limits at headwaters of the creek were appealed, and a compliance schedule was requested so that a dechlorination unit could be put in place to handle a more stringent chlorine limit at outfall 109 (DOE 2008).

Surface Water Quality. The streams and creeks of Tennessee are classified by TDEC and defined in the State of Tennessee Water Quality Standards. Classifications are based on water quality, designated uses, and resident aquatic biota. The Clinch River is the only surface water body on ORR classified for domestic water supply. Most of the streams at ORR are classified for fish and aquatic life, livestock watering, wildlife, and recreation. White Oak Creek and Melton Branch are the only streams not classified for irrigation, while portions of Poplar Creek and Melton Branch are not classified for recreation.

There are seven wastewater treatment facilities which operate under NPDES permits at Y-12. Another facility known as Big Spring Water Treatment Facility began operation in 2005 as an interim remedial action to remove mercury under a CERCLA ROD. Sanitary and certain industrial wastewaters are permitted for discharge to the city of Oak Ridge wastewater collection and treatment systems.

The water quality of surface streams in the vicinity of Y-12 is affected by current and past operations. While stormwater, groundwater, and wastewater flows may contribute contaminants to UEFPC, the water quality and ecological health of this stream has greatly improved over the last 20 years. This is primarily due to rerouting of discharge pipes, construction and operation of wastewater treatment facilities, dechlorination of process waters, and other ongoing environmental protection activities at Y-12.

EFPC, which discharges into Poplar Creek east of the ETTP, originates within Y-12 near the former S-3 ponds and flows northeast along the south side of the Y-12. Various Y-12 wastewater discharges to the upper reaches of EFPC from the late 1940s to the early 1980s left a legacy of contamination (e.g., mercury, PCBs, uranium) that has been the subject of water quality improvement initiatives over the past two decades. Bear Creek also originates within Y-12 with headwaters near the former S-3 Ponds, where the creek flows southwest. Bear Creek is mostly affected by stormwater runoff, groundwater infiltration, and tributaries that drain former waste disposal sites in the Bear Creek Valley Burial Grounds Waste Management Area and the current EMWMF (DOE 2008).

Routine surface water surveillance monitoring, above and beyond that required by the NPDES permit, is performed as a best management practice. The Y-12 Environmental Compliance Department staff monitor the surface water as it exits from each of the three hydrogeologic regimes (DOE 2008).

Monitoring is conducted in EFPC at Station 17 (9422-1), near the junction of Scarboro Road and Bear Creek Road. During the first quarter of 2006 the best management practices sampling program consisted of one 7-day composite each week. These samples are analyzed for mercury, ammonia-N, inductively coupled plasma (ICP) metals, and total suspended solids. The NPDES permit which became effective on May 1, 2006, includes most of these parameters plus dissolved oxygen, temperature, nitrate/nitrite and phosphorus as a requirement for monitoring and sets limits at Station 17 for pH within range of 6.0 to 9.0 units. Monitoring at Station 17 continued for the remainder of the year by a 7-day composite sampling conducted weekly to satisfy the NPDES permit conditions. For years monitoring has been conducted in Bear Creek at BCK 4.55 (former NPDES Station 304), which is at the western boundary of the Y-12 Complex area of responsibility. Surveillance sampling at this location was suspended in June 2006, and instream sampling is conducted upstream at S24 or BCK 9.4. in accordance with the permit issued in

2006. This sampling is quarterly and includes pH, total suspended solids, PCBs, phosphorus, nitrate/nitrite, total nitrogen and metals (DOE 2008).

The exit pathway from the Chestnut Ridge Hydrogeologic Regime is monitored via NPDES location S19 (the former NPDES Station 302) at Rogers Quarry. S19 is an instream location of McCoy Branch and is sampled annually for suspended and dissolved solids, metals, and pH (DOE 2008).

As shown in Table 4.7.2-2, comparisons with the Tennessee water quality criteria indicate that only mercury and zinc from samples collected at Station 17 were detected above the criteria maximum (DOE 2008). Of all the parameters measured in the surface water as a best management practice, mercury is the only demonstrated contaminant of concern (DOE 2008).

Table 4.7.2-2. Surface Water Surveillance Measurements Exceeding Tennessee Water Quality Criteria at Y-12, 2006.

Parameter Detected	Location	Number of Samples	Detection limit	Maximum	Average	Water quality Criteria (mg/L)	Number exceeding Criteria
Mercury	Station 17	99	0.0002	0.004	<0.0002	0.000051	75
Zinc	Station 17	17	0.05	0.344	<0.06	0.12	3

Source: DOE 2008.

The NPDES permit issued for Y-12 in 2006 mandates a BMAP with the objective of demonstrating that the effluent limitations established for the facility protect the classified uses of the receiving stream, EFPC. The BMAP, which has been monitoring the ecological health of EFPC since 1985, currently consists of three major tasks that reflect complementary approaches to evaluating the effects of Y-12 discharges on the aquatic integrity of EFPC. These tasks include (1) bioaccumulation monitoring, (2) benthic macroinvertebrate community monitoring, and (3) fish community monitoring. Data collected on contaminant bioaccumulation and the composition and abundance of communities of aquatic organisms provide a direct evaluation of the effectiveness of abatement and remedial measures in improving ecological conditions in the stream (DOE 2008).

Monitoring is presently being conducted at five primary EFPC sites, although sites may be excluded or added, depending upon the specific objectives of the various tasks. The primary sampling sites include upper EFPC at East Fork Poplar Creek kilometer (EFK) 24.4 and 23.4 (upstream and downstream of Lake Reality, respectively); EFK 18.7 (also EFK 18.2), located off ORR and below an area of intensive commercial and light industrial development; EFK 13.8, located upstream from the Oak Ridge Wastewater Treatment Facility; and EFK 6.3, located approximately 1.4 kilometers below ORR boundary. Brushy Fork at Brushy Fork kilometer (BFK) 7.6 is used as a reference stream in two tasks of the BMAP. Additional sites off ORR are also occasionally used for reference, including Beaver Creek, Bull Run, Cox Creek, Hinds Creek, Paint Rock Creek, and the Emory River in Watts Bar Reservoir (DOE 2008).

Drinking Water Quality. The Tennessee Regulations for Public Water Systems and Drinking Water Quality, Chap. 1200-5-1, set limits for biological contaminants and for chemical activities and chemical contaminants. Sampling for the following is conducted:

- total coliform
- chlorine residuals
- lead
- copper
- disinfectant byproduct
- propylene glycol

The city of Oak Ridge supplies potable water to Y-12 that meets all federal, state and local standards for drinking water. The water treatment plant, located north of Y-12, is owned and operated by the city of Oak Ridge. In 2007, TDEC completed a sanitary survey on the potable water system at Y-12 and gave it a grade of 98 out of a possible 100. This grade returned the Y-12 potable water system to an "approved" status from the previous status of "provisional." In response to TDEC comments, Y-12 has completed revisions to the site cross connection control program (DOE 2008).

Y-12 began sampling the site potable water system for propylene glycol in 2007 per TDEC requirements due to unapproved cross connections between the site potable water system and antifreeze fire sprinkler systems containing propylene glycol. A total of 92 samples were collected and analyzed, with one showing a slight trace of propylene glycol. Additional samples were collected; results were below the detection limits. A potable water system upgrade project is scheduled for the installation of approved backflow prevention devices, conversion to dry pipe, and/or disconnection of the antifreeze fire sprinkler systems by 2010 (DOE 2008).

All total coliform samples collected during 2007 were returned negative. Analytical results were satisfactory for disinfectant by-products (total trihalomethanes and haloacetic acids) for the Y-12 and ORNL water systems. The Y-12 potable water system is currently sampled triennially for lead and copper. The last scheduled sample period took place from June to September 2008 (DOE 2008).

Surface Water Rights and Permits. In Tennessee, the state's water rights are codified in the *Water Quality Control Act*. In effect, the water rights are similar to riparian rights in that the designated uses of a body of water cannot be impaired. The only requirement to withdraw from surface water would be a TDEC Chapter 1200-5-8 Water Registration Requirement, and the U.S. Army Corps of Engineers (USACE) and TVA permits to construct intake structures.

4.8 ECOLOGICAL RESOURCES

This section describes ecological resources at ORR including terrestrial and aquatic resources, threatened and endangered (T&E) species, and floodplains and wetlands. Information for Y-12 is also included.

4.8.1 Terrestrial and Aquatic Resources

4.8.1.1 *Terrestrial Resources*

The ORR is mostly contiguous native eastern deciduous forest. Forested areas are found throughout the reservation. Local plant life is characteristic of the intermountain regions of central and southern Appalachia; pine and pine-hardwood forest and oak-hickory forest are the most extensive plant communities found at ORR (DOE 2001a). The forests are mostly oak-hickory, pine-hardwood, or pine. Minor areas of other hardwood forest cover types are found throughout ORR, including northern hardwoods, a few small natural stands of hemlock or white pine, and floodplain forests. Over 1,100 vascular plant species are found on ORR (ORNL 2002). Animal species found on ORR include approximately 59 species of amphibians and reptiles; up to 260 species of migratory, transient, and resident birds; and 38 species of mammals (DOE 2001a). White-tailed deer and geese populations are controlled on ORR through managed hunts. Less than 2 percent of ORR remains as open agricultural fields (ORNL 2002).

Within the fenced, developed portion of Y-12, grassy and unvegetated areas surround the entire facility. Building and parking lots dominate the landscape at Y-12, with limited vegetation present. Fauna within the Y-12 area is limited due to the lack of large areas of natural habitat.

At ORR, DOE has set aside large tracts of land for conservation, including approximately 3,000 acres set-aside in April 2005. This conservation land is located on the western end of ORR and features mature forests, wetlands, river bluffs, cliffs and caves and is home to several rare species. Another conservation easement is Parcel G which contains a palustrine emergent/scrub-shrub wetland system totaling approximately 3.4 acres.

4.8.1.2 *Aquatic Resources*

Aquatic habitat on or adjacent to ORR ranges from small, free-flowing streams in undisturbed watersheds to larger streams with altered flow patterns due to dam construction. These aquatic habitats include tailwaters, impoundments, reservoir embayments, and large and small perennial streams. Aquatic areas within ORR also include seasonal and intermittent streams (DOE 2001a).

Sixty-three fish species have been collected on or adjacent to ORR (ORNL 2002). The minnow family has the largest number of species and is numerically dominant in most streams (DOE 2001a). Fish species representative of the Clinch River in the vicinity of ORR include shad and herring (Clupeidae), common carp (*Cyprinus carpio*), catfish and bullheads (Ictaluridae), bluegill (*Lepomis macrochirus*), crappie (*Pomoxis spp.*), and freshwater drum (*Aplodinotus grunniens*) (ORNL 1981a). The most important fish species taken commercially in ORR area are common carp and catfish. Commercial fishing is permitted on the Clinch River downstream from Melton Hill Dam (TWRA 1995). Recreational species consist of crappie, largemouth bass (*Micropterus salmonides*), sauger (*Stizostedion canadense*), sunfish (*Lepomis* spp.*)*, and catfish. The redbreast sunfish (*Lepomis auritus*) and rock bass (*Ambloplites rupestris*) are used in bioaccumulation studies for mercury and PCB concentrations as part of Y-12’s BMAP (DOE 2008). Sport fishing is not permitted within ORR.

In 2006 the Agency for Toxic Substances and Disease Registry released a fish consumption recommendation based on the level of PCBs found in the muscle and fatty tissues of several local fish species inhabiting waterways on or near the vicinity of Y-12 (Clinch River, EFPC, and Poplar Creek). Based on the levels of PCBs detected in fish, geese, and turtles, the Agency for Toxic Substances and Disease Registry (ATSDR) determined it is safe to eat up to one meal of any type of fish per month. However, the ATSDR suggests limiting the consumption of largemouth bass, catfish, striped bass, and white bass (ATSDR 2006). The PCBs in local waterways came from plant operations and former waste disposal practices at ORR's Y-12, K-25, X-10, and S-50 sites (ATSDR 2006).

4.8.2 Threatened and Endangered Species

There are three special status species known to occur on ORR, the gray bat (*Myotis grisescens*) is a federally and state-listed endangered species, the state-listed threatened northern saw-whet owl (*Aegolius acadicus*) and the state-listed endangered peregrine falcon (*Falco peregrinus*) (the peregrine falcon was federally delisted on August 25, 1999). These species, along with 17 other species of animals listed as species of concern known to be present on ORR (excluding the Clinch River bordering the reservation) are shown along with their status in Table 4.8.2-1. Table 4.8.2-1 illustrates the diversity of birds on ORR, which is also habitat for many species, some of which are in decline nationally or regionally. Other federally and/or state-listed species may also be present on ORR, although they have not been observed recently. These include several species of mollusks (such as the spiny river snail [*Io fluvialis*]), amphibians (such as the hellbender [*Cryptobranchus alleganiensis*]), birds (such as Bachman's sparrow [*Aimophila aestivalis*]), and mammals (such as the smoky shrew [*Sorex fumeus*]). Birds, fish, and aquatic invertebrates are the most thoroughly surveyed animal groups on ORR. The only federally listed animal species that has recently been observed on ORR is the gray bat, which was observed over water bordering ORR (the Clinch River) in 2003 and over a pond on ORR in 2004. A gray bat was mist-netted outside a cave on ORR in 2006 (DOE 2008).

Table 4.8.2-1. Animal Species of Concern Reported from the Oak Ridge Reservation[a].

Scientific name	Common name	Status[b]		
		Federal	State	PIF[c]
Fish				
Phoxinus tennesseensis	Tennessee dace		NM	
Amphibians and Reptiles				
Hemidactylium scutatum	Four-toed salamander		NM	
Birds				
Anhinga anhinga	Anhinga		NM	
Egretta caerulea	Little blue heron		NM	
Egretta thula	Snowy egret		NM	
Ardea alba	Great egret		NM	
Accipiter striatus	Sharp-shinned hawk		NM	
Aegolius acadicus	Northern saw-whet owl	MC	T	
Buteo platypterus	Broad-winged hawk			RI
Falco peregrinus	Peregrine falcon	*d*	E	
Circus cyaneus	Northern harrier		NM	
Haliaeetus leucocephalus	Bald eagle	*e*	NM	
Bonasa umbellus	Ruffed grouse			RI

Table 4.8.2-1. Animal Species of Concern Reported from the Oak Ridge Reservation[a] *(continued)*.

Scientific name	Common name	Status[b] Federal	State	PIF[c]
		Birds *(continued)*		
Colinus virginianus	Northern bobwhite			RI
Aegolius acadicus	Northern saw-whet owl	MC	T	RI
Tyto alba	Barn owl		NM	
Caprimulgus carolinensis	Chuck-will's-widow			RI
Caprimulgus vociferous	Whip-poor-will			RI
Ceryle alcyon	Belted kingfisher			RI
Melanerpes erythrocephalus	Red-headed woodpecker			RI
Picoides pubescens	Downy woodpecker			RI
Colaptes auritus	Northern flicker			RI
Sphyrapicus varius	Yellow-bellied sapsucker	MC	NM	
Contopus cooperi	Olive-sided flycatcher		NM	RI
Contopus virens	Eastern wood-pewee			RI
Empidonax virescens	Acadian flycatcher			RI
Empidonax trailii	Willow flycatcher			RI
Progne subis	Purple martin			RI
Sitta pusilla	Brown-headed nuthatch			RI
Hylocichla mustelina	Wood thrush			RI
Toxostoma rufum	Brown thrasher			RI
Lanius ludovicianus	Loggerhead shrike	MC	NM	RI
Viero flavifrons	Yellow-throated vireo			RI
Dendroica cerulea	Cerulean warbler		NM	RI
Dendroica discolor	Prairie warbler			RI
Dendroica fusca	Blackburnian warbler			RI
Mniotilta varia	Black-and-white warbler			RI
Wilsonia citrine	Hooded warbler			RI
Wilsonia canadensis	Canada warbler			RI
Icteria virens	Yellow-breasted chat			RI
Helmitheros vermivorus	Worm-eating warbler			RI
Oporonis formosus	Kentucky warbler			RI
Seiurus motacilla	Louisiana waterthrush			RI
Vermivora chrysoptera	Golden-winged warbler	MC	NM	RI
Vermivora pinus	Blue-winged warbler			RI
Piranga rubra	Scarlet tanager			RI
Piranga olivacea	Summer tanager			RI
Pooecetes gramineus	Vesper sparrow		NM	
Passerina cyanea	Indigo bunging			RI
Pipilo erythrophthalmus	Eastern towhee			RI
Ammodramus savannarum	Grasshopper sparrow			RI
Spizella pusilla	Field sparrow			RI
Sturnella magna	Eastern meadowlark			RI
		Mammals		
Myotis grisescens	Gray bat	E	E	
Sorex longirostris	Southeastern shrew		NM	

Source: DOE 2008.
a – Land and surface waters of ORR exlusive of the Clinch River, which borders ORR.
b – Abbreviations:
E = endangered, RI = species of regional importance, T= threatened, NM = in need of management, MC = management concern.
c – Partners in Flight
d - The peregrine falcon was federally delisted on August 25, 1999.
e – The bald eagle was federally delisted on August 8, 2007.

U.S. Fish and Wildlife Service (USFWS) records indicate that the Federal listed endangered Indiana bat (*Myotis sodalis*) may also be present in the vicinity of Y-12, however, this bat has not been observed at Y-12 or other parts of ORR (DOE 2001a). The peregrine falcon and northern saw-whet owl are only very rare transients on the site. Similarly, several state-listed bird species, such as the anhinga (*Anhinga anhinga*), olive-sided flycatcher (*Contopus cooperi*), and little blue heron (*Egretta caerulea*), are currently uncommon migrants or visitors to ORR; however, the little blue heron is probably increasing in numbers. The cerulean warbler (*Dendroica cerulea*), listed by the state as in need of management, has been recorded during the breeding season; however, this species is not actually known to breed at ORR. The bald eagle (*Haliaeetus leucocephalus*), also listed by the state as in need of management, is increasingly seen in winter and may well begin nesting at ORR within a few years. Others, such as the northern harrier (*Circus cyaneus*), great egret (*Ardea alba*), and yellow-bellied sapsucker (*Sphyrapicus varius*), are migrants or winter residents that do not nest on the reservation. The golden-winged warbler (*Vermivora chrysoptera*), listed by the state as in need of management, has been sighted once on the reservation. Barn owls (*Tyto alba*) have been known to nest on the reservation in the past. One Federal and state threatened species, the spotfin chub (*Cyprinella monnacha*), has been sighted and collected in the city of Oak Ridge and is possibly present on ORR. The Tennessee dace has been found in some sections of Grassy Creek (DOE 2008).

There are no Federal-listed threatened or endangered plant species on ORR. Twenty-three plant species listed as threatened or endangered species by the State of Tennessee have been observed on ORR in the last 10 years (DOE 2008). Table 4.8.2-2 presents vascular plant species known or previously reported from ORR and rare plants that occur near and could be present on ORR. No critical habitat for threatened or endangered species, as defined in the *Endangered Species Act*, exists on ORR (DOE 2001a).

Table 4.8.2-2. Vascular Plant Species Listed by Federal or State Agencies, 2007.

Common name	Species	Habitat on ORR	Status code[a]
Currently known or previously reported from ORR			
Spreading false-foxglove	*Aureolaria patula*	River bluff	FSC, S
Heavy sedge	*Carex gravida*	Varied	S
Hairy sharp-scaled sedge	*Carex oxylepis var. pubescensb*	Shaded wetlands	S
Appalachian bugbane	*Cimicifuga rubifolia*	River slope	FSC, T
Pink lady's-slipper	*Cypripedium acaule*	Dry to rich woods	E, CE
Tall larkspur	*Delphinium exaltatum*	Barrens and woods	FSC, E
Northern bush-honeysuckle	*Diervilla lonicera*	River bluff	T
Branching whitlow-grass	*Draba ramosissima*	Limestone cliff	S
Nuttall waterweed	*Elodea nuttallii*	Pond, embayment	S
Mountain witch-alder	*Fothergilla major*	Woods	T
Golden seal	*Hydrastis canadensis*	Rich woods	S, CE
Butternut	*Juglans cinerea*	Slope near stream	FSC, T
Small-head rush	*Juncus brachycephalus*	Open wetland	S
Canada lily	*Lilium canadense*	Moist woods	T
Michigan lily	*Lilium michiganense*	Moist woods	T
Fen orchid	*Liparis loeselii*	Forested wetland	E
Ginseng	*Panax quinquifolius*	Rich woods	S, CE
Tuberculed rein-orchid	*Platanthera flava var. herbiola*	Forested wetland	T

Table 4.8.2-2. Vascular Plant Species Listed by Federal or State Agencies, 2007 *(continued)*.

Common name	Species	Habitat on ORR	Status code[a]
Currently known or previously reported from ORR (continued)			
Pursh's wild-petunia	*Ruellia purshiana*	Dry, open woods	S
River bulrush	*Scirpus fluviatilis*	Wetland	S
Shining ladies-tresses	*Spiranthes lucida*	Boggy wetland	T
Northern white cedar	*Thuja occidentalis*	Rocky river bluffs	S
Rare plants that occur near and could be present on ORR			
Three-parted violet	*Viola tripartite var. tripartita*	Rocky woods	S
Earleaf false foxglove	*Agalinis auriculata*	Calcareous barren	FSC, E
Ramps	*Allium burdickii or A. tricoccom*[d]	Moist woods	S, CE
American barberry	*Berberis canadensis*	Rocky bluff, creek bank	S
Catfoot	*Gnaphalium helleri*	Dry woodland edge	S
A vetch	*Vicia caroliniana*	Moist meadows	S
Slender blazing star	*Liatris cylindracea*	Calcareous barren	E
Mountain honeysuckle	*Lonicera dioica*	Rocky river bluff	S
Heartleaf meehania	*Meehania cordata*	Moist calcareous woods	T
Swamp lousewort	*Pedicularis lanceolata*	Calcareous wet meadow	T
Torrey's mountain-mint	*Pycnanthemum torrei*	Calcareous barren edge	S
Prairie goldenrod	*Solidago ptarmicoides*	Calcareous barren	E

Source: DOE 2008.
[a] Status codes:
CE - Status due to commercial exploitation.
E - Endangered in Tennessee.
FSC - Federal Special Concern; formerly designated as C2. See *Federal Register*, February 28, 1996.
S - Special concern in Tennessee.
T - Threatened in Tennessee.
[b] *Carex oxylepis var. pubescens* has not been observed during recent surveys.
[c] *Lilium michiganense* is believed to have been extirpated from ORR by the impoundment at Melton Hill.
[d] Ramps have been reported near ORR, but there is not sufficient information to determine which of the two species is present or if the occurrence may have been introduced by planting. Both species of ramps have the same state status.

4.8.3 Floodplains and Wetlands

Floodplains. A floodplain is defined as the valley floor adjacent to a streambed or arroyo channel that may be inundated during high water. The TVA conducted floodplain studies along the Clinch River, Bear Creek, and EFPC. Eastern Portions of Y-12 lie within the 100- and 500-year floodplains of EFPC; however, facilities associated with the alternatives in this SWEIS are located outside of the 500-year floodplain (see Figure 4.8.3-1).

Wetlands. Approximately 600 acres of wetlands exist on ORR, with most classified as forested palustrine, scrub/shrub, and emergent wetlands (DOE 2008). Wetlands occur across ORR at lower elevations, primarily in the riparian zones of headwater streams and their receiving streams, as well as in the Clinch River embayments. Wetlands identified to date range in size from several square yards at small seeps and springs to approximately 24.7 acres at White Oak Lake (DOE 2008).

Wetlands are protected under Executive Order (EO) 11990 (42 Federal Register (FR) 26961, May 24, 1977). A wetlands survey of the Y-12 area found palustrine, scrub/shrub, and emergent wetlands. An emergent wetland was found at the eastern end of Y-12, at a seep by a small tributary of EFPC, between New Hope Cemetery and Bear Creek Road. Eleven small wetlands have been identified north of Bear Creek Road in remnants of the UEFPC. A relatively undisturbed, forested wetland was identified in the stream bottomland of Bear Creek Tributary 1, between Bear Creek Road and the powerline right-of-way (LMES 1997). Although wetlands were identified in ORR, no wetlands were observed in close proximity to the project area.

4.8.4 Biological Monitoring and Abatement Programs

The NPDES permit issued to Y-12 in 2006 mandates a BMAP with the objective of demonstrating that the effluent limitations established for the facility protect the classified uses of the receiving stream, EFPC. The BMAP, which has been monitoring the ecological health of EFPC since 1985, consists of three major tasks that reflect complementary approaches to evaluating the effects of Y-12 discharges on the aquatic integrity of EFPC. These tasks include (1) bioaccumulation monitoring, (2) benthic macroinvertebrate community monitoring, and (3) fish community monitoring. Data collected on contaminant bioaccumulation and the composition and abundance of communities of aquatic organisms provide a direct evaluation of the effectiveness of abatement and remedial measures in improving ecological conditions in the stream (DOE 2008).

Monitoring is currently being conducted at five primary EFPC sites, although sites may be excluded or added, depending upon the specific objectives of the various tasks. The primary sampling sites include upper EFPC at EFK 24.4 and 23.4 (upstream and downstream of Lake Reality, respectively); EFK 18.7 (also EFK 18.2), located off ORR and below an area of intensive commercial and light industrial development; EFK 13.8, located upstream from the Oak Ridge Wastewater Treatment Facility; and EFK 6.3, located approximately 1.4 kilometers below ORR boundary (Figure 4.8.4-1). Trends of increases in species richness and diversity at upstream locations over the last decade, along with similar but more subtle trends in a number of other BMAP indicators, demonstrate that the overall ecological health of EFPC continues to improve. However, the pace of improvement in the health of EFPC near Y-12 has slowed in recent years, and fish and invertebrate communities continue to be degraded when compared to similar communities in reference streams (DOE 2008).

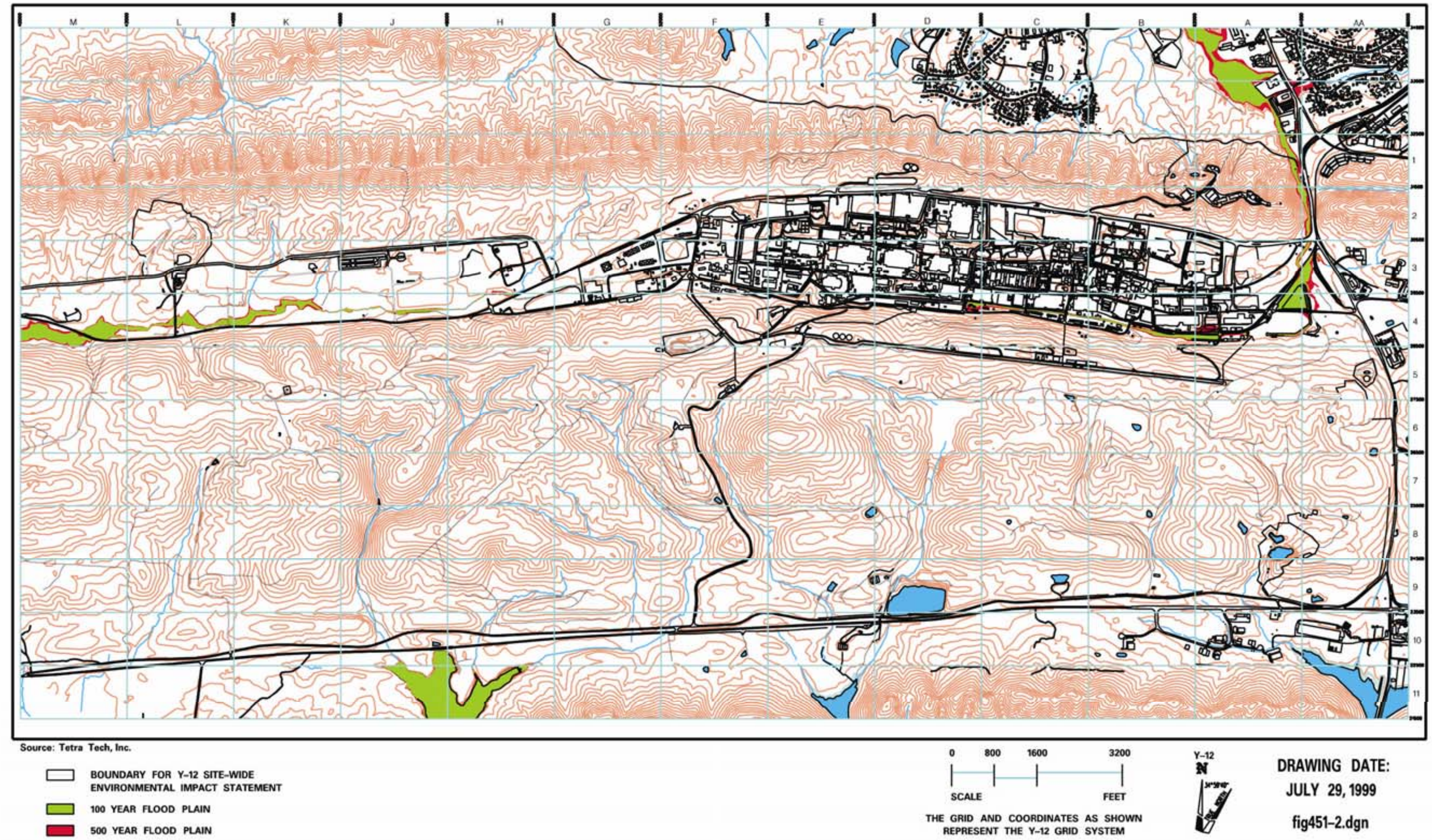
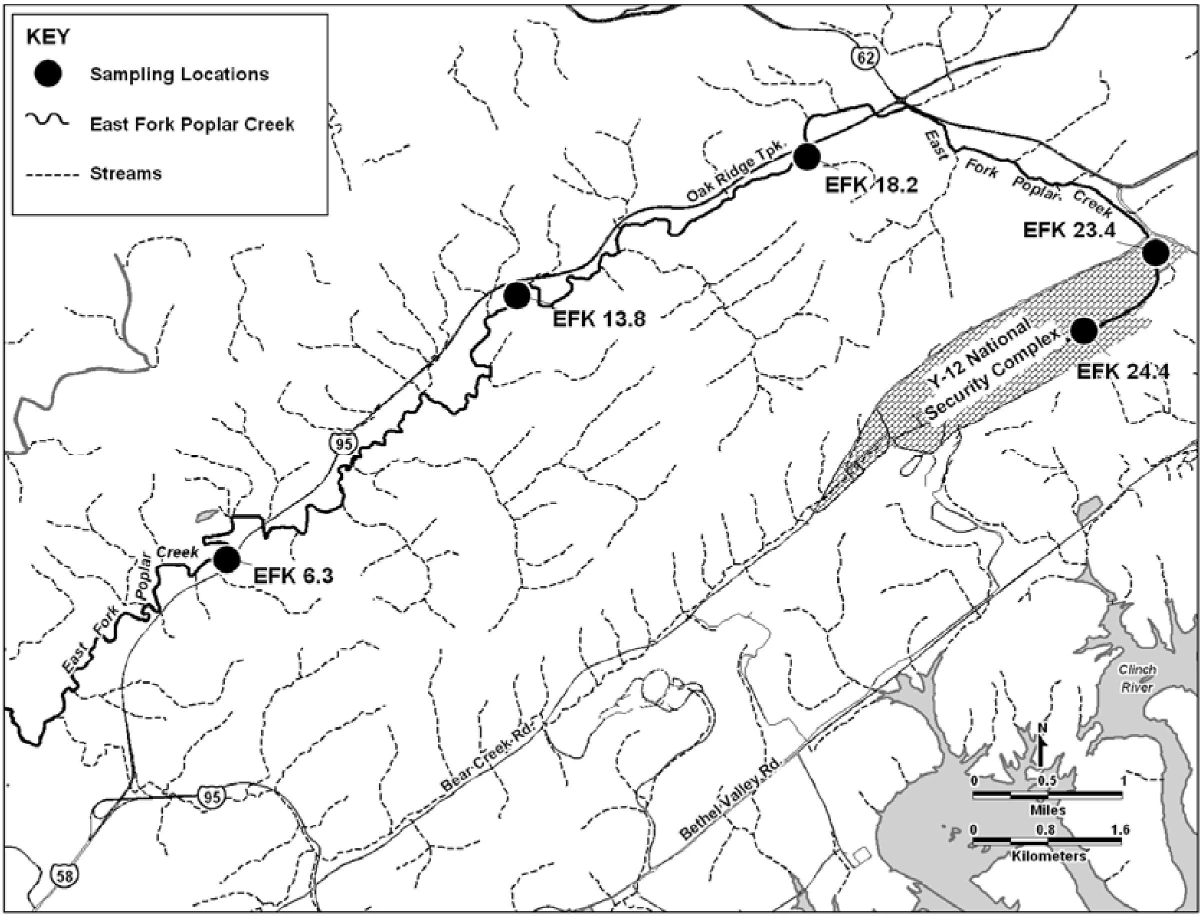


Figure 4.8.3-1. 100 and 500-year Floodplains for Y-12.



Source: DOE 2008.

Figure 4.8.4-1. Locations of Biological Monitoring Sites on East Fork Poplar Creek in Relation to Y-12.

Mercury and PCB levels in EFPC fish have historically been elevated relative to fish in uncontaminated reference streams. Fish are monitored regularly in EFPC for mercury and PCBs to assess spatial and temporal trends in bioaccumulation associated with ongoing remedial activities and plant operations. Mercury concentrations remained much higher during 2007 in fish from EFPC than in fish from reference streams. Elevated mercury concentrations in fish from the upper reaches of EFPC indicate that Y-12 remains a continuing source of mercury to fish in the stream. Although waterborne mercury concentrations in the upper reaches of EFPC decreased substantially following the 2005 start-up of a treatment system on a mercury-contaminated spring, mercury concentrations in fish have not decreased in response. Lead PCB concentrations in fish were much lower in 2007 than peak concentrations observed in the mid-1990s (DOE 2008).

The biological indicator task is designed to evaluate the effects of water quality and other environmental variables on the health and reproductive condition of individual fish and fish populations in EFPC. The health and reproductive condition of fish from sites upstream in EFPC remain lower in several respects than in fish from reference sites or downstream EFPC.

4.9 CULTURAL RESOURCES

4.9.1 Introduction

Cultural resources are those aspects of the physical environment that relate to human culture and society, and those cultural institutions that hold communities together and link them to their surroundings. The cultural resources present within ORR region are complex because of the long prehistoric use of the area; the relocation of the Cherokee from villages during historic times; the presence of well-established settlements prior to acquisition by the Federal government; the continuity of traditional American folklife traditions; and the importance of ORR facilities in the history of nuclear research and production activities for World War II and the Cold War era. An extensive discussion of cultural resources of ORR region can be found in the DOE-Oak Ridge Office (ORO) Cultural Resource Management Plan (Souza et al.1997).

A short history of the human use of the area surrounding ORR and Y-12 is presented to provide a background for the discussion of cultural resources. The region of influence (ROI) for cultural resources is ORR. The ROI defines the general resource base and relevant cultural and historical contexts for addressing impacts in the area of potential effects. An area of potential effects is the geographic area within which an action may cause changes in the character or use of an historic property (36 CFR 800.3[a]). The resources of the ROI provide a comparative basis for establishing the relative importance of resources in the area of potential effects and considering the intensity of potential impacts. The area of potential effects for this SWEIS is the Y-12 site and land adjacent to the Y-12 site boundary.

4.9.2 Significance of Cultural Resources

The long history of legal jurisdiction over cultural resources, dating back to 1906 with the passage of the *Antiquities Act* (16 U.S.C. 431-433), demonstrates a continuing concern on the part of Americans for their cultural resources. Foremost among these statutes are the *National Historic Preservation Act* (NHPA) of 1966, as amended (16 U.S.C. 470), and its revised implementing regulations (36 CFR Part 800). This statute describes the process for identification and evaluation of cultural resources, assessment of effects of Federal actions on historic resources, and consultation to avoid, reduce, or mitigate adverse effects. The NHPA does not require preservation of cultural resources, but does ensure that Federal agency decisions concerning the treatment of these resources result from meaningful consideration of cultural and historic values, and identification of options available to protect the resources.

Identified cultural resources are fully recorded and evaluated to determine if they are eligible for listing on the National Register of Historic Places (NRHP). To be eligible, a resource must retain most of 7 aspects of integrity, be at least 50 years old (although there are exceptions to this), and meet 1 of 4 criteria of significance. Eligible resources are afforded consideration under the NHPA. If a Federal action will adversely affect an eligible resource, then measures must be taken to avoid, reduce, or mitigate the effect.

4.9.3 Regional Cultural History

Archaeologists and historians have developed a basic framework to describe changes observed in the cultural traditions of the region. Human occupation and use of the East Tennessee Valley between the Cumberland Mountains and the southern Appalachians is believed to date back to the Late Pleistocene, at least 14,000 years ago. Archaeologists have traditionally believed that these Paleo-Indian bands subsisted primarily by hunting the large game of that era and collecting wild plant foods. More recent research indicates that a generalized subsistence strategy was probably practiced. In response to warmer and drier climatic conditions and the subsequent loss of Pleistocene megafauna, hunter-gatherers practiced a more diverse subsistence strategy by targeting smaller game and increasing their plant-gathering activities. More sedentary adaptations on river terraces, floodplains, and labor specialization concurred with the development and refinement of fishing gear and the exploitation of additional plant materials. Between 3000 and 900 B.C., larger, multifamily communities evolved and primitive horticulture first appeared. Trade goods such as marine shells, copper goods and soapstone bowls were first found on sites dating to this period. The introduction of pottery, a continued pattern of multiseasonal settlement along river terraces, refinement of agricultural practices, and the use of a broader scope of food resources characterized the next 1,800 years.

During the Mississippian cultural periods (900 A.D. to historic times), larger scale, permanent communities developed, first along the alluvial terraces, and later on the second river terraces in rich bottomlands suitable for intensive agriculture. These expanding villages included multiple structures, storage pits, hearths, mounds, stockades, plazas, and semisubterranean earth lodges. Archaeological evidence reflects an increasingly complex and specialized society with a high degree of organization, which included the development of elite social classes. Just prior to Euro-American contact in the late 17th century, however, there appears to have been a breakdown in the hierarchies and a scaling-back of both village size and elaborate public structures. The first Euro-Americans to visit the region were French and English traders and trappers, soon followed by permanent settlers. These newcomers introduced a variety of domesticated animals, fruit trees, food crops, beads, metal, glass, and other raw materials and derived products to the native inhabitants, now known as the Overhill Cherokee. After a series of conflicts, most of the Cherokee were forcibly relocated to the Oklahoma Territory in 1838. Small, close-knit, agricultural communities developed and continued until 1942, when 58,575 acres were purchased by the U.S. government as a military reservation. To contribute to the development of nuclear weapons for the World War II effort, three production facilities (including Y-12) and a residential townsite were built inside the reservation. New facilities were constructed on ORR after the War and new missions continued through the Cold War period to the present.

4.9.4 Cultural Resources of ORR and Y-12

Section 106 of the NHPA requires federal agencies take into account the effects of their undertakings on properties included in, or eligible for, inclusion in the NRHP. To comply with Section 106 of the NHPA and its implementing regulations at 36 CFR Part 800, DOE-ORO was instrumental in the ratification of a programmatic agreement among DOE-ORO, the Tennessee State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP) concerning management of historical and cultural properties on ORR. The programmatic agreement was ratified on May 6, 1994, and has been incorporated into the approved *Cultural Resource Management Plan, DOE Oak Ridge Reservation* (DOE 2004b). The plan was completed in accordance with stipulations in the programmatic agreement, including historical surveys to identify significant historical properties on ORR. Because of plans to demolish a significant number of buildings at ORNL and at Y-12, a second programmatic agreement was drafted for each site. It was approved by DOE-ORO, the SHPO, and the ACHP on February 23, 2005 (DOE 2005a).

Compliance with NHPA at ORNL, Y-12, and ETTP is achieved and maintained in conjunction with NEPA compliance. The scope of proposed actions is reviewed in accordance with the *Cultural Resource Management Plan* and Programmatic Agreement and the appropriate level of documentation is prepared and submitted. If warranted, consultation is initiated with the SHPO and the ACHP. Y-12 developed an Interpretative Plan on Historic Preservation for Y-12, which was reviewed by NNSA, DOE-ORO, the SHPO, and the ACHP. It was approved by the SHPO January 28, 2005. The Interpretative Plan examined Y-12's purpose and significant resources in order to establish interpretative themes, goals and objectives for conveying the site's history. The plan identified interpretive themes, analyzed the interpretive needs of Y-12, and outlined recommended actions. The actions recommended in the plan are those that can reasonably be expected to be accomplished in 7 to 10 years, the projected life span of the plan. The plan was driven by the site's historic significance and historic resources, as well as the site's operational objectives and security requirements (DOE 2008).

Methods used to identify the presence of cultural resources and to determine eligibility vary according to the resource types. Pedestrian surveys are used to locate archaeological resources, and a separate excavation phase is often required to evaluate archaeological resources for NRHP eligibility. Approximately 90 percent of ORR has been surveyed, on a reconnaissance level, for prehistoric and historic archaeological resources. Less than five percent has been intensely surveyed. To date, over 44 prehistoric sites and 254 historic sites, including 32 cemeteries, have been recorded within the current boundaries of ORR. Fifteen prehistoric sites and 35 historic archaeological resources are considered eligible for listing on the NRHP (Souza et al. 1997).

Architectural and archaeological studies have been conducted for Y-12 (Thomason and Associates 2003). In 1995, with a final version in 1999, Thomason and Associates completed a comprehensive architectural and historical evaluation of Y-12. A total of 248 properties were individually recorded and evaluated, and the remaining 325 facilities were identified and categorized by use. At least 10 major archaeological reconnaissance-level surveys have been conducted on ORR. A survey conducted of Y-12 in the early 1990s identified one archeological site (40AN68) which is located on a flat rise overlooking the EFPC within the boundaries of Y-12. This site is of an ephemeral nature and is not eligible for inclusion in the NRHP pursuant to 36 CFR Part 60.4 (DuVall and Associates 1999). It was concluded that the potential is low for identifying significant archeological sites within Y-12 proper that meet the criteria for inclusion in the NRHP. All buildings and structures in Y-12 have been surveyed and evaluated.

Y-12 currently has a proposed National Register Historic District of historic buildings associated with the Manhattan Project that are eligible for listing in the NRHP (Figure 4.9.4-1) (NNSA 2005c). The Tennessee SHPO has concurred with this determination (Thomason and Associates

2003). The district and its contributing properties are eligible under Criterion A for its historical associations with the Manhattan Project, development as a nuclear weapons component plant within the post-World War II scientific movement, and early nuclear activities. The historic district is also eligible under Criterion C for the engineering merits of many of the properties and their contributions to science.

Within the proposed historic district, two buildings have been recommended for the National Historic Landmark status as individual properties (see Figure 4.9.4-1) Building 9731 is the oldest facility completed at Y-12 and played a major part in the Manhattan Project. The prototype calutron was housed and operated in this building and the building was also the location of the original production of stabilized metallic isotopes used in nuclear medicine. Building 9204-3 (Beta-3) functioned as a uranium enrichment facility during World War II and is significant for its pioneering role in the nuclear research in enriched uranium and the separation of stabilized isotopes (NNSA 2005c).

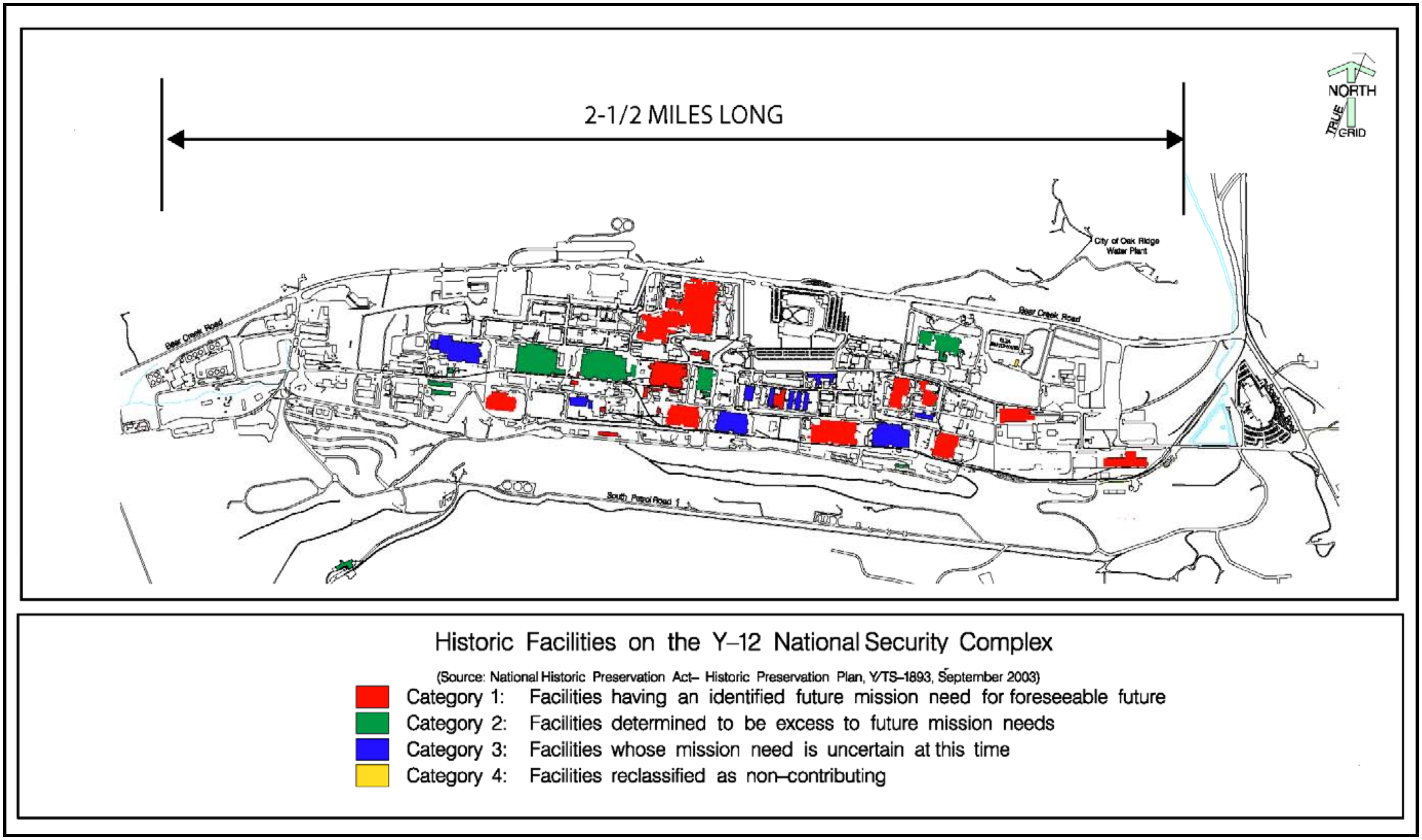
To better fulfill the requirements of the NHPA, in September, 2003, DOE NNSA developed the *National Historic Preservation Act Historic Preservation Plan* (HPP) for Y-12. The HPP provides an effective approach to preserving the historically significant features of the Y-12 site, while facilitating continued use of the site for ongoing and future missions. The preservation strategy outlined in the HPP ensures historic preservation is an integral part of the comprehensive planning process. As a part of this strategy and based on the dynamics of Y-12's planning efforts, the existing historic properties were categorized into four groups. These groups and their respective facilities are shown in Figure 4.9.4-1 and described as follows:

- **Category 1—Facilities having an identified future mission need for foreseeable future.** This category is subject to change since long-range planning to consolidate operations continues to take place.

- **Category 2—Facilities determined to be excess to future mission needs.** This category includes facilities that have been declared excess and those projected to become excess.

- **Category 3—Facilities whose mission need is uncertain at this time.** This category continues to evolve as short-term planning on key consolidation projects matures. For example, many of the facilities in this category are linked to the construction of new administrative and technical facilities.

- **Category 4—Facilities reclassified as non-contributing.** This category includes facilities discontiguous to the historic district that were identified and recommended for re-evaluation. They were re-evaluated and reclassified as non-contributing properties to the historic district. Implementation of the Y-12 historic preservation strategy is being accomplished through the combined application of interpretive initiatives and physical preservation of historic properties. Physical preservation will be evaluated in the context of, but not limited to, continuing mission need, functional use, security considerations, and economics. This strategy recognizes that historic preservation goes beyond the retention of physical structures, principally due to the fact that much of Y-12's historical significance goes beyond physical structures (NNSA 2005c).



Source: NNSA 2007.

Figure 4.9.4-1. Location of the Historic Facilities at Y-12.

Ancestors of the Eastern Band of the Cherokee Indians and the Cherokee Nation of Oklahoma may be culturally affiliated with the prehistoric use of the Y-12 area. No Native American traditional use areas or religious sites are known to be present on the Y-12 site. Also, no artifacts of Native American religious significance are known to exist or to have been removed from the Y-12 site (DOE 2001a).

There are at least 32 cemeteries located within the boundaries of ORR, 7 of which are located on the Y-12 site. These cemeteries are associated with Euro-American use of the area prior to World War II and are likely to have religious or cultural importance to descendants and the local community (DOE 2001a). All are currently maintained and protected. No other traditional, ethnic, or religious resources have been identified on the Y-12 site.

4.9.5 Paleontological Resources

Paleontological resources are the physical remains, impressions, or traces of plants or animals from a former geologic age. Paleontological resources are important mainly for their potential to provide scientific information on paleoenvironments and the evolutionary history of plants and animals. Impact assessments for paleontological resources are based on the research potential of the resource, the quality of the fossil preservation in the deposit, and on the numbers and kind of resources that could be affected. Resources with high research potential include well-preserved terrestrial vertebrates, unusual depositional contexts or concentrations, assemblages containing a variety of different fossil forms, and deposits with poorly understood fossil forms that originate from areas that are not well studied.

Paleontological Resources of ORR and Y-12. The ORR is underlain by bedrock formations predominated by calcareous siltstones, limestones, sandstones, siliceous shales, and siliceous dolostones. The majority of geologic units with surface exposures on ORR contain paleontological materials. All of these paleontological materials consist of common invertebrate remains which are unlikely to be unique from those available throughout the East Tennessee region.

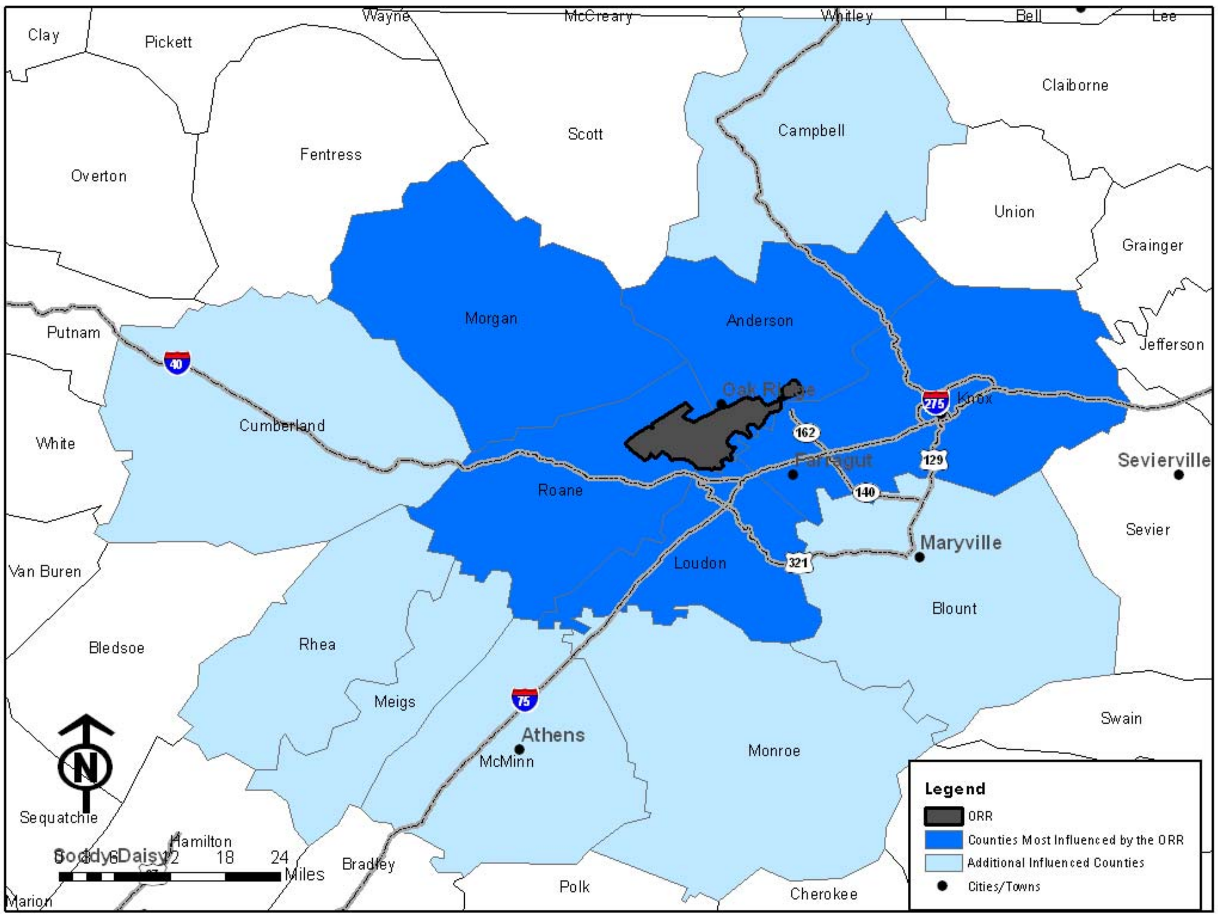
4.10 SOCIOECONOMICS

This section describes current socioeconomic conditions within an ROI where more than 90 percent of ORR workforce resides. The ROI is a four-county area in Tennessee comprised of Anderson, Knox, Loudon, and Roane Counties. Figure 4.10–1 shows the surrounding counties influenced by ORR. Approximately 40 percent of the current ORR labor force, which includes employed and unemployed individuals, resides in Knox County, 29 percent in Anderson County, 16 percent in Roane County, and 6 percent in Loudon County. The remaining 9 percent of the labor force resides in other counties across Tennessee, none of which are home to more than 3 percent of the labor force.

4.10.1 Employment and Income

The ORR ROI has historically been dependent on manufacturing and government employment. More recent trends show growth in the service sector and a decline in manufacturing and government employment. Table 4.10.1–1 presents current and historical employment for the major sectors of the ROI economy. Although there have been fluctuations in these estimates, the ROI labor force grew by approximately 11 percent from 280,986 in 2000 to 312,211 in 2007 (BLS 2007).

The ROI unemployment rate was 3.7 percent in 2007, continuing on a downward trend after a 5-year high of 4.5 percent in 2005, as shown in Table 4.10.1–2. In 2007, unemployment rates within the ROI ranged from a low of 3.4 percent in Knox County to a high of 5.3 percent in Roane County. The unemployment rate in Tennessee was 4.7 percent (BLS 2007).



Source: derived from DOE 2001a.

Figure 4.10-1. Location of Oak Ridge Reservation and Surrounding Counties.

Table 4.10.1-1. Employment by Sector (Percent).

Sector	1980	1990	2000	2005
Services	19.1	27.3[a]	32.2	39.0
Wholesale	5.5	5.5	5.0	7.9
Retail	15.6	19.3[a]	18.3	12.3
Government (including Federal, State, local, and military)	20.3	15.4	13.7	13.1
Manufacturing	21.9	15.8	10.7	8.6
Farm	2.0	1.5	1.2	1.0

Table 4.10.1-1. Employment by Sector (Percent) [*continued*].

Sector	1980	1990	2000	2005
Construction	4.9	5.4	6.3	6.1
Finance, Insurance, and Real Estate	6.0	5.1	6.3	5.8
Transportation and Public Utilities	3.7	4.0	5.1	ND
Agricultural Service, Forestry, and Other	0.3	0.6	1.1[b]	0.1[c]
Mining	0.7	0.4	0.2[b]	0.2[c]

Source: BEA 2003, BEA 2007.
a – Percentage only includes Knox and Loudon Counties. Data for Roane and Anderson Counties not available.
b – Percentage only includes Knox and Roane Counties. Data for Loudon and Anderson Counties not available.
c – Percentage only includes Knox County. Data for Anderson, Loudon, and Roane Counties not available.
ND – No Data available.

Table 4.10.1–2. Region of Influence Unemployment Rates (Percent).

County	2000	2001	2002	2003	2004	2005	2006	2007
Anderson	4.2	4.8	4.8	5.3	4.9	4.9	4.7	4.2
Knox	3.2	3.4	3.7	4.0	4.0	3.9	3.9	3.4
Loudon	3.6	4.3	4.9	4.9	4.5	4.4	4.4	3.9
Roane	4.4	4.8	5.5	5.5	5.8	5.8	5.8	5.3
ROI Total	3.4	3.7	4.1	4.3	4.3	4.5	4.1	3.7
Tennessee	4.0	4.7	5.3	5.7	5.4	5.6	5.1	4.7

Source: BLS 2007.

Per capita income statistics for 2001 to 2006 are shown in Table 4.10.1-3. The average per capita income in the ROI was $31,493 in 2006, a 21.7 percent increase from the 2001 level of $25,880. Per capita income in 2006 in the ROI ranged from a low of $29,074 in Roane County to a high of $33,963 in Knox County. The per capita income in Tennessee was $32,172 in 2006 (BEA 2007).

Table 4.10.1-3. Per Capita Income Statistics, 2001-2006.

County	2001	2002	2003	2004	2005	2006
Anderson	$25,985	$26,798	$27,566	$28,055	$29,007	$30,218
Knox	$29,179	$29,583	$30,059	$31,417	$32,815	$33,963
Loudon	$25,717	$26,377	$27,528	$29,554	$30,538	$32,715
Roane	$22,638	$23,942	$24,863	$26,447	$27,584	$29,074
ROI Average	$25,880	$26,675	$27,504	$28,868	$29,986	$31,493
Tennessee	$26,871	$27,499	$28,350	$29,641	$30,969	$32,172

Source: BLS 2007.

Y-12 employs approximately 6,500 workers, including DOE employees and multiple contractors and subcontractors (NNSA 2005c). This represents approximately 3.1 percent of the ROI employment. DOE has a significant impact on the economies both of the ROI and of Tennessee. As a whole, DOE employees and contractors number more than 13,700 individuals in Tennessee, primarily in the ROI. These DOE jobs have an average salary of $54,800 in comparison to the statewide average of $32,919 (UTenn 2005).

DOE employment and spending generate additional benefits to the ROI and state economies through the creation of additional jobs in sectors providing support to DOE and its workers. An analysis of the economic impacts of DOE operations conducted by the Center for Business and Economic Research at the University of Tennessee revealed the following:

- Spending by DOE and its contractors led to an increase of nearly $3.7 billion in the state of Tennessee gross state product in 2004.
- Total personal income generated in the state of Tennessee by DOE-related activities was roughly $1.9 billion in 2004. Each dollar of income directly paid by DOE in the state translates into a total of $2.26 in personal income for Tennessee residents.
- DOE-related spending generated $74.7 million in state and local sales tax revenue in Tennessee in 2004 (UTenn 2005).

4.10.2 Population and Housing

U.S. Census Bureau data from the 2000 Census was used in the discussion of population and housing. From 2000 to 2007, the population of the ROI increased 3 percent from 544,358 to 596,192 in 2007. Loudon County experienced the largest population growth within the ROI between 2000 and 2007 with an increase of 16 percent. Roane County experienced the lowest growth rate with an increase of 2.9 percent (USCB 2007).Populations in all counties in the ROI are projected to continue to grow at a slower rate between 2000 and 2020, as shown in Table 4.10.2–1.

Table 4.10.2-1. Historic and Projected Population Levels in the Region of Influence.

County	1990	2000	2010	2020
Anderson	68,250	71,330	75,163	77,226
Knox	335,749	382,032	427,593	481,842
Loudon	31,255	39,086	48,362	58,729
Roane	47,227	51,910	57,042	61,836
ROI	482,481	544,358	608,160	679,633
Tennessee	4,877,203	5,689,283	6,425,969	7,195,375

Source: USCB 2007, State of Tennessee 2003.

Knox County is the largest county in the ROI with a 2007 population of 423,874. Knox County includes the city of Knoxville, the largest city in the ROI. Loudon County is the smallest county in the ROI with a total population of 45,448 in 2007. The city of Oak Ridge and ORR are located in both Roane and Anderson Counties which had 2003 populations of 53,399 and 73,471, respectively (USCB 2007).

Table 4.10.2-2 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 244,537 with 224,796 occupied (91.9 percent). There were 156,219 owner-occupied housing units and 68,577 rental units. The median value of owner-occupied units in Loudon County was the greatest of the counties in the Y-12 ROI ($97,300). The vacancy rate was the lowest in Loudon County (7.7 percent) and the highest in Roane County (9.3 percent) (USCB 2007).

Table 4.10.2-2. Region of Influence Housing Characteristics (2000).

County	Total Units	Occupied housing Units	Owner Occupied Units	Renter Occupie d Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Units (dollars)
Anderson	32,452	29,780	21,592	8,188	2,671	8.2	87,500
Knox	171,439	157,872	105,562	52,310	13,567	7.9	98,500
Loudon	17,277	15,944	12,612	3,332	1,333	7.7	97,300
Roane	23,369	21,200	16,453	4,747	2,169	9.3	86,500
ROI	244,537	224,796	156,219	68,577	19,740	8.1	95,619

Source: USCB 2007.
NA - Not applicable.

4.10.3 Community Services

Community services analyzed in the ROI include public schools, law enforcement, fire suppression and medical services. There are 7 school districts with 145 schools serving the Y-12 ROI. Educational services are provided for approximately 81,729 students by an estimated 5,216 teachers for the 2005 to 2006 school year (IES 2007). The student-to-teacher ratio in these school districts ranges from a high of 18:1 in the Lenoir City School District in Loudon County to a low of 14:1 in the Oak Ridge School District. The student-to-teacher ratio in the ROI was 16:1 (IES 2007).

The counties within the ROI employ approximately 46,000 firefighters and law enforcement officers. Security at Y-12 is provided by Wackenhut Services, Inc. (DOE 2001a). There are eleven hospitals that serve residents of the ROI with the majority located in Knox County. These hospitals have a total bed capacity of 2,195 (ESRI 2007).

4.11 ENVIRONMENTAL JUSTICE

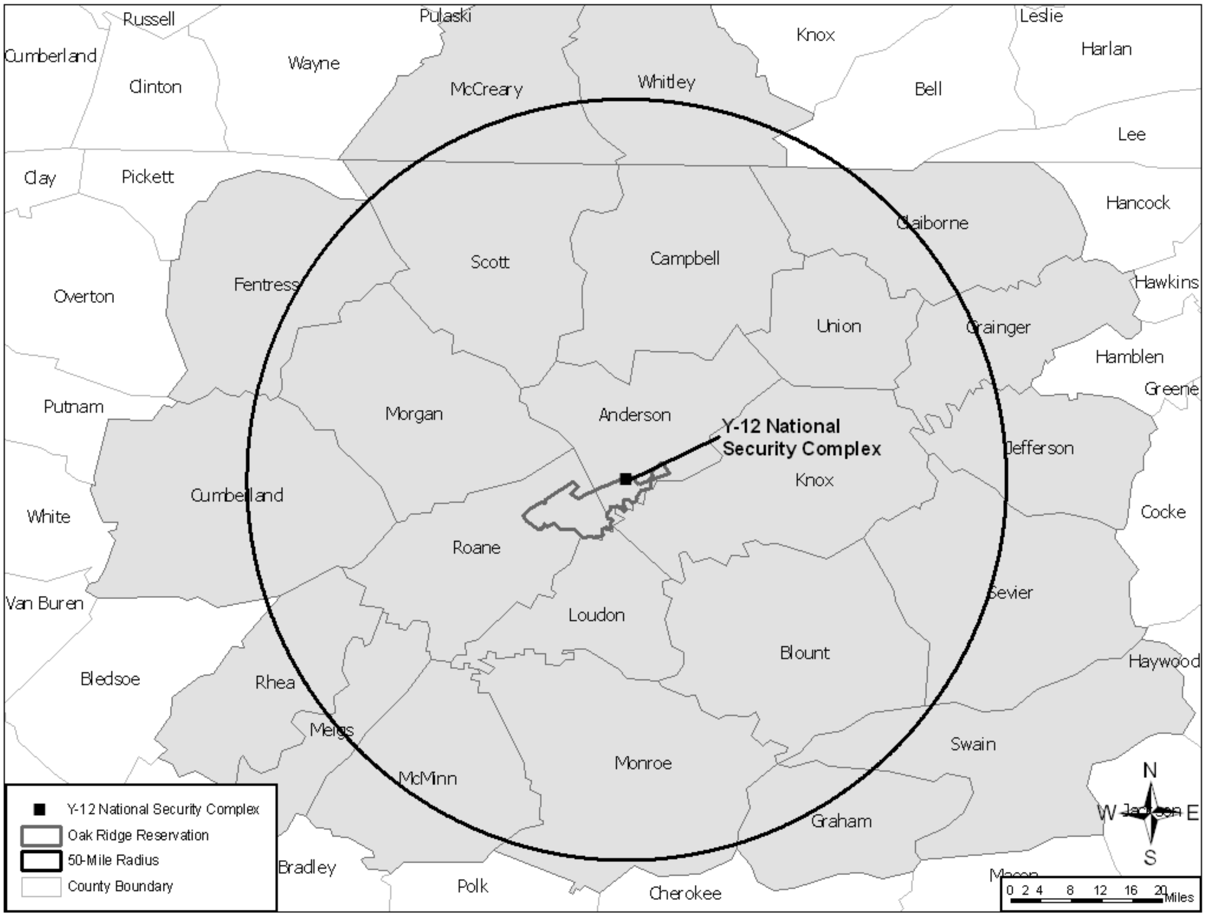
Environmental justice has been defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (EPA 2005b). Concern that minority and/or low-income populations might be bearing a disproportionate share of adverse health and environmental impacts led President Clinton to issue an EO in 1994 to address these issues. That Order, EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," directs Federal agencies to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. When conducting NEPA evaluations, DOE incorporates environmental justice considerations into both technical analyses and public involvement programs in accordance with EPA and the Council on Environmental Quality (CEQ) regulations (CEQ 1997).

Demographic information from the U.S. Census Bureau was used to identify minority and low-income populations in the ROI. Information on locations and numbers of minority and low-income populations was obtained from the 2000 U.S. Census. Census data are reported on the level of census tracts, a geographical area that varies with size depending largely on population density, with low-population density census tracts generally covering larger geographical areas.

Minority refers to people who classified themselves in the 2000 U.S. Census as Black or African American, Asian or Pacific Islander, American Indian or Alaskan Native, Hispanic of any race or origin, or other non-White races (CEQ 1997). Environmental Justice guidance defines "low-income" using statistical poverty thresholds used by the U.S. Census Bureau. Information on low-income populations was developed from 1999 incomes reported in the 2000 U.S. Census. In 1999, the poverty weighted average threshold for an individual was $8,501 annually (USCB 2002).

The CEQ identifies minority and low-income populations when either (1) the minority or low-income population of the affected area exceeds 50 percent or (2) the minority or low-income population percentage in the affected area is meaningfully greater (i.e., 20 percentage points greater) than the minority population percentage in the general population or appropriate unit of geographical analysis. The potentially affected area considered for environmental justice analysis is the area within a 50-mile radius of Y-12. Figure 4.11-1 shows counties potentially at risk from the current missions performed at Y-12. There are 19 counties that are included in the potentially affected area. Table 4.11-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

Any disproportionately high and adverse human health or environmental effects on minority populations and/or low-income populations that could result from the alternatives being considered for Y-12 are assessed for the census tract which contains the site. Health effects resulting from discharge to water pathways would also be assessed for this area.



Source: USCB 2007.

Figure 4.11-1. Potentially Affected Counties Surrounding Y-12 Environmental Justice.

Table 4.11-1. Demographic Profile of the Potentially Affected Area Surrounding Y-12, 2000.

Population Group	Population	Percent
Minority	**81,942**	**7.4**
Hispanic alone	7,115	0.6
Black or African American	46,871	4.2
American Indian and Alaska Native	3,058	0.3
Asian	8,053	0.7
Native Hawaiian and Other Pacific Islander	267	0.02
Some other race	5,185	0.5
Two or more races	11,393	1.0
White alone	**1,023,659**	**92.6**
Total Population	**1,105,601**	**100.0**

Source: USCB 2007.

In 2000, persons self-designated as minority individuals in the potentially affected area comprised 7.4 percent of the total population. This minority population is composed largely of Black or African American residents. As a percentage of the total resident population in 2000, Tennessee had a minority population of 20.8 percent and the U.S. had a minority population of 30.9 percent (USCB 2007).

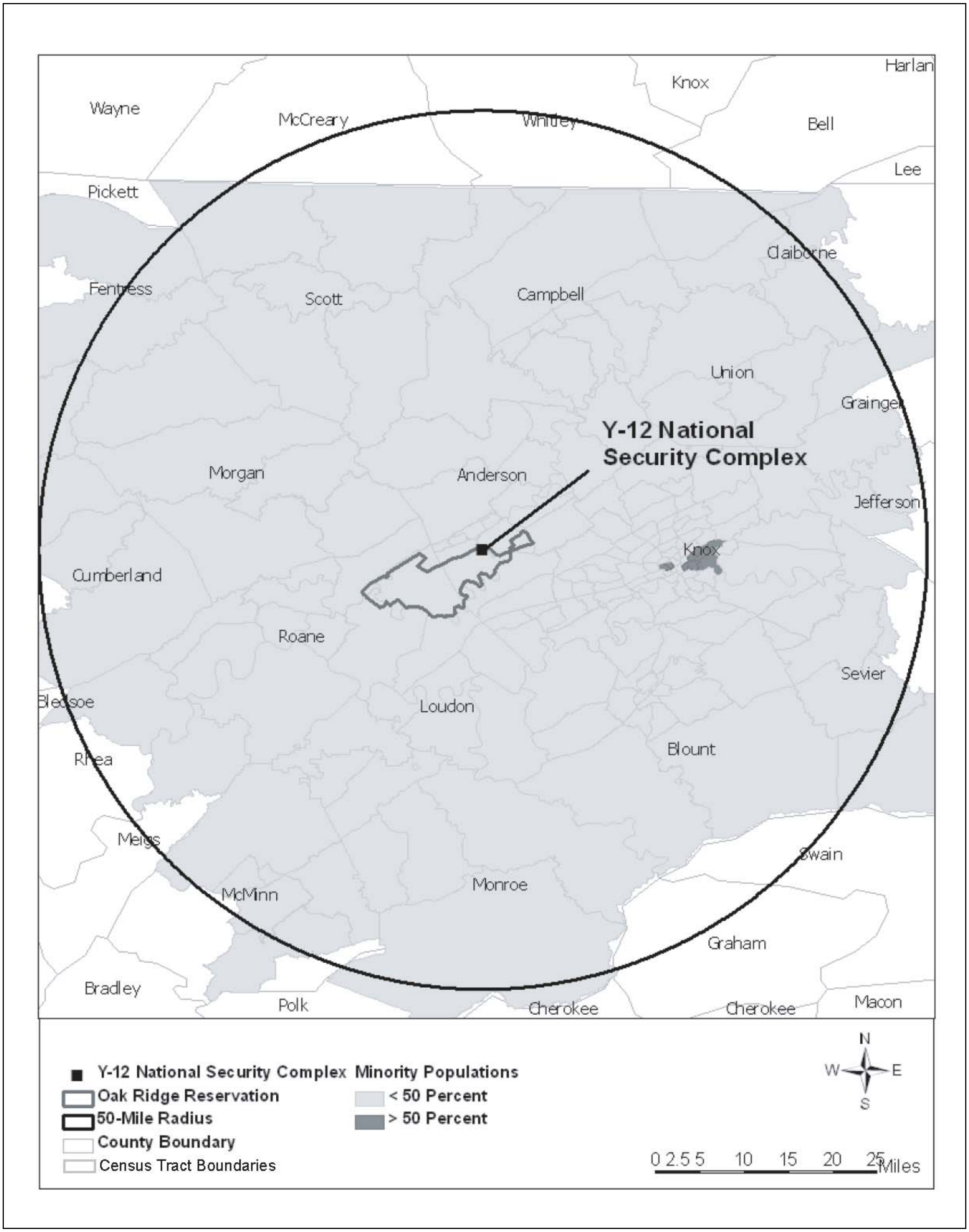
Census tracts with minority populations exceeding 50 percent were considered minority census tracts. Based on 2000 census data, Figure 4.11-2 shows minority census tracts within the 50-mile radius where more than 50 percent of the census tract population is minority.

Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.11-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tracts population is living below the Federal poverty threshold.

According to 2000 census data, approximately 122,216 individuals residing within census tracts in the 50-mile radius of Y-12 were identified as living below the Federal poverty threshold, which represents approximately 13 percent of the census tracts population within the 50-mile radius. There were five census tracts located in Knox County with populations greater than 50 percent identified as living below the Federal poverty threshold. In 2000, 13.5 percent of individuals for whom poverty status was determined were below the poverty level in Tennessee and 12.4 percent in the U.S. (USCB 2007).

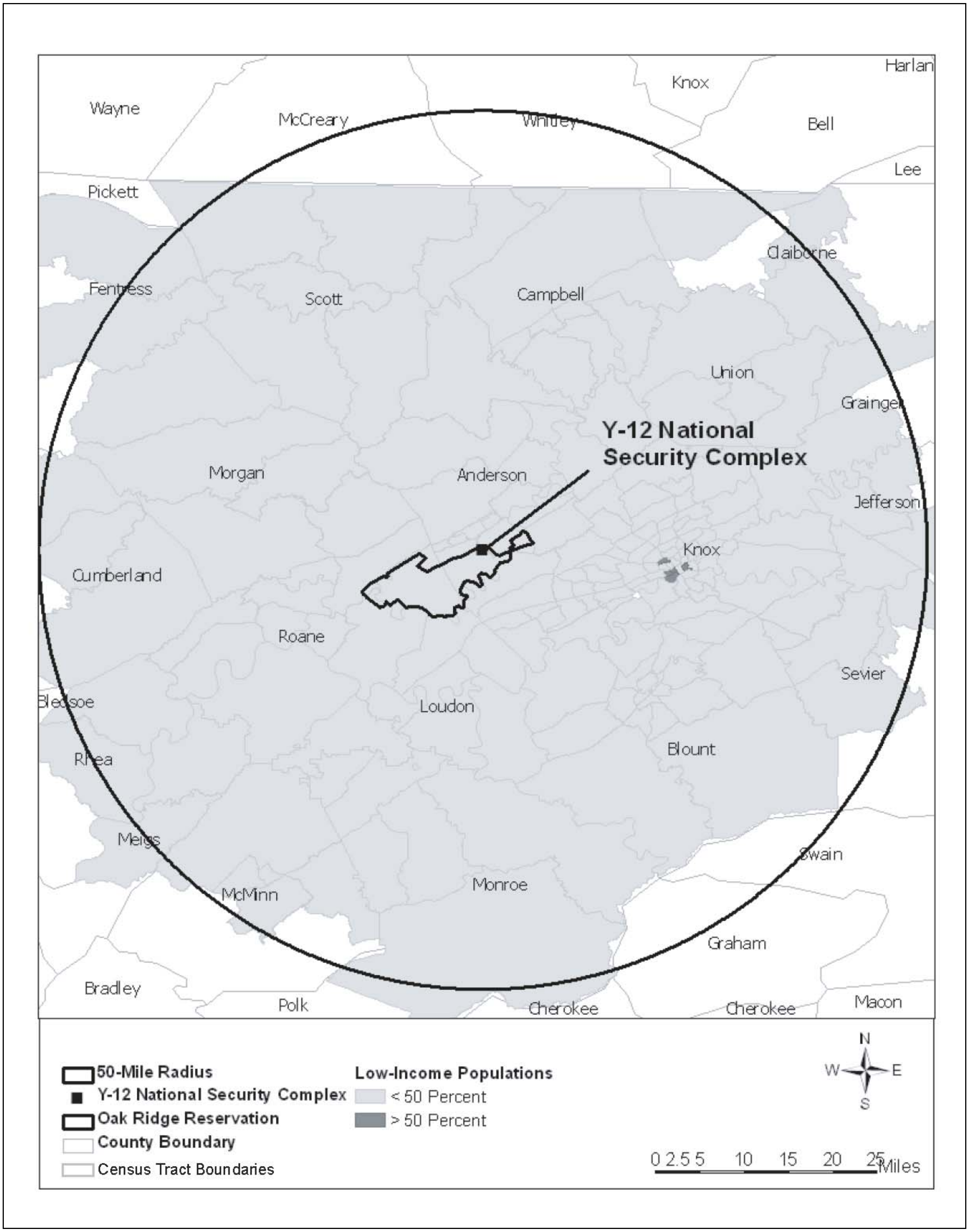
In April 2003, the EPA completed a study of soil and water quality in the Scarboro community (EPA 2003). Scarboro Community is an urban minority community located closer to the boundary of ORR than any other residential community. EPA's study looked for hazardous substances and radionuclides associated with the operations of nearby Y-12, several of which had not been included in sample analysis from other studies. None of the EPA radionuclide analytical values exceeded normal background levels, Maximum Concentration Levels (MCLs) or Preliminary Remediation Goals (PRGs) that may indicate a health concern. None of the mercury samples were above the MCL or PRG. The National Secondary Drinking Water Standard (NSDWS) and PRG levels were exceeded for aluminum, iron and manganese in a few water, sediment and soil samples. However, aluminum, iron and manganese are naturally occurring in the geographic area of Oak Ridge, indicating that these are not related to releases from DOE operations and do not in any case present a health risk. All other metals were undetected or below the MCLs, NSDWSs, or PRGs. EPA's work gives a completed representation of any contamination that might have been encountered.

The EPA study concludes that the residents of Scarboro are not currently being exposed to substances that pose an unreasonable risk to health or the environment. The soil, sediment and water quality in this community does not pose a risk to human health and the environment. The EPA does not propose to conduct any further environmental sampling in the Scarboro community unless such work is needed as part of future studies within the entire Oak Ridge community. These results confirm that existing soil and water quality pose no risk to human health within the Scarboro community.



Source: USCB 2007.

Figure 4.11-2. Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of Y-12.

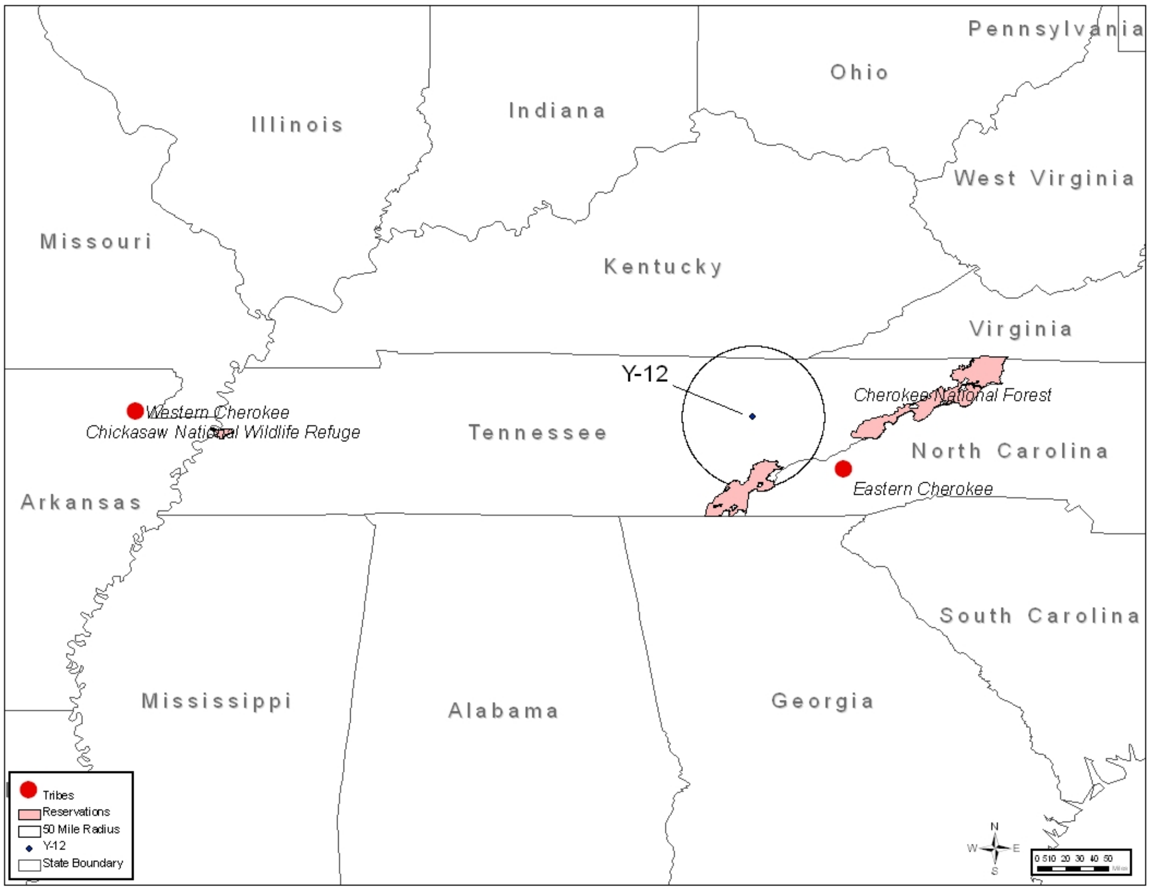


Source: USCB 2007.

Figure 4.11-3. Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of Y-12.

4.11.1 Characteristics of Native American Populations within the Vicinity of or with Interest in Y-12 Activities/Operations

Native American groups which are known to have used the lands surrounding Y-12 are the Ancestors of the Eastern Band of the Cherokee Indians and the Cherokee Nation of Oklahoma. The 2000 U.S. Census Bureau was used to obtain characteristics, including population, employment, educational attainment, income, poverty level, average family size, and housing characteristics for all population subcategories associated with the ones mentioned above. The locations of various tribes in relation to Y-12 are shown in Figure 4.11.1-1. The results of this analysis are provided in the following section.



Source: ESRI 2007.

Figure 4.11.1-1. Location of Tribes within Vicinity of or with Interest in Y-12.

As shown in Table 4.11.1-1, the Eastern Cherokee had a population of 8,451, which was larger than the Western Cherokee population of 6,693 in 2000. The Eastern Cherokee also have a larger percentage of their population as members of the civilian labor force with 65.9 percent and the Western Cherokee with a smaller percentage of their population as members of the civilian labor force with 64.3 percent. The Eastern Cherokee had a higher unemployment rate at 4.8 percent and the Western Cherokee had a lower unemployment rate of 4.1 percent (USCB 2007).

Table 4.11.1-1. Population and Employment Estimates for Native American Populations within the Vicinity of or With Interest in Y-12, 2000.

Y-12	Population	Civilian Labor Force	Civilian Labor Force (percent)	Employed	Employed (percent)	Unemployed	Unemployed (percent)
Eastern Cherokee	8,451	4,033	65.9	3,740	61.1	293	4.8
Western Cherokee	6,693	3,255	64.3	3,048	60.2	207	4.1

Source: USCB 2007.

Of those individuals over 25 with some form of education, the largest constituency of the two Native American populations had received a high school diploma as shown in Table 4.11.1-2. A slightly lesser percentage of individuals had attended some college and lesser percentages of these populations had received degrees from institutions of higher learning (Associate, Bachelor, or Graduate/Professional) (USCB 2007).

The Western Cherokee population had the higher mean household earnings and per capita income with $45,538 and $17,616, respectively, in 2000 as shown in Table 4.11.1-3. The Eastern Cherokee population had the lower mean household earnings with $41,727 and the lower per capita income with $14,955 (USCB 2007).

Of the two Native American populations with ties to Y-12, the Eastern Cherokee had the larger percentage of individuals below the poverty level in 2000 with 18.5 percent as compared to the Western Cherokee population which had 13.6 percent of the total population living below the poverty level as shown in Table 4.11.1-3 (USCB 2007).

In 2000, the Eastern Cherokee had the larger average family size with 3.17 persons per family as compared to the Western Cherokees who had an average family size of 3.06 persons per family. The Eastern Cherokee had the greater number of occupied housing units which is consistent with their larger population as shown in Table 4.11.1-4 (USCB 2007).

Table 4.11.1-2. Level of Educational Attainment by Native American Populations within the Vicinity of or With Interest in Y-12, 2000.

Y-12	High School Graduate	High School Graduate (percent)	Some College	Some College (percent)	Associate Degree	Associate Degree (percent)	Bachelor Degree	Bachelor Degree (percent)	Graduate/ Professional Degree	Graduate/ Professional Degree (percent)
Eastern Cherokee	1,392	28.1	1,206	24.4	484	9.8	406	8.2	320	6.5
Western Cherokee	1,113	25.8	1,219	28.2	362	8.4	589	13.6	334	7.7

Source: USCB 2007.

Table 4.11.1-3. Income and Poverty Level Estimates for Native American Populations within the Vicinity of or With Interest in Y-12, 2000.

Y-12	Mean Household Earnings	Per Capita Income	Individuals Below the Poverty Level	Individuals Below the Poverty Level (percent)
Eastern Cherokee	$41,727	$14,955	1,517	18.5
Western Cherokee	$45,538	$17,611	883	13.6

Source: USCB 2007.

Table 4.11.1-4. Housing Characteristics for Native American Populations within the Vicinity of or With Interest in Y-12, 2000.

Y-12	Average Family Size	Housing Units	Occupied Housing Units	Owner Occupied Housing Units	Owner Occupied Housing Units (percent)	Renter Occupied Housing Units	Renter Occupied Housing Units (percent)
Eastern Cherokee	3.17	3,008	3,020	2,274	75.3	746	24.7
Western Cherokee	3.06	2,610	2,543	1,692	66.5	851	33.5

Source: USCB 2007.

4.12 HEALTH AND SAFETY

Current activities associated with routine operations at Y-12 have the potential to affect worker and public health. Air emissions at Y-12 can lead to exposure to radioactive and non-radioactive materials. Liquid effluents discharged into nearby waterbodies may affect downstream populations using the water for drinking or recreation. Additionally, workers are exposed to occupational hazards similar to those experienced at most industrial work sites. Monitoring of materials released from the reservation and environmental monitoring and surveillance on and around the reservation are discussed in Sections 4.6 and 4.7.

The following discussion characterizes the human health impacts from current releases of radioactive and nonradioactive materials at Y-12. It is against this baseline that the potential incremental and cumulative impacts associated with the alternatives are compared and evaluated.

4.12.1 Public Health

Radiological. This section presents estimates of potential radiation doses to the public from releases of radiological materials at Y-12. The dose estimates are performed using monitored and estimated release data, environmental monitoring and surveillance data, estimated exposure conditions that tend to maximize the calculated dose equivalents, and environmental transport and dosimetry codes that also tend to overestimate the calculated dose equivalents. Thus, the presented dose estimates do not necessarily reflect doses received by typical people in the vicinity of ORR; they are likely to be overestimates.

Calculated radiation doses to maximally exposed individuals (MEI) from airborne releases from ORR are listed in Table 4.12.1-1. The hypothetical MEI for ORR was located about 3.6 miles south of the main Y-12 Complex release point, about 2.6 miles east northeast of the 7911 stack at ORNL, and about 6.8 miles east of the *Toxic Substances Control Act* (TSCA) Incinerator (stack K-1435) at the ETTP. This individual could have received an effective dose (ED) of about 0.3 mrem, which is well below the NESHAP standard of 10 mrem and is 0.1 percent of the 300 mrem that the average individual receives from natural sources of radiation. The calculated collective ED to the entire population within 50 miles of ORR (about 1,040,041 persons) was about 19.5 person-rem, which is approximately 0.006 percent of the 312,012 person-rem that this population received from natural sources of radiation (based on an individual dose of 300 mrem per year) (DOE 2008). For liquid effluents, the MEI dose to a member of the public would be approximately 0.006 mrem per year (DOE 2008).

Table 4.12.1-1. Calculated Radiation Doses to Maximally Exposed Offsite Individuals from Airborne Releases during 2007.

Plant	Effective dose, mrem (mSv)	
	At plant max	At ORR max
Oak Ridge National Laboratory	0.26 (0.0026)[a]	0.26 (0.0026)
East Tennessee Technology Park	0.02 (0.0002)[b]	0.009 (0.00009)
Y-12	0.15 (0.0015)[c]	0.009 (0.00009)
Entire ORR	[d]	0.3 (0.003)[e]

Source: DOE 2008.
a – The maximally exposed individual was located 5,060 meters east of X-3039 and 4,259 meters east-northeast of X-7911.
b – The maximally exposed individual was located 685 meters west of K-1435.
c – The maximally exposed individual is located 2,307 meters northeast of Y-12 release point.
d – Not Applicable.
e – The maximally exposed individual for the entire ORR is ORNL maximally exposed individual.

The maximally exposed individual for Y-12 was located at about 1.43 miles northeast of the main Y-12 site release point. This individual could have received an ED of about 0.15 mrem from Y-12 emissions. Inhalation and ingestion of uranium radioisotopes (i.e., 232U, 233U, 234U, 235U, 236U, and 238U) accounted for essentially all (about 99 percent) of the dose. The contribution of Y-12 emissions to the 50-year committed collective ED to the population residing within 50 miles of ORR was calculated to be about 1.5 person-rem, which is approximately 8 percent of the collective ED for ORR (DOE 2008).

The maximally exposed individual for ORNL was located at a residence about 3.1 miles east of the 3039 stack and 2.6 miles east-northeast of the 7911 stack. This individual could have received an ED of about 0.26 mrem from ORNL emissions. Radionuclides contributing 1 percent or more to the dose include 41Ar (54.2 percent), 138Cs (22.9 percent), 212Pb (12.2 percent), and 88Kr (4.2 percent). The contribution of ORNL emissions to the collective ED to the population residing within 50 miles of ORR was calculated to be about 17.2 person rem, approximately 88 percent of the collective ED for ORR (DOE 2008). Calculated effective dose equivalents from airborne releases are listed in Table 4.12.1-2.

The maximally exposed individual for the ETTP was located at a business about 0.42 miles west of the TSCA Incinerator stack (K-1435). The ED received by this individual was calculated to be about 0.02 mrem. About 79 percent of the dose is from ingestion and inhalation of uranium radioisotopes, about 16 percent is from 3H, and 4 percent is from 99Tc. The contribution of ETTP emissions to the collective ED to the population residing within 50 miles of ORR was calculated to be about 0.8 person-rem; approximately 4 percent of the collective ED for the reservation (DOE 2008).

Table 4.12.1-2. Calculated Collective Effective Dose Equivalents from Airborne Releases during 2007.

Plant	Collective effective dose[a]	
	Person-rem	Person-Sv
Oak Ridge National Laboratory	17.2	0.172
East Tennessee Technology Park	0.8	0.008
Y-12	1.5	0.015
Entire ORR	19.5	0.195

Source: DOE 2008.
a – Collective effective dose to the 1,040,041 persons residing within 50 miles of ORR.

Radionuclides discharged to surface waters from ORR enter the Tennessee River system by way of the Clinch River. Discharges from Y-12 enter the Clinch River via Bear Creek and EFPC, both of which enter Poplar Creek before it enters the Clinch River, and by discharges from Rogers Quarry into McCoy Branch and then into Melton Hill Lake. Discharges from ORNL enter the Clinch River via White Oak Creek and enter Melton Hill Lake via some small drainage creeks. Discharges from the ETTP enter the Clinch River either directly or via Poplar Creek (DOE 2008).

Table 4.12.1-3 is a summary of potential EDs from identified waterborne radionuclides around ORR. Adding worst-case EDs for all pathways in a water-body segment gives a maximum individual ED of about 0.9 mrem to a person obtaining his or her full annual complement of fish from and participating in other water uses on Lower EFPC. The maximum collective ED to the 50-mile population could be as high as approximately 6.3 person-rem. These are small percentages of individual and collective doses attributable to natural background radiation, about 0.3 percent and 0.002 percent, respectively (DOE 2008).

Table 4.12.1-3. Summary of annual maximum individual (mrem) and collective (person-rem) effective doses (EDs) from waterborne radionuclides[ab]

	Drinking water	Eating fish	Other uses	Total[c]
Upstream of all ORR discharge locations (CRK 70 and CRK 66, City of Oak Ridge Water Plant)				
Individual ED	0.0	0.03	0.0	0.03
Collective ED	0.0	0.001	0.0	0.001
Melton Hill Lake (CRK 58, Knox County Water Plant)				
Individual ED	0.0007	0.001	0.00005	0.002
Collective ED	0.02	0.00005	0.0003	0.02
Upper Clinch River (CRK 23, Gallaher Water Plant, CRK 32)				
Individual ED	0.2	.01	0.02	0.3
Collective ED	0.08	0.03	0.005	0.1
Lower Clinch River (CRK 16)				
Individual ED	NA[d]	0.08	0.1	0.2
Collective ED	NA[d]	0.04	0.03	0.08
Upper Watts Bar Lake, Kingston Municipal Water Plant				
Individual ED	0.04	0.03	0.03	0.09
Collective ED	0.5	0.04	0.05	0.6
Lower System (Lower Watts Bar Lake and Chickamauga Lake)				
Individual ED	0.04	0.03	0.005	0.07
Collective ED	4	0.3	0.4	5
Poplar Creek (near Lower East Fork Poplar Creek)				
Individual ED	0.0	0.03	0.0	0.03
Collective ED	0.0	0.001	0.0	0.001
Upstream of all ORR discharge locations (CRK 70 and CRK 66, City of Oak Ridge Water Plant)				
Individual ED	NA[d]	0.9	0.01	0.9
Collective ED	NA[d]	0.03	0.0005	0.03

Source: DOE 2008.
a – 1 mrem = 0.01 mSv.
b – Doses based on measured radionuclide concentrations in water or estimated from measured discharges and known or estimated steam flows.
c – Rounded difference between individual pathway doses and total.
d – Not at drinking water supply locations.

Current-Year Summary. A summary of the maximum EDs to individuals by pathway of exposure is given in Table 4.12.1-4. In the unlikely event that any person was irradiated by all of those sources and pathways for the duration of 2007, that person could have received a total ED of about 4 mrem. Of that total, 0.3 mrem would have come from airborne emissions, 1.2 mrem from waterborne emissions, (0.2 mrem from drinking water from the Watts Bar Lake, 0.9 mrem from consuming fish from Lower EFPC near its confluence with Poplar Creek, and 0.1 mrem from other water uses along the Lower Clinch River), and 0.4 mrem from direct radiation while fishing on Clinch River. This dose is about 1.3 percent of the annual dose (300 mrem) from background radiation. The ED of 4 mrem includes the person who received the highest EDs from eating wildlife harvested on ORR. A total of about 2.2 mrem are attributed to the consumption of wildlife from ORR, with 2.0 mrem associated with eating deer and 0.2 mrem associated with eating geese and turkey (0.1 mrem from each). If the maximally exposed individual did not consume wildlife harvested from ORR, the estimated dose would be about 2 mrem (DOE 2008).

DOE Order 5400.5 limits the ED that an individual may receive from all exposure pathways from all radionuclides released from ORR during 1 year to no more than 100 mrem. The 2007 maximum ED should not have exceeded about 4 mrem, or about 4 percent of the limit given in DOE Order 5400.5 (DOE 2008).

The total collective ED to the population living within a 50-mile radius of ORR was estimated to be about 26 person-rem. This dose is about 0.008 percent of the 312,012 person-rem that this population received from natural sources during 2007 (DOE 2008). Table 4.12.1-4 presents the potential radiological impacts to the public, from all sources, resulting from normal operations at ORR including Y-12.

Table 4.12.1-4. Potential Radiological Impacts to the Public Resulting from Normal Operations at ORR (including Y-12).

Pathway	Dose to maximally exposed individual		Percentage of DOE mrem/year limit (%)	Estimated population dose		Population within 50 miles	Estimated background radiation population dose (person-rem)[a]
	mrem	mSv		Person-rem	Person-Sv		
Airborne effluents:							
All pathways	0.3	0.003	0.3	19.5	0.195	1,040,041[b]	
Liquid effluents:							
Drinking water	0.2	0.002	0.2	5	0.05	367,438[c]	
Eating fish	0.9	0.009	0.9	0.5	0.005	49,455[d]	
Other activities	0.1	0.001	0.1	0.5	0.005	489,023[d]	
Eating deer	2[e]	0.02	2	0.3	0.003	358	
Eating geese	0.1[f]	0.001	0.1	g	g		
Eating turkey	0.1[h]	0.001	0.1	0.0007	0.000007	31	
Direct radiation	0.4[i]	0.004	0.4				
All pathways	4	0.04	4	26	0.26	1,040,041	312,012

Source: DOE 2008.

a – Estimated background population dose is based on 300 mrem/year individual dose and the population with 50 miles of ORR.

b – Population based on 2000 census data.

c – Population estimates based on community and non-community drinking water supply data from the Tennessee Department of Environment and Conservation, Division of Water.

d – Population estimates based on population within 50 miles and fraction of fish harvested from Melton Hill, Watts Bar, and Chickamauga reservoirs. Melton Hill and Chickamagua recreational use information were obtained from the Tennessee Valley Authority.

e – From consuming one hypothetical worst-case deer, each a combination of the heaviest deer harvested and the highest measured concentrations of ^{137}Cs in released deer on ORR in 2007 and the population dose is based on number of hunters that harvested deer.

f – From consuming two hypothetical worst-case geese, each a combination of the heaviest goose harvested and the highest measured concentrations of ^{137}Cs in released geese.

g – Population doses were not estimated for the consumption of geese since no geese were brought to checking station during the goose hunt.

h – From consuming two hypothetical worst-case turkey, a combination of the heaviest turkey harvested and the highest measured concentrations of ^{137}Cs in released turkey. The population dose is based on number of hunters that harvested turkey.

i – Direct radiation dose estimate based on exposure to a fisherman on the Clinch River.

Five-Year Trends. Dose equivalents associated with selected exposure pathways for the years from 2003 to 2007 are given in Table 4.12.1-5. The variations in values over the 5-year period likely are not statistically significant. The dose estimates for direct irradiation along the Clinch River have been corrected for background.

Table 4.12.1-5. Trends in Total Effective Dose (mrem)[a] for Selected Pathways.

Pathway	2003	2004	2005	2006	2007
All air	0.2	0.4	0.9	0.8	0.3
Fish consumption (Clinch River)	1	0.2	0.3	0.7	0.9
Drinking water (Kingston)	0.1[b]	0.04	0.03	0.02	0.04
Direct radiation (Clinch River)	0.4[c]	0.4	0.4	0.5[d,e]	0.4[f]
Direct radiation (Poplar Creek)	2[d]	3[d]	1[d]	0.8[d]	NA

Source: DOE 2008.

a – 1 mrem = 0.01 mSv.

b – Based on water samples from the Clinch River System.

c – These values have been corrected by removing the contribution of natural background radiation and by using International Commission on Radiological Protection recommendations for converting external exposure to effective dose equivalent.

d – Included gamma and neutron radiation measurement data. In 2006, the Poplar Creek location was near the K-1066E Cylinder Yard.

e – This location is along the bank of the Clinch River near the K-770 Scrap Yard.

f – From 2003 to 2005 and 2007, the direct radiation measurements are from an area near Jones Island.

Nonradiological. Each ORR facility evaluates their respective operations to determine applicability for submittal of annual toxic release inventory reports to EPA and TDEC on or before July 1 of each year. The reports cover the previous calendar year and address releases of certain toxic chemicals to air, water, and land as well as waste management, recycling, and pollution prevention activities. Threshold determinations and reports for each of ORR facilities are made separately. Operations involving toxic release inventory chemicals are compared with regulatory thresholds to determine which chemicals exceed the reporting thresholds based on amounts manufactured, processed, or otherwise used at each facility. After threshold determinations are made, releases and offsite transfers are calculated for each chemical that exceeded one or more of the thresholds (DOE 2008).

Total 2007 reportable toxic releases to air, water, and land and waste transferred offsite for treatment, disposal, and recycling were less than the amounts reported for Y-12 in 2006. This was the result of a return to pre-2006 methanol use in the methanol brine system. The following list describes the reported chemicals for Y-12. Table 4.12.1-6 summarizes releases and offsite transfers for those chemicals exceeding reporting thresholds (DOE 2008).

Table 4.12.1-6. EPCRA Section 313 Toxic Chemical Release and Offsite Transfer Summary for Y-12, 2007[a].

Chemical	Year	Quantity (lb)[b]
Chromium	2006	c
	2007	c
Cobalt	2006	d
	2007	c
Copper	2006	c
	2007	c
Lead/lead compounds	2006	10,049
	2007	6,729
Manganese	2006	d
	2007	c
Mercury/mercury compounds	2006	39
	2007	32
Methanol	2006	140,840
	2007	48,478
Nickel	2006	c
	2007	c
Nitrate compounds	2006	0
	2007	c
Nitric Acid	2006	c
	2007	2,060
Ozone	2006	d
	2007	c
Silver	2006	d
	2007	c
Sulfuric acid (aerosol)	2006	52,000

Table 4.12.1-6. EPCRA Section 313 Toxic Chemical Release and Offsite Transfer Summary for Y-12, 2007[a] (*continued*).

Chemical		Year	Quantity (lb)
Sulfuric acid (aerosol)		2006	52,000
		2007	41,000
	Total	2006	202,928
		2007	98,299

Source: DOE 2008.
a – Represents total releases to air, land, and water and includes off-site waste transfers. Also includes quantities released to the environment as a result of remedial actions, catastrophic events, or one-time events not associated with production processes.
b – 1 lb = 0.45 kg.
c – Not applicable because releases were less than 5,000 lb, and hence a Form A was submitted.
d – No reportable releases because the site did not exceed the applicable Toxic Release Inventory reporting thresholds.

Chromium, cobalt, copper, manganese, nickel, and silver. The processing threshold for each of these metals was exceeded as a result of offsite metal recycling and metal machining and welding operations.

Sulfuric acid (aerosol form). Sulfuric acid aerosols were coincidentally manufactured in excess of the reporting threshold as a combustion by-product from burning coal at the steam plant.

Lead and lead compounds. The "otherwise-use" threshold for lead was exceeded at the steam plant and at the Central Training Facility firing range. The processing threshold for lead was exceeded as a result of metal being sent offsite for recycling.

Mercury and mercury compounds. Mercury compounds were otherwise used and coincidently manufactured as a combustion by-product from burning coal in excess of the 10 pound reporting threshold at the steam plant.

Methanol. Most of the methanol at Y-12 is otherwise used in the chiller buildings for the brine-methanol system.

Nitrate compounds. Nitrate compounds were coincidentally manufactured in excess of the reporting threshold as by-products of neutralizing nitric acid wastes and in the sanitary sewer. Various mixtures used throughout the complex contain the compounds.

Nitric acid. Nitric acid was used in excess of the otherwise-use threshold as a chemical-processing aid.

Ozone. Ozone was produced in excess of the manufacture threshold.

4.12.2 Worker Health

One of the major goals of DOE is to keep worker exposures to radiation and radioactive material as low as reasonably achievable (ALARA). The purpose of an ALARA program is to minimize doses from both external and internal exposures. Y-12 worker doses have typically been well below DOE worker exposure limits. The Radiation Exposure and Monitoring System 2007

Annual Report indicates that Y-12 personnel received a total internal dose of 49.4 person-rem. The Y-12 internal dose is spread across approximately 2,400 workers. About 10 percent of those workers account for about half the total exposure, mainly hands-on production and maintenance workers. None of the internal exposures exceeded the site's 1.0 rem administrative limit. The exposures ranged from 0 to 0.936 rem (REMS 2007).

4.13 WASTE MANAGEMENT

There are many waste management facilities at Y-12. The disposal facilities and landfills are operated by the Environmental Management Program. The majority of the waste management, treatment and storage facilities are operated by NNSA. Waste management facilities are located in buildings or on the sites where they are needed, or are collocated with other waste management facilities or operations.

The TDEC Division of Solid Waste Management (DSWM) regulates the management of waste streams under the *Tennessee Solid Waste Management Act* (TSWMA). Onsite waste disposal facilities in operation at Y-12 include industrial, construction/demolition landfills, and a CERCLA waste landfill.

Waste Management PEIS RODs affecting ORR and ORNL are shown in Table 4.13.1-1 for the waste types analyzed in this SWEIS. Decisions on the various waste types were announced in a series of RODs that were issued under the *Waste Management PEIS* (DOE 1997). The initial transuranic (TRU) waste ROD was issued on January 20, 1998 (63 FR 3629) with several subsequent amendments; the hazardous waste ROD was issued on August 5, 1998 (63 FR 41810); the high-level radioactive waste ROD was issued on August 12, 1999 (64 FR 46661), and the low-level radioactive waste and mixed low-level radioactive waste ROD was issued on February 18, 2000 (65 FR 10061). The TRU waste ROD states that DOE will develop and operate mobile and fixed facilities to characterize and prepare TRU waste for disposal at Waste Isolation Pilot Plant (WIPP). Y-12 does not generate TRU waste. Each DOE site that has or will generate TRU waste will, as needed, prepare and store its TRU waste onsite until the waste is shipped to WIPP. The hazardous waste ROD states that most DOE sites will continue to use offsite facilities for the treatment and disposal of major portions of the non-wastewater hazardous waste, with ORR and the Savannah River Site (SRS) continuing to treat some of their own non-wastewater hazardous waste onsite in existing facilities where it is economically feasible.

The high-level radioactive waste ROD states that immobilized high-level radioactive waste will be stored at the site of generation until transferred to a geologic repository. The ROD for LLW and mixed-LLW (MLLW) states that, for the management of LLW, minimal treatment will be performed at all sites and disposal will continue, to the extent practicable, onsite at Idaho National Environmental Laboratory (INL), Los Alamos National Laboratory (LANL), ORR, and SRS. In addition, the Hanford Site and Nevada Test Site (NTS) will be available to all DOE sites for LLW disposal. MLLW will be treated at the Hanford Site, INL, ORR, and SRS and disposed of at the Hanford Site and the NTS. More detailed information concerning DOE's preferred alternatives for the future configuration of waste management facilities at ORR is presented in the *Waste Management PEIS* as well as the high-level radioactive waste, TRU waste, hazardous waste, and LLW and mixed-LLW waste RODs.

4.13.1 Waste Generation from Routine Operations

The major waste types generated at Y-12 from routine operations include LLW, MLLW, hazardous waste, and nonhazardous waste. Table 4.13.1-1 presents the types of wastes generated by Y-12 and the way these wastes are managed. Table 4.13.1–2 presents a summary of waste generation totals for routine operations at Y-12 for FY 2007. Other waste includes sanitary and industrial wastewater, PCBs, asbestos, construction debris, general refuse, and medical wastes. Y-12 does not generate or manage high-level radiological waste or TRU waste.

Table 4.13.1-1. Waste Management PEIS Records of Decision Affecting Oak Ridge Reservation and Y-12.

Waste Type	Preferred Action
High-level radioactive	ORR does not currently manage high-level radioactive waste.[a]
Transuranic and mixed transuranic	DOE decided that ORR should prepare and store its transuranic waste on-site pending disposal at WIPP.[b]
Low-level radioactive	DOE decided to treat ORR liquid low-level radioactive waste on-site.[c] Separate from the Waste Management PEIS, DOE prefers offsite management of ORR solid low-level radioactive waste after temporary onsite storage.
Mixed low-level radioactive	DOE decided to regionalize treatment of mixed low-level radioactive waste at ORR. This includes the onsite treatment of ORR waste and could include treatment of some mixed low-level radioactive waste generated at other sites.[d]
Hazardous	DOE decided to use commercial and onsite ORR facilities for treatment of ORR nonwastewater hazardous waste. DOE will also continue to use onsite facilities for wastewater hazardous waste.[e]

a – From the ROD for high-level radioactive waste (64 FR 46661).
b – From the ROD for transuranic waste (63 FR 3629).
c – From the ROD for low-level waste (65 FR 10061).
d – From the ROD for mixed low-level waste (65 FR 10061).
e – From the ROD for hazardous waste (63 FR 41810).

Low-Level Waste. Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, and process equipment is generated at Y-12. In FY 2007, Y-12 generated approximately 9,405 cubic yards of solid LLW. Liquid LLW is treated in several facilities, including the West End Treatment Facility (WETF). Y-12 is the largest generator of routine LLW at Oak Ridge. In FY 2007, Y-12 generated 713 gallons of liquid LLW.

Mixed Low-Level Waste. Mixed waste subject to treatment requirements to meet Land Disposal Restrictions (LDRs) under RCRA are generated and stored at Y-12. DOE is under a State Commissioner's Order (October 1, 1995) to treat and dispose of these wastes in accordance with milestones established in the *Site Treatment Plan for Mixed Waste on the Oak Ridge Reservation* and to comply with a *Federal Facilities Compliance Act* (FFC Act) that went into effect on

June 12, 1992. TSCA-regulated waste (containing PCBs) that is also radioactive waste is managed under a separate Federal Facilities Compliance Agreement (FFCA), first effective February 20, 1992. In FY 2007, Y-12 generated 126 cubic yards of solid mixed low-level waste and 1,096 gallons of liquid MLLW.

Hazardous Waste. RCRA-hazardous waste is generated through a wide variety of production and maintenance operations. The majority of RCRA-hazardous waste is in solid form. In FY 2007, Y-12 generated 11.62 short tons of RCRA waste. The hazardous waste is shipped offsite for treatment and disposal at either DOE or commercially-permitted facilities.

Other Waste Types. During 2004, the sanitary wastewater flow averaged about 663,000 gallons per day. Treated sanitary wastewater is discharged to the sanitary system in accordance with the Industrial and Commercial User Wastewater Discharge Permit No. 1-91. PCBs are transported to permitted facilities for treatment and disposal. Medical wastes are autoclaved to render them noninfectious and are then sent to a Y-12 sanitary industrial landfill, as are asbestos wastes and general refuse. Construction, demolition, and nonhazardous industrial materials are disposed of in a construction/demolition landfill at Y-12.

Capacities. Excess treatment and disposal capacity for hazardous waste exist both onsite and offsite at Y-12. Storage capacities at Y-12 are currently adequate for hazardous, MLLW, and LLW.

Table 4.13.1–2. Waste Generation Totals by Waste Type for Routine Operations at Y-12.

Waste Type	Waste Volume (FY-2007)
Low-level waste (liquid)	713 gallons
Low-level waste (solid)	9,405 cubic yards
Mixed low level waste (liquid)	1,096 gallons
Mixed low level waste (solid)	126 cubic yards
RCRA waste	11.62 short tons
TSCA waste	0.73 short tons
Mixed TSCA	15.89 short tons
Sanitary waste	10,373.88 short tons

Source: Jackson 2008.

4.13.2 Waste Management Facilities

The majority of waste management facilities at Y-12 are operated by NNSA. Waste management facilities are located in buildings, or on sites, dedicated to their individual functions, or are collocated with other waste management facilities or operations. Active facilities for the storage and treatment of LLW, MLLW, RCRA-hazardous and TSCA-regulated waste as well as disposal facilities for non-hazardous waste are summarized in this section. Many of the facilities are used for more than one waste stream.

The TDEC DSWM regulates the management of both hazardous and non-hazardous waste streams under the TSWMA. Facilities used to store or treat RCRA-hazardous waste at Y-12 are regulated by the DSWM as authorized by the EPA. These facilities may also be used to manage mixed waste (waste that is both RCRA-hazardous and radioactive). There are no facilities for the disposal of solid hazardous waste currently in operation at Y-12. Storage and physical treatment (e.g., shredding, compaction) of non-hazardous waste does not generally require a permit under RCRA. There are three landfills in operation for disposal of non-hazardous waste at Y-12. These disposal facilities are regulated by the TDEC DSWM as well.

TSCA-regulated waste that contains PCBs is managed at Y-12 in accordance with EPA regulations (40 CFR Part 761) and with the FFCA for managing PCBs on ORR (EPA 1997). Many requirements for the safe storage and handling of PCB waste are similar to requirements for RCRA-hazardous waste. Therefore, PCB wastes and TSCA mixed waste (waste containing both PCBs and radioactivity) are often stored in facilities approved for RCRA-hazardous and mixed waste storage. Some Y-12 databases and reports group TSCA regulated and RCRA-hazardous wastes together and refer to this grouping as hazardous waste.

DOE is authorized to manage radioactive waste that it generates under the *Atomic Energy Act* of 1954. LLW is generated during machining and other operations at Y-12. DOE stores, treats, and repackages, but does not dispose of LLW at Y-12. The majority of the LLW generated at Y-12 is dry active waste, construction debris, and scrap metal. LLW at Y-12 is managed in accordance with DOE Orders, policies, and guidance related to management of radioactive waste. Management of this waste is not directly regulated by EPA or TDEC.

The following description of waste management facilities at Y-12 focuses on the facilities currently available for managing waste at Y-12. The facilities are grouped by functional program area: storage, treatment, or disposal.

4.13.3 Waste Storage at Y-12

Storage for Mixed Waste Residues/Ash. The enriched uranium (EU) Building along with Building 9206 provide container storage areas for mixed waste residues or ash. An RCRA operating permit was issued in 2005. The ash results from the burning of solvent- and uranium-contaminated solid wastes. The ash does not contain free liquids. Uranium-bearing solutions generated during the uranium recovery process and laboratory analyses are also stored in these buildings. These solutions, as well as the residues, are mixed (hazardous and radioactive) wastes and are being stored prior to further uranium recovery. Occasionally, uranium-bearing materials generated offsite may be stored in the EU and EU storage buildings, prior to uranium recovery at the EU Building. Although a Phaseout/Deactivation Program Management Plan has been approved by DOE for the EU Storage Building, and the recovery operations within this facility will no longer be operated, this building will continue to store hazardous and mixed waste for several years.

Production Tank Farm. The Production Tank Farm, a RCRA permit-by-rule facility, consists of three dikes containing four 10,000-gallon stainless-steel tanks that are used to collect nitrate waste from operations before being transferred to the WETF.

Liquid Storage Facility. The Liquid Storage Facility is a hazardous and mixed waste storage and pretreatment facility built during the Bear Creek Burial Ground closure activities. It is located in Bear Creek Valley approximately two miles west of Y-12, and operates under RCRA permit-by-rule as materials from the facility are subsequently transferred to an NPDES-permitted facility. It collects, stores, and pre-treats groundwater and other wastewater received from the seep collection lift station, the Disposal Area Remedial Action (DARA) Solid Storage Facility, tankers, polytanks, and a water collection/storage tank which accommodates rainfall accumulation in the diked area. Feed streams may contain oil contaminated with PCBs, VOCs, non-VOCs, and heavy metals. Most equipment is in an outdoor containment area which includes two 75,000-gallon bulk water storage tanks, a 6,000-gallon oil storage tank; a gravity separator, two filtering units, a composite monitoring station, and a tanker transfer station. Collected liquids are pretreated by traveling through the gravity separator, filters, and composite monitoring station prior to entering bulk storage tanks. The wastewater is then transferred by tanker to the Groundwater Treatment Facility for further treatment.

PCB and RCRA Hazardous Drum Storage Facility. This building is a 12,500- square foot, single-story, prefabricated metal building with slab on grade built in 1955. The facility provides a drum storage area for mixed and PCB waste, including an area for flammable waste. The building is used to store both RCRA and PCB mixed waste.

Container Storage Facility. The Container Storage Facility, also called the LLW Storage Areas, provides storage for mixed (hazardous and radioactive) waste residues, ash, and combustibles. It also contains some classified waste. A RCRA operating permit was issued in 2005. The ash is a product of burning solvent- and uranium-contaminated wastes. Unburned solvent- and uranium-contaminated solid wastes are also here. The waste at this building contains no free liquids and is typically generated during the uranium recovery process. Some of this waste is also stored in the buildings that store mixed waste residues/ash, as described above.

Waste Storage Facility. The Waste Storage Facility is a 17,600- square foot, single-story building with masonry-bearing walls and a precast concrete roof system built in 1962. It provides storage for PCB waste, LLW and MLLW, which is classified for national security purposes under provisions of the *Atomic Energy Act.* A new RCRA operating permit was issued in 2005.

PCB Storage Facility. The PCB Storage Facility provides storage capability for PCB waste, primarily PCB-containing ballasts. This building is a 3,600- square foot, single-story building with masonry-bearing walls and a structural steel roof built in 1984.

RCRA and Mixed Waste Staging and Storage Facility. The RCRA Staging and Storage Facility is a 6,571- square foot, single-story building with masonry-bearing walls and a precast concrete roof system built in 1986. A new RCRA permit was issued in 2005. Solid, liquid, and sludge wastes are prepared for offsite shipment at this facility. The facility consists of seven storage rooms and seven staging rooms, each with a separate ventilation system. The staging rooms house small containers that are packed with compatible materials and shipped. The storage rooms hold larger containers, such as 55-gallon drums.

West Tank Farm. The West Tank Farm provides storage for mixed and LLW sludge and is associated with the WETF. It operates under RCRA permit-by-rule (see also Section 4.13.4, WETF). The West Tank Farm includes thirteen 500,000-gallon tanks. Six are utilized as process bioreactors, and three serve as holding tanks for an effluent polishing system. The remaining four tanks hold sludges that are RCRA-hazardous due either to listing or characteristics. Currently, one tank is empty and one is being emptied. In addition, three, 100,000-gallon tanks provide storage for radioactively contaminated calcium carbonate sludge generated as a result of WETF processes.

Old Salvage Yard. The Old Salvage Yard, located at the west end of Y-12, contains both low-level uranium-contaminated and non-radioactive scrap metal. Most scrap currently sent to this area is contaminated. The Contaminated Scrap Metal Storage is an area within the Old Salvage Yard that is used to store uranium-contaminated scrap metal. Contaminated scrap is placed in approved containers and eventually will be shipped offsite for disposal. Non-contaminated scrap is sold when allowed.

Salvage Yard. The Salvage Yard is used for the staging and public sale of nonhazardous, non-radioactive scrap metal that has been approved by DOE for release. It consists of 8 enclosed acres; 1 acre is paved. The New Salvage Yard provides accumulation and sorting space for the scrap metal. This facility is located west of Y-12 on the north side of Bear Creek Road, near the Bear Creek Burial Grounds.

DARA Solid Storage Facility. The DARA Solid Storage Facility provides 17,500 square feet of storage space for PCB-, RCRA-, and uranium-contaminated soil. The facility has a synthetic liner for leachate collection and a leak detection system. Collected leachate is transferred to the Liquid Storage Facility for pretreatment. The DARA Solid Storage Facility is an interim-status facility under RCRA, but is now being managed through the CERCLA process. No additional wastes are being added to the facility.

Containerized Waste Storage Area. The Containerized Waste Storage Area consists of three concrete pads covering approximately 24,800 square feet. An impermeable dike for spill containment surrounds each pad. No wastes are currently stored at the Containerized Waste Storage Area, which has been turned over to the DOE-EM surveillance and maintenance program.

Production Waste Storage Facility. The Production Waste Storage Facility (also a Container Storage Area) has not yet been used for storage, but future use is planned. The building is separated into two areas, a smaller one for ignitable RCRA waste, and a larger area for non-ignitable waste. Both areas have curbing and may be used for containerized liquids if stored on self-containing pallets. The facility houses the non-destructive assay equipment for Y-12 and has a design capacity for storage of 616,968 gallons. The permitted area was closed in 2004.

LLW Storage Pad. The LLW Storage Pad, is located in the Sludge Handling Facility that originally provided water filtration and sludge dewatering to support a storm sewer cleaning and relining project. The facility is empty currently and transitioning to the DOE-EM surveillance and maintenance program.

Liquid Organic Solvent Storage Facility. The Liquid Organic Waste Storage Facility is a 2,250- square foot single-story pavilion with metal posts and roof panels, built in 1987. It contains four 6,500-gallon and 3,000-gallon stainless-steel tanks for storage of ignitable nonreactive liquids, including those contaminated with PCBs and uranium. In addition, a diked and covered storage area provides space for 10,600 gallons of containerized waste. The facility is set up to segregate various spent solvents for collection and storage. Major solvent waste streams are transferred to tanks until final disposal. This facility is currently empty, RCRA-closed, and managed under the DOE-EM surveillance and maintenance program.

RCRA and PCB Container Storage Area. The RCRA and PCB Container Storage Area is a 4,200- square foot single-story, prefabricated metal building with metal wall panels built in 1987. It is a warehouse facility used for staging prior to treatment or disposal of PCB- and RCRA-contaminated equipment (e.g., transformers, capacitors, and electrical switchgear) and non-reactive, non-ignitable RCRA, mixed and PCB waste. The facility was emptied and the permitted area was closed in 2002. It is currently used as a vehicle maintenance garage.

Classified Container Storage Facility. The Classified Container Storage Facility (also a Production Waste Storage Facility) is a 15,105- square foot, single-story, prefabricated metal building with metal wall panels. The permitted area was closed in 2003, and the facility is currently used for material storage.

Depleted Uranium Oxide Storage Vaults I and II. The Depleted Uranium Oxide Storage Vaults I and II are located on Chestnut Ridge. The vaults are constructed of reinforced concrete and provide a retrievable storage repository for uranium oxide, uranium metal, and a blended mixture of uranium sawfines and oxide. The vaults contain a negative pressure exhaust system that operates during material entry. The exhaust is filtered and monitored prior to its release to the atmosphere. Waste is no longer accepted in the vaults. One vault is empty and was never used. One building was formerly used as storage for drummed, depleted uranium oxide materials; it is a 1,200- square foot single-story building built in 1990 with masonry-bearing walls and a structural steel roof system. The third building is currently empty. This building and the vaults are inactive and currently managed by the DOE-EM surveillance and maintenance program.

OD7 Waste Oil Storage Tank Area. This building houses three areas for storage of RCRA liquids (OD7, OD8, and OD9), and is an 874-square foot, single-story, prefabricated metal building with metal wall panels, built in 1986. OD7 contains a diked storage area for tanks (permitted in 2005). The OD7 contains four 30,000-gallon tanks, two 10,000-gallon tanks, and associated piping and pumps. The OD7 facility was emptied, RCRA-closed in 2002, and is now managed by the DOE-EM surveillance and maintenance program.

OD8 Waste Oil Solvent Drum Storage Facility. The Waste Oil Solvent Drum Storage Facility (OD8) has a capacity for 55 gallon drums and a smaller number of Tuff tanks. RCRA waste oil/solvent mixtures containing various concentrations of chlorinated and nonchlorinated hydrocarbon solvents, uranium, trace PCBs, and water for specific chemical constituents are stored at OD8 in 55 gallon drums and 300 gallon Tuff tanks. The facility was emptied and the permitted area was closed in 2002. The facility is currently used for material storage.

OD9 Waste Oil/Solvent Storage Facility. The Waste Oil/Solvent Storage Facility (OD9) houses LLW, MLLW, and hazardous waste, including PCBs. It consists of a diked area supporting five 40,000 gallon tanks, a tanker transfer station with five centrifugal transfer pumps, and a drum storage area. A diked and covered pad furnishes space for 1,165 cubic feet of containerized waste. The diked area contains additional space for a sixth 40,000-gallon tank. All tanks were emptied and the facility was RCRA-closed in 2002. The facility is now managed by the DOE-EM surveillance and maintenance program.

Oil Landfarm Soil Storage Facility. The Oil Landfarm Soil Storage Facility is a RCRA-interim-status facility containing approximately 14,832 cubic feet of soil contaminated with PCBs and volatile organics. The soil was excavated from the Oil Landfarm and Tributary 7 in 1989. The soil is contained in a covered, double-lined concrete dike with a leak-detection system. This facility is now closed.

4.13.4 Treatment of Waste at Y-12

Central Pollution Control Facility. The Central Pollution Control Facility, a 20,000- square foot multistory structural steel building with masonry walls, began operation in 1985. The Central Pollution Control Facility operates under RCRA permit-by-rule and an NPDES permit issued in April 28, 1995. It is the primary facility for treatment of non-nitrated waste. It receives wastes that are acidic or caustic, oily mop water containing beryllium, thorium, uranium, emulsifiers, and cleansers. The facility can also destroy diluted quantities of cyanide in wastewater using ultraviolet oxidation. The Central Pollution Control Facility provides both physical and chemical processing, including oil/water separation, neutralization, precipitation, coagulation, flocculation, carbon adsorption, decanting, and filtration. Treated water is discharged to EFPC through an NPDES monitoring station or sent to the WETF for further processing. Sludge from the treatment processes is transferred to the West End Tank Farm. Spent carbon cartridges and filters are disposed of in commercial treatment, storage, and disposal (TSD) facilities.

Plating Rinsewater Treatment Facility. The Plating Rinsewater Treatment Facility treats dilute, non-nitrate bearing, plating rinsewater contaminated primarily with chromium, copper, nickel, and zinc. In addition, the facility can remove chlorinated hydrocarbons. It is currently not maintained in operable status because the Plating Shop that formerly produced most of Y-12's rinsewater has been deactivated. The facility's neutralization and equalization equipment are located outdoors in a diked basin. The remainder of the facility process is located within the Central Pollution Control Facility.

Central Mercury Treatment System. The Central Mercury Treatment System (CMTS) is designed to treat mercury-contaminated sump water from former mercury use buildings. The CMTS was installed as part of the Y-12 Integrated Mercury Strategy Program to achieve compliance with regulations and guidance addressing mercury contamination in EFPC. Sump water from several buildings is treated at the CMTS. The CMTS is located in the Central Pollution Control Facility. Outfall 551 is the discharge point where treated wastewater is discharged in conformance with NPDES monitoring guidelines.

West End Treatment Facility. The WETF treats MLLW- and LLW-contaminated wastewater generated by Y-12 production operations and other DOE-ORO activities meeting the facility waste acceptance criteria under a RCRA permit-by-rule. Treatment methods include hydroxide precipitation of metals, sludge settling and decanting, bio-denitrification, bio-oxidation, pH adjustment, degasification, coagulation, flocculation, clarification, filtration, and carbon adsorption. Wastewaters are primarily nitrate bearing and include the following: nitric acid wastes, mixed acid wastes, waste coolant solutions, mop water, and caustic wastes. Wastes are received at the WETF in 5,000 gallon tankers, 300- gallon polytanks, drums, carboys, and small bottles. Detailed waste characterization documentation and jar tests are used to determine the treatment scheme for wastewater shipments. Treatment at WETF is performed in three processes: Head End Treatment, West Tank Farm biological treatment, and Effluent Polishing. The Head End Treatment System consists of waste receiving, hydroxide precipitation of heavy metals, sludge settling, and decanting. Biological treatment in the West Tank Farm consists of bio-denitrification, then bio-oxidation. The Effluent Polishing System consists of pH adjustment, degasification, coagulation, flocculation, clarification, filtration, carbon adsorption, and effluent discharge to the EFPC through an NPDES monitoring station.

Legacy MLLW treatment sludges are presently being removed from sludge storage tanks at the West Tank Farm for offsite disposal. Currently generated MLLW and LLW treatment sludges are being accumulated and concentrated for final characterization and disposal. Other treatment residuals, such as spent carbon and personal protective equipment, are being sent for immediate offsite disposal where feasible or otherwise characterized for onsite treatment or disposal.

Organic Handling Unit for Mixed Waste. The Organic Handling Unit provides storage and treatment of organic solutions containing EU. The uranium level in the waste material arriving at the Organic Handling Unit is typically less than 400 parts per million. These wastes are characterized as mixed hazardous and radioactive wastes. Occasionally, EU-contaminated wastes generated offsite may be treated at the Organic Handling Unit. An assay reduction process is used to dilute the U-235 isotope with U-238 isotope in such a manner that they cannot be easily separated chemically or physically. This is accomplished by first mixing depleted uranyl nitrate with the organic solution and then neutralizing the organic solution by adding sodium hydroxide or other acceptable material. Since uranyl nitrate solution is not readily soluble in most organic solutions, "extractant" may be added to the organic solution.

Biodenitrification Unit. The Biodenitrification Unit has been in stand-down, but restart is anticipated. It is capable of treating nitrate-bearing, liquid MLLW generated by enriched uranium recovery operations in EU Building. The denitrification unit removes nitrates from the waste and also separates liquids and solids. The wastewater is then transferred to the WETF for further treatment, and the sludge is transferred to the West Tank Farm.

Uranium Recovery Operations. Uranium Recovery Operations are a recovery process to increase production efficiency at Y-12. Liquid waste from the operation is transferred to the Biodenitrification Unit. The system is exempt from permitting requirements under RCRA.

Groundwater Treatment Facility. The Groundwater Treatment Facility treats wastewater from the Liquid Storage Facility at Y-12 seepwater collected at East Chestnut Ridge waste piles to remove VOCs, non-VOCs, and iron and elsewhere. It is part of the DARA program to treat groundwater contaminated with LLW and MLLW that is collected from the Bear Creek Burial

Grounds. The Groundwater Treatment Facility is located at the far west end of Y-12, in the same building as the WETF. This facility uses an air stripping operation to remove VOCs. In addition, carbon adsorption eliminates nonvolatile organics and PCBs. Precipitation and filtration are used to remove iron. After treatment, wastewater is sampled and recycled if additional processing is required. Wastewater that meets discharge specifications is pumped into the EFPC through a NPDES monitoring station.

East End Mercury Treatment System. The East End Mercury Treatment System (EEMTS) is designed to treat mercury-contaminated sump water a former mercury use building constructed in the late 1940s and located in the eastern part of Y-12 on Second Street directly south of the North Portal parking lot. The EEMTS was installed as part of the Y-12 Integrated Mercury Strategy Program to achieve compliance with regulations and guidance addressing mercury contamination in EFPC. Sump water is treated at the EEMTS. A new outfall (Outfall 550) is the discharge point where treated water is discharged in conformance to NPDES monitoring guidelines. Mercury-contaminated wastewater is pumped from building sumps to the treatment unit installed on the first floor. The water is treated there and released to EFPC through the NPDES Outfall 550. The EEMTS process consists of influent filtration, granular-activated carbon adsorption, and associated water transfer equipment.

Big Spring Wastewater Treatment System. Y-12 Big Spring Wastewater Treatment System (BSWTS) is a full-scale treatment system that removes mercury contamination from a spring (outfall 51) that discharges directly to UEFPC. The BSWTS can reduce the mercury concentration to less than 50 nanograms per liter at a flow rate of 300 gallons per minute. Unit processes in the facility include (1) a water collection wetwell, (2) a 92,000 gallon equalization tank, (3) pre and post filters, (4) carbon adsorption columns, (5) a backwash feed and collection system, and (6) a caustic feed pH adjustment system. The process system is housed in a pre-engineered, ventilated, steam-heated metal building. The 1.5-story building is about 40 feet wide and 75 feet long. The instrumentation and control system allows the process to operate automatically and unattended.

Steam Plant Wastewater Treatment Facility. The Steam Plant Wastewater Treatment Facility treats wastewater from Steam Plant operations, demineralizers, and coal pile runoff. Treatment processes include wastewater collection/sedimentation, neutralization, clarification, pH adjustment, and dewatering. The treatment facility uses automated processes for continuous operation. All solids generated during treatment are nonhazardous and are disposed of in the sanitary landfill. The treated effluent is monitored prior to discharge to the Oak Ridge public sewage system.

Uranium Chip Oxidation Facility. The Uranium Chip Oxidation Facility is a 3,750-square foot, single-story, prefabricated building with metal wall panels built in 1987. The facility thermally oxidizes depleted and natural uranium machine chips under controlled conditions to a stable uranium oxide. Upon arrival, chips are weighed, drained of machine coolant, placed into an oxidation chamber, and ignited. The oxide is transferred into drums and disposed of in an offsite commercial facility. The Uranium Chip Oxidation Facility is not designed to treat uranium sawfines. Hence, sawfines are currently blended with uranium oxide and placed in storage as a short-term treatment method.

Waste Feed Preparation Facility. The Waste Feed Preparation Facility is a 3,600- square foot, single-story, prefabricated building with metal wall panels built in 1984. It was previously used to process and prepare solid LLW for volume reduction (compaction and repackaging) by an outside contractor or storage facility. Although the compactor/baler is inactive, the facility has been used in recent years as a waste sorting/segregation facility to prepare containers for offsite shipment.

Steam Plant Ash Disposal Facility. The Steam Plant Ash Disposal Facility is used to collect, dewater, and dispose of sluiced bottom ash generated during operation of the coal-fired Y-12 Steam Plant. To comply with environmental regulations for landfill operations, it includes a leachate collection system and a transfer system to discharge the collected leachate into the Oak Ridge public sewage system. The dewatered ash is disposed of in Landfill VI.

Cyanide Treatment Unit. The Y-12 Cyanide Treatment Unit provides storage and treatment of LLW and MLLW solutions containing metallic cyanide compounds from spent plating baths and precious metal recovery operations or other areas; the unit's RCRA permit was issued on September 28, 1995. Treatment is by chemical oxidation and pH adjustment. The cyanide reduction process performed within the unit is currently performed in 55 gallon containers. After waste is treated at the Cyanide Treatment Unit, it is transferred to the WETF for further treatment, then discharged to the EFPC. The Cyanide Treatment Unit was closed in 2004 (DOE 2005a).

4.13.5 Disposal of Waste at Y-12

DOE operates solid waste disposal facilities located near Y-12, called ORR Sanitary Landfills. In 2004, industrial, construction/demolition, classified, and spoil material waste were disposed of at these landfills. The wastes must be non-hazardous, non-radioactive, and non-RCRA-regulated. DOE must use approved operations in receiving, compacting, and covering waste.

TDEC performs a monthly audit of DOE's landfills on ORR. It also reviews DOE practices to ensure that radioactive waste is not disposed of in these landfills. Waste that contains residual radioactive materials at levels below authorized limits established in accordance with DOE Order 5400.5 may be accepted for disposal. All DOE facilities may receive materials containing residual radioactivity of any radionuclide on material surfaces provided that they are below limits specified in DOE Order 5400.5. Current waste acceptance criteria (WAC) for the landfills include a ceiling for residual radioactivity of 35 picocuries per gram for total uranium on a volumetric basis. Materials containing uranium and other radioisotopes with residual levels of radioactivity below DOE authorized limits on a volumetric basis are accepted for disposal on a case-by-case basis. The landfills are summarized below, based on information in the TDEC Status Report to the Public for FY 2004.

Industrial Landfill IV. Industrial Landfill IV is used for disposal of classified, non-hazardous industrial waste, for construction/demolition waste, and for approved special waste. It has a footprint of about four acres. This industrial waste landfill operates as an approved Class II landfill in accordance with TDEC permit No. IDL-01-103-0075. Because it was opened prior to implementation of the current Class II requirement established in the TDEC solid waste processing and disposal regulation, the eastern area does not require a leachate collection system or gas monitoring capabilities. However, it has a leachate collection system in place in the western area and a gas monitoring system. Landfill IV is a classified industrial landfill.

Industrial Landfill V. Industrial Landfill V is a Class II landfill permitted under TDEC permit No. IDL 01-103-0083. The landfill receives mostly sanitary and industrial waste generated at the plants. It does accept special waste approved by TDEC. Industrial Landfill V is used for disposal of unclassified, non-hazardous sanitary/industrial waste and for approved special waste. Approved special wastes have included asbestos materials, empty aerosol cans, materials contaminated with beryllium, glass, fly ash, coal pile runoff sludge, empty pesticide containers, and Steam Plant Wastewater Treatment Facility sludge. The landfill area is located on Chestnut Ridge near the eastern end of Y-12 and serves Y-12, ORNL, ETTP, and other DOE prime contractors at Oak Ridge. The landfill is equipped with a liner and leachate collection system. Disposal of special waste is approved on a case-by-case basis by the State of Tennessee. Requests are filed with the state to provide disposal for additional materials as needed. The landfill is approximately 15 percent filled. The landfill has a footprint of almost 26 acres and is being constructed in phases as disposal capacity is needed.

Construction/Demolition Landfill VI. Construction/Demolition Landfill VI accepts unclassified, non-hazardous construction/demolition debris and approved special waste. Dewatered ash from the Y-12 Steam Plant is currently disposed of in Landfill VI. The facility has been constructed to 100 percent design capacity and has been in operation since 1993. Landfill VI was certified closed during FY 2004 and, therefore, no waste was disposed at the landfill during the year.

Construction/Demolition Landfill VII. Landfill VII is a Class IV landfill permitted under TDEC permit No. DML-01-103-0045. This landfill is used for the disposal of demolition/construction waste and certain other TDEC-approved waste having similar characteristics. It was placed in service when Landfill VI filled to capacity in 2004. It has a footprint of slightly more than 30 acres. The Construction/Demolition Landfill VII was expanded in 2004 to add 175,000 cubic yards of capacity. Construction/Demolition Landfill VII is the repository for much of the uncontaminated debris generated by demolition of buildings at ETTP. Future expansion will add another 336,000 cubic yards of capacity to Construction Demolition Landfill-VII.

Onsite Low-Level Waste Disposal Capability. Y-12 has no active disposal facility onsite for LLW or hazardous waste. All disposal activities at the Bear Creek Burial Grounds were terminated in 1993. These burial grounds were used to dispose of radiologically contaminated waste. Similar waste streams generated today are containerized and stored at Y-12 or are shipped offsite for disposal.

However, the EMWMF was constructed to provide a new disposal capability at ORR for various types of hazardous and radioactively-contaminated waste under certain conditions. This facility has only been approved to accept waste generated as a result of response actions to expedite cleanup of contamination that resulted from previous DOE and *Atomic Energy Act* operations on ORR and that are conducted under CERCLA authorization (or in a few cases, under the Inactive Hazardous Substances Site Remedial Action Program [State Superfund] of the State of

Tennessee). The EMWMF was constructed in Bear Creek Valley (near Y-12) to dispose of wastes generated by CERCLA activities on ORR. The facility relies on waste profiles provided by the waste-generating organizations to characterize waste disposed in the facility. This profile is based on an average of contaminants in a waste lot. Since the size of waste lots can vary from a single package to many truckloads of waste, the averages reported are not necessarily representative of each load of waste transported to the facility. That is, some loads may have highly contaminated wastes, while other loads may contain very little contamination. The EMWMF has a design capacity of 1,300,000 cubic yards.

4.13.6 Pollution Prevention

The *Pollution Prevention Act* of 1990 and the *Hazardous and Solid Waste Amendments* of 1984 enabled Federal agencies to implement the pollution prevention program. NEPA's original purpose, which was to promote efforts that would prevent or eliminate damage to the environment, was complemented by both acts. This relationship was further strengthened by a 1993 memorandum from the CEQ, which recommended that Federal agencies incorporate pollution prevention principles, techniques, and mechanisms throughout their NEPA planning and decisionmaking processes. DOE-ORO established a Pollution Prevention and Waste Minimization Program. This section provides detailed information regarding pollution prevention and waste minimization at Y-12.

EPA has published strategies and guidelines to help facilities meet regulatory requirements. The *Pollution Prevention Act* establishes an environmental protection hierarchy, with source reduction as the most desirable environmental management option. If pollution cannot be prevented at the source, then the following waste management options should be explored in order of preference: reuse, recycling, treatment, and disposal. Waste avoidance is accomplished by source reduction or the recycling of solid wastes regulated under the RCRA. Pollution prevention complements the concept of waste avoidance by focusing on source reduction and other practices that reduce or eliminate pollutants through increased efficiency in the use of raw materials, energy, water, or other resources, or protection of natural resources by conservation. Waste avoidance is an applied element of the pollution prevention process.

The Y-12 Pollution Prevention Program is consistent with DOE and other legal requirements and designed to eliminate or minimize pollutant releases to all media and incorporate a pollution prevention ethic into the facility. Y-12 has a well-established recycling program and continues to identify new material streams and expand the types of materials that can be recycled by finding new markets and outlets for the materials. As shown in Figure 4.13.6-1, Y-12 has diverted thousands of metric tons of materials from the landfill and into viable recycle processes. Currently, materials recycled by Y-12 range from office-oriented materials such as paper (including phone books), aluminum cans, and toner cartridges to operations-oriented materials such as scrap metal, tires, and batteries. Many Y-12 recycling activities have been implemented, including the 2007 activities highlighted in this section (DOE 2008).

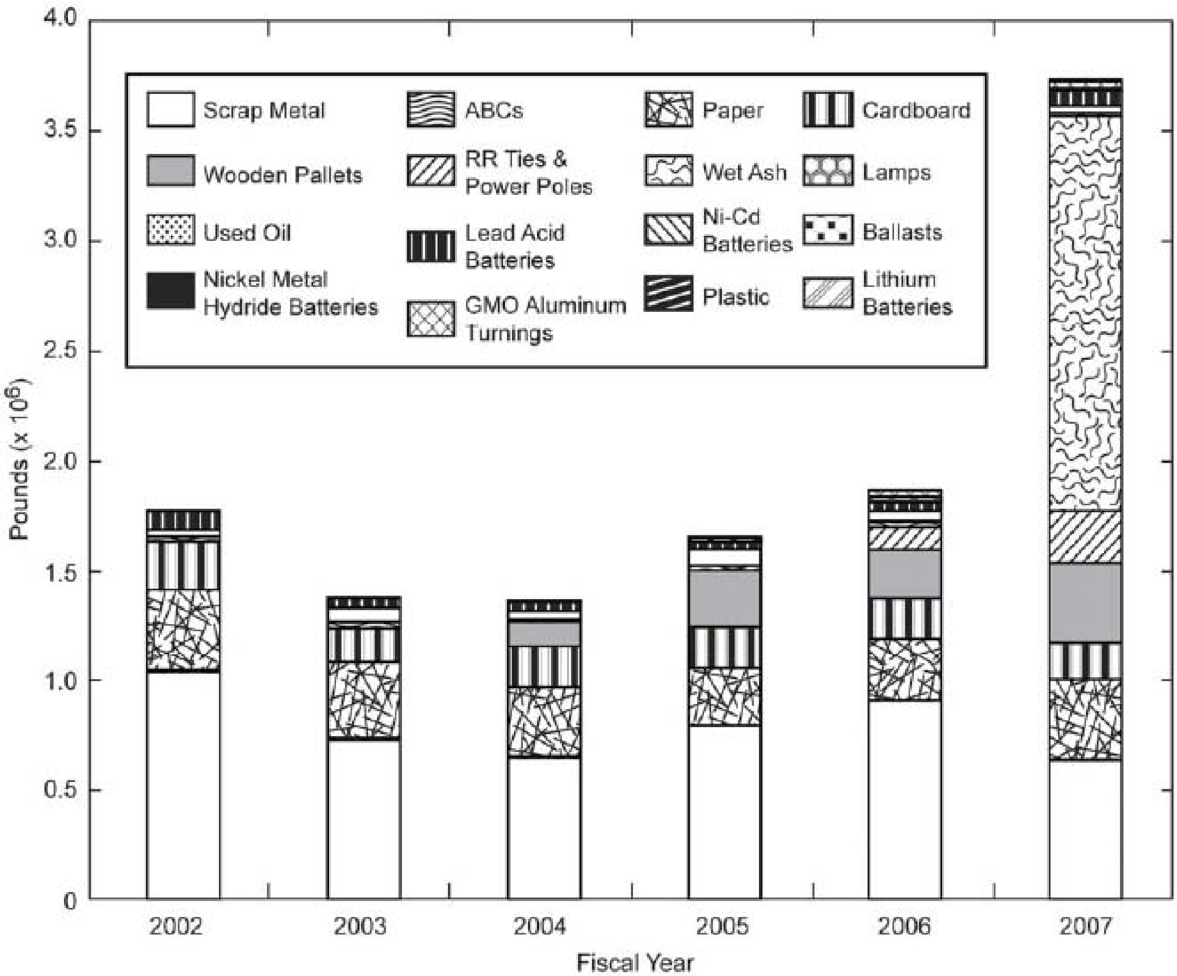


Figure 4.13.6-1. Y-12 Recycling Program Results.

In FY 2007, Y-12 established a comprehensive program for recycling transformers through an offsite vendor. This recycling initiative began in FY 2006, when more than 80 transformers were identified and earmarked for disposition. Recycling provides an environmentally friendly way to disposition transformers and greatly minimizes the environmental liability related to storing old transformers onsite. In FY 2007, this initiative resulted in 118 transformers, totaling 62,100 pounds being sent offsite for recycle, saving more than 1,670 cubic feet of landfill space, generating $8,000 in revenue, and avoiding more than $3,660 in landfill disposal cost. The total estimated cost avoidance for this initiative was more than $11,660 (DOE 2008).

Y-12 teamed with 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 Complex. 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 Complex. In contrast, Y-12 had excess lead onsite 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 offsite smelting operation for use across the DOE Complex. While the transfer of the lead resulted in more than $113,300 in costs for Y-12, the disposal costs alone for Y-12 would have been more than $213,290, resulting in an overall cost avoidance of almost $100,000 (DOE 2008).

Y-12 expanded the battery recycling initiative to include the recycling of silver, lithium, and mercury batteries to an offsite 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).

Energy management is an ongoing and comprehensive effort that contains a key strategy of implementing guidelines to reduce the consumption of energy, water, and fuel (including gasoline, diesel fuel, electricity, and natural gas). Energy savings performance contracts (ESPCs) have been used at Y-12 and are integral to the future of Y-12 as a means of funding modernization of the complex with energy-saving equipment. With the advent of requirements of Executive Order 13423, “Strengthening Federal Environmental, Energy, and Transportation Management,” ESPCs have been reinvigorated as a method for recapitalizing energy saving investments at Y-12. Johnson-Controls, Inc., has been selected as Y-12’s Energy savings contractor (ESCO). The ESPC kick-off meeting was conducted in January 2008, initiating the project development phase (DOE 2008).

Energy consumption over the past several years has continued a steady downward trend. By FY 2006, Y-12 achieved an overall energy usage reduction of 44.5 percent from the previously existing FY 1985 baseline. In FY 2007, EO 13423 reset the baseline for comparison to FY 2003. Energy consumption in FY 2007 continued its downward trend, achieving a 6.8 percent reduction in energy intensity relative to the new FY 2003 baseline.

4.14 ENVIRONMENTAL RESTORATION ACTIVITIES AT ORR

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 FFCA and the CERCLA. The FFCA 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 ORR in accordance with the Site Treatment Plan.

CERCLA, also known as Superfund, was passed in 1980 and was amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA). Under CERCLA, a site is investigated and remediated if it poses significant risk to health or the environment. The EPA National Priorities List (NPL) is a comprehensive list of sites and facilities that have been found to pose a sufficient threat to human health and/or the environment to warrant cleanup under CERCLA. In 1989, ORR was placed on EPA’s NPL.

In 1992, ORR Federal Facility Agreement among EPA, TDEC, and DOE became effective and established the framework and schedule for developing, implementing, and monitoring remedial actions on ORR. The onsite CERCLA Waste Facility, located in Bear Creek Valley, is used for disposal of waste resulting from CERCLA cleanup actions on ORR, including ORNL (DOE 2008).

The CERCLA Waste Facility is an engineered landfill that accepts low-level radioactive and hazardous wastes in accordance with specific waste acceptance criteria under an agreement with state and federal regulators. The ORR Federal Facility Agreement is intended to coordinate the corrective action processes of RCRA required under the Hazardous and Solid Waste Amendments permit with CERCLA response actions. Three RCRA postclosure permits, one for each of the three hydrogeologic regimes at Y-12, have been issued to address the eight major closed waste disposal areas at Y-12. Because it falls under the jurisdiction of two postclosure permits, the S-3 Pond Site is described as having two parts (eastern and former S-3). Postclosure care and monitoring of East Chestnut Ridge Waste Pile was incorporated into permit TNHW-128. Groundwater corrective actions required under the postclosure permits have been deferred to CERCLA. RCRA groundwater monitoring data will be reported yearly to TDEC and EPA in the annual CERCLA *Remediation Effectiveness Report* for ORR (DOE 2008).

Periodic updates of proposed construction and demolition activities at Y-12 (including alternative financing projects) have been provided to managers and project personnel from the TDEC DOE Oversight Division, and EPA Region 4. A CERCLA screening process is used to identify proposed construction and demolition projects that warrant CERCLA oversight. The goal is to ensure that modernization efforts do not impact the effectiveness of previously completed CERCLA environmental remedial actions and that they do not adversely impact future CERCLA environmental remedial actions (DOE 2008).

CHAPTER 5: ENVIRONMENTAL CONSEQUENCES

Chapter 5 describes the environmental consequences of the Site-Wide Environmental Impact Statement (SWEIS) alternatives. The Chapter discusses the consequences of each alternative by resource area, in a format consistent with Chapter 4. Chapter 5 also describes the environmental impacts common to all alternatives. Where applicable, Chapter 5 also discusses potential mitigation measures that could be employed to reduce impacts.

5.0 INTRODUCTION

In accordance with Council on Environmental Quality (CEQ) regulations, the environmental consequences discussions provide the analytical detail for comparisons of environmental impacts associated with the various Y-12 National Security Complex (Y-12) SWEIS alternatives. Discussions are provided for each environmental resource and relevant issues that could be affected. For each resource or issue in Chapter 5, the impacts of the No Action Alternative and the four action alternatives are presented. For comparison purposes, environmental concentrations of emissions and other potential environmental effects are presented with the appropriate regulatory standards or guidelines. However, compliance with regulatory standards is not necessarily an indication that the environmental impacts are not significant for purposes of the *National Environmental Policy Act* (NEPA).

Impacts of the SWEIS alternatives are assessed in the following resource areas: land use (Section 5.1); visual resources (Section 5.2); site infrastructure (Section 5.3); transportation and traffic (Section 5.4); geology and soils (Section 5.5); air quality and noise (Section 5.6); water resources (Section 5.7); ecological resources (Section 5.8); cultural resources (Section 5.9); socioeconomics (Section 5.10); environmental justice (Section 5.11); health and safety (Section 5.12); waste management (Section 5.13); and accidents (Section 5.14). Section 5.15 discusses impacts associated with the transportation and receipt of nuclear materials in support of the Global Threat Reduction Initiatives. Section 5.16 discusses decontamination and decommissioning impacts. The impacts presented in Sections 5.15 and 5.16 are applicable to each of the SWEIS alternatives. The impact analysis for this Y-12 SWEIS is based on the best data currently available. The methodology used to perform the impact assessments is described in Appendix E.

5.1 LAND USE

The land use resources analysis considers a region of influence (ROI) that includes the Y-12 area of responsibility, which covers approximately 5,400 acres, as well as the rest of the Oak Ridge Reservation (ORR) (approximately 35,000 acres) and the adjoining properties of the City of Oak Ridge. The land use impacts of all the alternatives are compared with existing land use patterns, plans and policies.

5.1.1 Alternative 1 – No Action Alternative

The main area of Y-12 (approximately 800 acres) is largely developed and classified as "industrial use" (Figure 5.1.1-1 illustrates the industrialized nature of Y-12). The land surrounding the main Y-12 area is used primarily for environmental restoration, waste management, and environmental field research activities. The No Action Alternative activities at Y-12 are consistent with current land use plans, classifications, and policies. Under the No Action Alternative, ongoing National Nuclear Security Administration (NNSA) and U.S. Department of Energy (DOE) activities would continue. Ongoing downsizing of Y-12 would result in more facilities being declared surplus and recommended for decontamination and decommissioning (D&D).

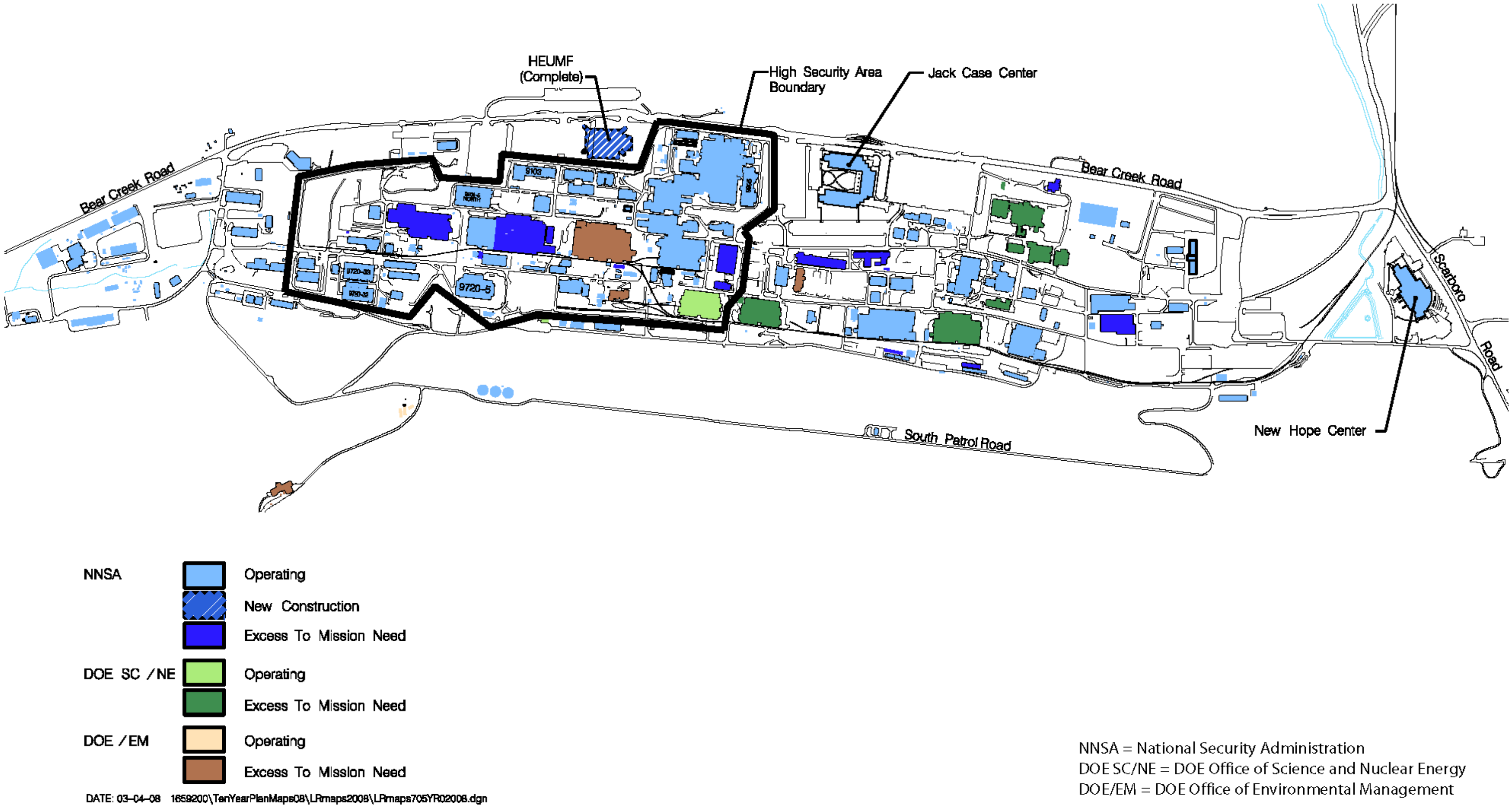
As discussed in Section 3.2.1 of this SWEIS, the long term plan for Y-12 is to consolidate operations and reduce the number of excess facilities. This is an ongoing mission that will continue for the foreseeable future. While specific land usage within Y-12 may change, the overall industrial use classification would likely remain the same. Because Y-12 would continue to require security and emergency response buffers, real estate associated with eliminating excess facilities would likely not be released for public use and there would be no local land use benefits. Impacts to land use adjacent to Y-12 are not expected.

5.1.2 Alternative 2 – Uranium Processing Facility Alternative

Construction. The new Uranium Processing Facility (UPF) and Complex Command Center (CCC), described in Section 3.2.2, would be compatible and consistent with the current land use at Y-12 and would not change the current industrial use classification that exists at the proposed location. Construction of and future operations at the UPF and CCC would be consistent with the Y-12 Ten Year Site Plan (TYSP) and would be a significant contribution to achieving an optimum configuration of Y-12 (see Figure 5.1.2-1). The Y-12 TYSP presents the fiscal year (FY) 2009–2018 facility and infrastructure requirements to maintain progress in achieving the overall Complex Transformation vision for Y-12. The Y-12 TYSP is one of ten such plans for NNSA, and may be accessed at: http://nnsa.energy.gov/infrastructure/Ten-year_site_plan.htm. As shown by comparing Figures 5.1.1-1 and 5.1.1-2, under the Y-12 TYSP, the UPF would enable the enriched uranium (EU) operations to be consolidated into an area approximately 10 percent of the current size.

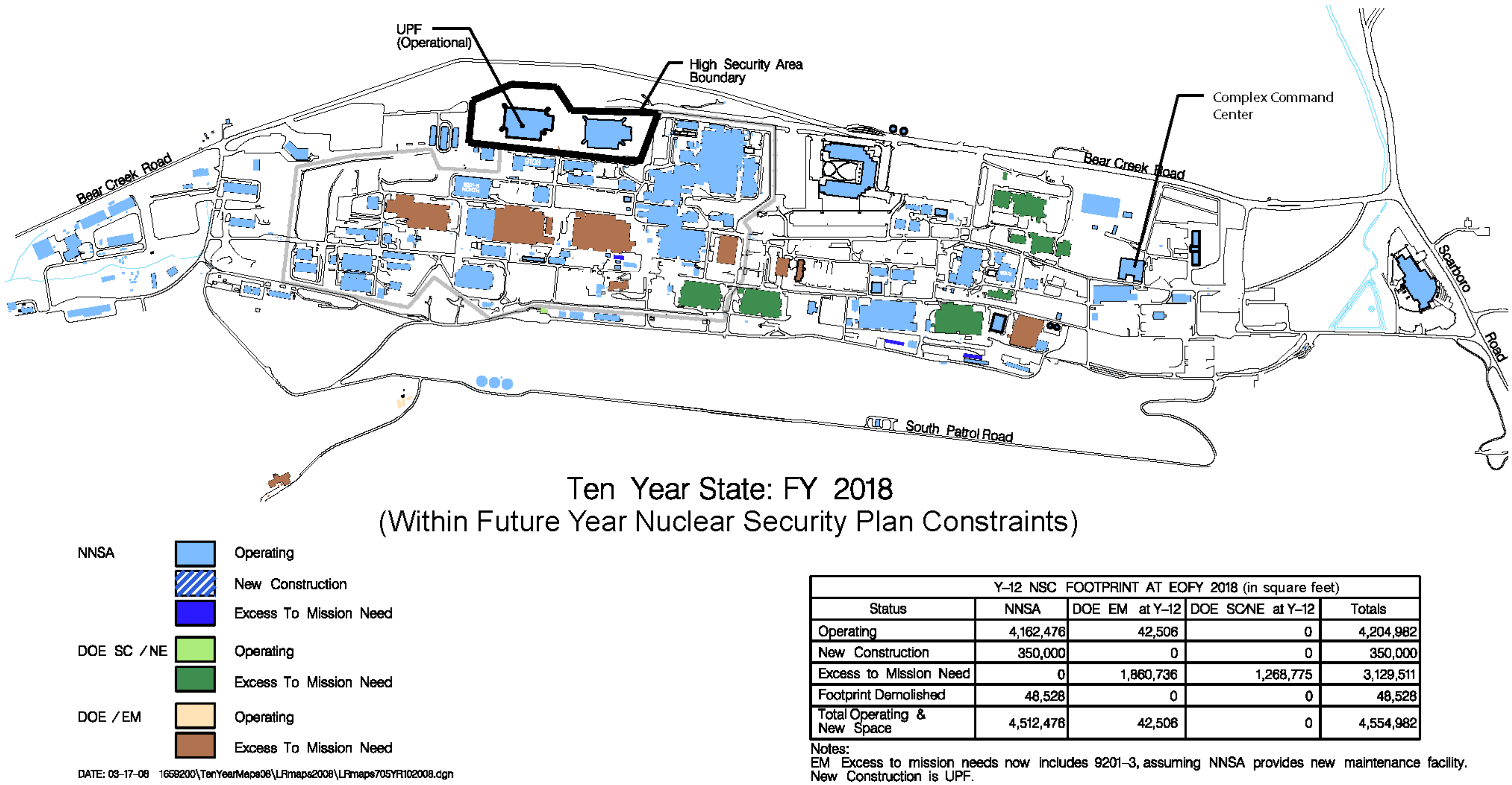
The proposed UPF site is in the Pine Ridge and Bear Creek Parking Lots, collocated to the west of the Highly Enriched Uranium Materials Facility (HEUMF). This site is outside of, but adjacent to, the existing Perimeter Intrusion Detection and Assessment System (PIDAS). Figure 3.2.2-2, in Chapter 3 of this SWEIS, shows the location of the proposed UPF and CCC relative to other buildings at Y-12. The majority of the site for the UPF is presently a parking lot and represents a large level site with minimal site preparation requirements.

Construction of the UPF would require approximately 35 acres of land, including land for a construction laydown area (four acres) and temporary parking. The construction laydown area for the UPF would be developed on the west side of the proposed UPF site. This area would be



Source: NNSA 2008a.

Figure 5.1.1-1. Major Operational Facilities Currently Supporting Y-12 Missions.



Y-12 NSC FOOTPRINT AT EOFY 2018 (in square feet)				
Status	NNSA	DOE EM at Y-12	DOE SC/NE at Y-12	Totals
Operating	4,162,476	42,506	0	4,204,982
New Construction	350,000	0	0	350,000
Excess to Mission Need	0	1,860,736	1,268,775	3,129,511
Footprint Demolished	48,528	0	0	48,528
Total Operating & New Space	4,512,476	42,506	0	4,554,982

Notes:
EM Excess to mission needs now includes 9201-3, assuming NNSA provides new maintenance facility.
New Construction is UPF.

Source: NNSA 2008a.

Figure 5.1.1-2. Optimum Functional Diagram of Y-12 in Approximately 2018.

finished with an 8-inch-thick compacted, stabilized base for the construction phase. Interim employee parking lots would be developed west of the proposed construction laydown area. The site would be sufficiently graded and developed to accommodate a number of temporary construction trailers, storage buildings, and materials storage yards. The staging area would have electric power and potable water. Sanitary service would be provided by PVC double-wall collection tanks, which would be pumped out as needed. After construction of the UPF is complete, the construction office trailers would be removed and material laydown areas would be re-graded and seeded after removal of any soil that may have become contaminated with construction-related materials such as diesel fuel. Alternatively, it may be feasible to rework the laydown area to provide for additional parking. Impacts to land use adjacent to Y-12 are not expected.

The CCC would be located in a previously developed area. The project would require excavation within the Y-12 industrial area for utility/communication lines. Excavation locations would be selected such that known *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) remediation areas of concern are avoided. Approximately 7 acres of land would be disturbed for the CCC.

Operation. The operational UPF would occupy about eight acres of land. Upon completion of UPF construction (approximately 2016), the PIDAS would be extended to surround the new facility. When the new PIDAS is completed, the existing EU operations would be relocated to the new facility, the current EU facilities could be declared surplus and evaluated for D&D, and the PIDAS surrounding the old EU facilities could be removed. D&D of the current EU facilities and removal of the PIDAS surrounding those facilities could not occur until at least 2018, once the UPF would become operational. Section 5.16 of this SWEIS provides a qualitative assessment of the types of impacts that might result from the D&D of these facilities. Although the ultimate disposition of these facilities would be determined by a separate NEPA review and determination in the future, when such actions are ripe for decisionmaking, this SWEIS acknowledges that approximately 633,000 square feet of facilities could become excess if the UPF is constructed. In the D&D of these facilities potential contamination could come from:

- Surface contamination on equipment, walls, ceilings, roof, floors, sinks, laboratory hoods, air ventilation ducts, etc;
- Solid and liquid contaminated waste from normal operations and off-normal and accident events; and
- Land contamination from normal and off-normal operations and accident events.

Ultimately, such D&D could result in the reuse of the land and facilities for activities not related to weapons production operations. While specific usage of this land may change, the overall industrial use classification would remain the same. Because Y-12 would continue to require security and emergency response buffers, no real estate associated with these facilities would likely be released for public use and there would be no local land use benefits. Once operational, the UPF would take up approximately eight acres, which represents a very small percentage of the land encompassed by the main area of Y-12 (approximately 800 acres). The UPF and new PIDAS would allow the Protected Area at Y-12 to be reduced from approximately 150 acres to 15 acres.

The UPF footprint and the alignment of the new PIDAS would require Bear Creek Road to be closed to through traffic. Although it would be feasible to reroute Bear Creek Road, this is not proposed at this time, but could be evaluated in the future. Up to 1,200 parking spaces may be built to replace the parking spaces lost if the proposed UPF is constructed. Impacts to land use adjacent to Y-12 would not be expected to result from the construction of the proposed UPF and associated parking spaces.

Once operational, the CCC would occupy about 7 acres of land. Impacts to land use adjacent to Y-12 are not expected.

5.1.3 Alternative 3 – Upgrade in-Place Alternative

Construction. The Upgrade in-Place Alternative, described in Section 3.2.3, would be both compatible and consistent with the current land use at Y-12 and would not change the current industrial use classification that exists. Construction activities would consist of internal modifications to existing facilities, as well as construction of the CCC, as described above. Overall, there would be no appreciable land use impacts or changes beyond those described for the No Action Alternative. Impacts to land use adjacent to Y-12 are not expected.

Operation. Operation of the upgraded facilities would have no impact on the current land use at Y-12 and would not change the current industrial use classification that exists at Y-12. Once operational, the CCC would occupy about 7 acres of land. Impacts to land use adjacent to Y-12 are not expected under the Upgrade in-Place Alternative.

5.1.4 Alternative 4 – Capability-sized UPF Alternative

Construction. The Capability-sized UPF Alternative, described in Section 3.2.4, would be compatible and consistent with the current land use at Y-12 and would not change the current industrial use classification that exists. The Capability-sized UPF would disturb no more than 32 acres of land during construction. The CCC would disturb 7 acres, as described above. Standard construction mitigation techniques would be utilized and impacts to land use adjacent to Y-12 are not expected.

Operation. Under the Capability-sized UPF Alternative, operation of facilities would have no impact on the current land use at Y-12 and would not change the current industrial use classification that exists at Y-12. Consequently, the Capability-sized UPF Alternative would not entail any significant change to land use. Once operational, the CCC would occupy about 7 acres of land. Impacts to land use adjacent to Y-12 are not expected.

5.1.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Construction. The No Net Production/Capability-sized UPF, described in section 3.2.5, would be compatible and consistent with the current land use at Y-12 and would not change the current industrial use classification that exists. The No Net Production/Capability-sized UPF would disturb no more than 32 acres of land during construction. The CCC would disturb 7 acres, as described above. Standard construction mitigation techniques would be utilized and impacts to land use adjacent to Y-12 are not expected.

Operation. Under the No Net Production/Capability-sized UPF Alternative, operation of facilities would have no impact on the current land use at Y-12 and would not change the current industrial use classification that exists at Y-12. Consequently, the No Net Production/Capability-sized UPF Alternative would not entail any significant change to land use. Once operational, the CCC would occupy about 7 acres of land. Impacts to land use adjacent to Y-12 are not expected.

5.1.6 Potential Mitigation Measures

Because any construction would occur within the Y-12 industrial site, there would be no changes in land use at Y-12, and no conflicts with existing and approved future land uses. Therefore, no additional mitigation measures would be required.

5.1.7 Summary Comparison of Alternative Impacts for Land Use

No Action Alternative. Land uses at Y-12 would be compatible with the surrounding areas and with existing land use plans. There would be no change to existing land uses or total acreage of Y-12.

UPF Alternative. There would be a potential land disturbance of approximately 42 acres of previously disturbed land. Land uses at Y-12 would remain compatible with surrounding areas and with the existing land use plans.

Upgrade in-Place Alternative. Same as the No Action Alternative.

Capability-sized UPF Alternative. There would be a potential land disturbance of approximately 39 acres of previously disturbed land for construction of the Capability-sized UPF and CCC. Land uses at Y-12 would remain compatible with surrounding areas and with the existing land use plans.

No Net Production/Capability-sized UPF Alternative. There would be a potential land disturbance of approximately 39 acres of previously disturbed land for construction of the No Net Production/Capability-sized UPF and CCC. Land uses at Y-12 would remain compatible with surrounding areas and with the existing land use plans.

5.2 VISUAL RESOURCES

The visual resources analysis considers a ROI that addresses the Y-12 area of responsibility, which covers approximately 5,400 acres. The impacts of the alternatives are evaluated for visual impacts.

5.2.1 Alternative 1 – No Action Alternative

As discussed in Section 4.2, the existing structures at Y-12 are mostly low-profile, reaching heights of three stories or less, and were built mainly in the 1940s and 1950s of masonry and concrete. Facilities at Y-12 are brightly lit at night, making them especially visible. Although there is no Bureau of Land Management (BLM) classification for Y-12, the level of development at Y-12 is consistent with Visual Resource Management (VRM) Class IV which is used to describe a highly developed area. Most of the land surrounding the Y-12 site would be consistent with VRM Class II and III (i.e., left to its natural state with little to moderate changes).

Under the No Action Alternative, ongoing activities associated with NNSA and DOE would continue. As discussed in Section 1.2 of this SWEIS, the long term plan for Y-12 is to consolidate operations and reduce the number of excess facilities. This is an ongoing mission that will continue for the foreseeable future. Although there would be some reduction in the density of industrial facilities as a result of such consolidation, Y-12 would still remain a highly developed area with an industrial appearance, and no change to the VRM classification would be expected. Figure 5.2.1-1 depicts many of the facilities that have been, or will be constructed at Y-12. As shown on that figure, these modern facilities are expected to improve the overall visual appearance of Y-12.

5.2.2 Alternative 2 – Uranium Processing Facility Alternative

Construction. The new UPF and CCC described in Section 3.2.2 would be compatible and consistent with the current visual appearances at Y-12. The proposed UPF site is in the Y-12 West Portal Parking Lot, located to the west of the HEUMF. This site is outside of, but adjacent to, the existing PIDAS. Figure 5.2.1-1 shows the location of the proposed UPF relative to other buildings at Y-12. The West Portal Parking Lot is close to the existing HEU processing complex and represents a large level site with minimal site preparation requirements. The proposed CCC site is in the eastern portion of Y-12 in a disturbed area near existing facilities.

Cranes used during construction of the UPF and CCC would create short-term visual impacts, but would not be out of character for an industrial site such as Y-12. The construction laydown areas, temporary parking, and temporary construction office trailers would also be typical for an industrial site. For the UPF, Y-12 would use the same construction support areas as were used for HEUMF construction, if possible. After construction of the facilities are complete, cranes and temporary construction office trailers would be removed, and construction laydown areas would be re-graded and seeded after removal of any soil that may have become contaminated with construction-related materials such as diesel fuel. Alternatively, the laydown areas could be used to provide for additional parking.

Operation. Upon completion of the UPF construction (approximately 2016), the PIDAS would be extended to surround the new facility. When the new PIDAS is completed, the existing EU operations would be relocated to the new facility, the current EU facilities could be declared surplus, and evaluated for D&D. Although the ultimate disposition of these facilities would be determined by a separate NEPA review in the future, when such actions are ripe for decision-making, this SWEIS acknowledges that approximately 633,000 square feet of facilities could

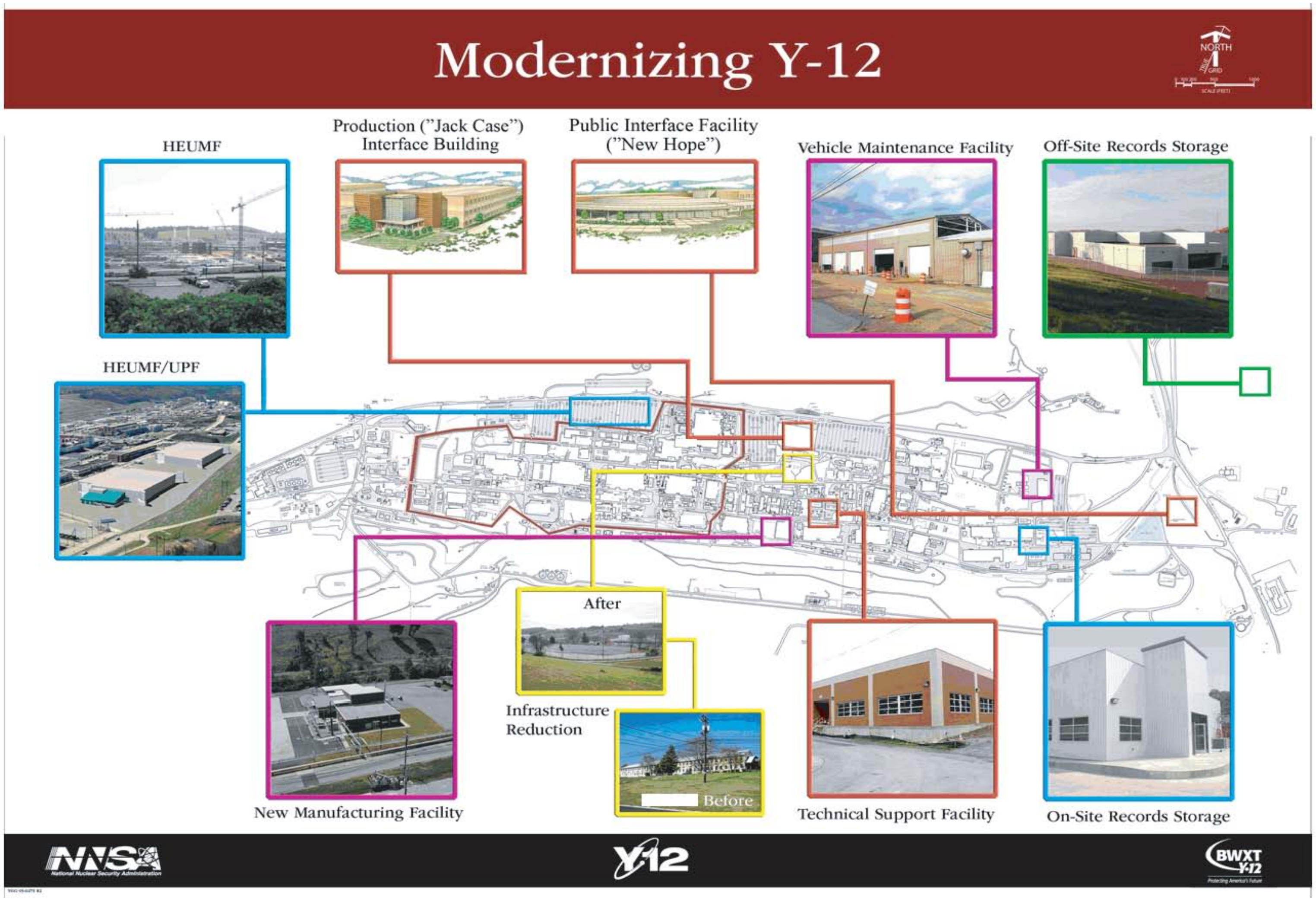


Figure 5.2.1-1. New Facilities at Y-12.

become excess if the UPF is constructed. Ultimately, this could improve the visual character of the site by reducing the density of industrial facilities. The CCC would be a one-story structure upon completion of construction (approximately 2012) and would not impact the visual character of Y-12. Y-12 would remain a highly developed area with an industrial appearance, and no change to the VRM classification would be expected.

5.2.3 Alternative 3 – Upgrade in-Place Alternative

Construction. The Upgrade in-Place Alternative, described in Section 3.2.3, would consist mainly of internal upgrades to existing facilities and would not change the current visual impact of Y-12. Impacts of constructing the CCC would be the same as those described above under Alternative 2. Y-12 would still remain a highly developed area with an industrial appearance, and no change to the VRM classification would be expected.

Operations. Operation of the upgraded facilities and the CCC would have no impact on the current visual impact of Y-12. Upgrading existing facilities would not significantly reduce the density of industrial facilities in the protected area of Y-12.

5.2.4 Alternative 4 – Capability-sized UPF Alternative

Construction. The Capability-sized UPF Alternative would include construction of a 350,000 square foot UPF and the CCC. The Capability-sized UPF would be compatible and consistent with the current visual appearances at Y-12. It would be located at the same site as the UPF in Alternative 2, in the Y-12 West Portal Parking Lot, to the west of the HEUMF. The CCC would disturb 7 acres, as described above.

Cranes used during construction of the Capability-sized UPF and CCC would create short-term visual impacts, but would not be out of character for an industrial site such as Y-12. The construction laydown areas, temporary parking, and temporary construction office trailers would also be typical for an industrial site. After construction of the facilities is complete, cranes and temporary construction office trailers would be removed, and construction laydown areas would be re-graded and seeded after removal of any soil that may have become contaminated with construction-related materials such as diesel fuel. Alternatively, the laydown areas could be used to provide for additional parking.

Operation. Upon completion of construction of the Capability-sized UPF (in approximately 2016), the PIDAS would be extended to surround the new facility. When the new PIDAS is completed, the existing EU operations would be relocated to the new facility. NNSA would need to maintain many of the current production facilities in a “ready-to-use” state in the event that changes were directed by the President. Therefore, there would be little change from the current visual appearance of Y-12. The CCC would be a one-story structure upon completion of construction (approximately 2012) and would not impact the visual character of Y-12. Y-12 would remain a highly developed area with an industrial appearance, and no change to the VRM classification would be expected. Consequently, the Capability-Sized UPF Alternative would not entail any significant change to visual resources.

5.2.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Construction. The No Net Production/Capability-sized UPF Alternative would include construction of a 350,000 square foot UPF and the CCC. The No Net Production/Capability-sized UPF would be compatible and consistent with the current visual appearances at Y-12. It would be located at the same site as the UPF in Alternative 2, in the Y-12 West Portal Parking Lot, to the west of the HEUMF. The CCC would disturb 7 acres, as described above.

Cranes used during construction of the No Net Production/Capability-sized UPF and CCC would create short-term visual impacts, but would not be out of character for an industrial site such as Y-12. The construction laydown areas, temporary parking, and temporary construction office trailers would also be typical for an industrial site. After construction of the facilities is complete, cranes and temporary construction office trailers would be removed, and construction laydown areas would be re-graded and seeded after removal of any soil that may have become contaminated with construction-related materials such as diesel fuel. Alternatively, the laydown areas could be used to provide for additional parking.

Operation. Upon completion of construction of the No Net Production/Capability-sized UPF (in approximately 2016), the PIDAS would be extended to surround the new facility. When the new PIDAS is completed, the existing EU operations would be relocated to the new facility. NNSA would need to maintain many of the current production facilities in a "ready-to-use" state in the event that changes were directed by the President. Therefore, there would be little change from the current visual appearance of Y-12. The CCC would be a one-story structure upon completion of construction (approximately 2012) and would not impact the visual character of Y-12. Y-12 would remain a highly developed area with an industrial appearance, and no change to the VRM classification would be expected. Consequently, the No Net Production/Capability-sized UPF Alternative would not entail any significant change to visual resources.

5.2.6 Potential Mitigation Measures

Under all alternatives, Y-12 would remain a highly developed area with an industrial appearance, and no change to the VRM classification would be expected. No mitigation measures would be required.

5.2.7 Summary Comparison of Alternative Impacts for Visual Resources

No Action Alternative. Y-12 would remain a highly developed area with an industrial appearance and with no change to VRM classification.

UPF Alternative. Cranes and other construction activities would create short-term visual impacts during construction of the UPF and CCC. Construction of the UPF would reduce the Protected Area from 150 acres to 15 acres, resulting in a minor industrial density reduction. There would be no change to the VRM classification.

Upgrade in-Place Alternative. Cranes and other construction activities would create short term visual impacts during construction of the CCC.

Capability-sized UPF Alternative. Same as the UPF Alternative.

No Net Production/Capability-sized UPF Alternative. Same as the UPF Alternative.

5.3 SITE INFRASTRUCTURE

The site infrastructure impacts were assessed by comparing all the alternatives. The assessment focuses on the basic resource requirements of electrical power, fuel requirements, and water usage. These three resource requirements were judged to be the most effective measures of potential infrastructure impacts resulting from implementation of any of the alternatives. Projections of electricity availability, site development plans, and other Y-12 mid- and long-range planning documents were used to project site infrastructure conditions for the evaluated alternatives.

5.3.1 Alternative 1 – No Action Alternative

As discussed in Section 4.3, Y-12 maintains an extensive network of existing infrastructure. Site infrastructure at Y-12 includes; an extensive road and railroad system, electric power, natural gas, steam, water, sanitary sewer, industrial gases, and telecommunications.

As discussed in Section 3.2.1 under the No Action Alternative, ongoing NNSA and DOE activities would continue. The long-range plan for Y-12 is to consolidate operations and reduce the number of excess facilities, an ongoing mission that will continue for the foreseeable future. Table 5.3.1-1 presents the annual usage for electricity, steam, and water at Y-12 from 2006–2008. Activities under the No Action Alternative would cause minimal changes to the energy use and other infrastructure requirements at the site. As Y-12 continues to downsize and become more efficient, trends indicate that energy usage and most other infrastructure requirements would be expected to continue reducing by approximately 2 to 5 percent per year. Although Table 5.3.1-1 illustrates rates of reduction different than this, a reduction rate of 2 to 5 percent per year is considered a reasonable long term estimate.

Table 5.3.1-1. Annual Site Utility Usage for Years 2006-2008

	Annual Power Usage (MWh)	Annual Gross Steam Produced (1000 lb)	Potable Water Annual Consumption (1000 gal)
2006	272,245	1,176,000	1,666,647
2007	260,730	1,131,000	806,190
2008	252,682	1,045,000	1,140,618

Source: B&W 2009.
Note: Available site electrical capacity is approximately 3,766,800 MWh/yr.

5.3.2 Alternative 2 – Uranium Processing Facility Alternative

Construction. The new UPF and CCC described in Section 3.2.2 would require additional infrastructure demands during the construction phase above those for the No Action Alternative. During construction, the UPF would require a peak of approximately 2.2 megawatts (MW) per month of electric power, which is less than 5 percent of the current electrical usage at Y-12 and less than one percent of available capacity. Water requirements during construction (4 million gallons) would be less than 1 percent of current site usage. Construction of the CCC would not impact current site water usage. Both Federal and DOE initiatives would require new construction to quantify and achieve energy savings.

Operation. During operations, the UPF would require approximately 14,000 megawatt hours (MWh) per month of electric power, which is less than 5 percent of available capacity. Additionally, the UPF would require an estimated 105 million gallons of water per year for operations. The UPF would not increase electricity or water demands at the site because EU operations would be phased out in existing facilities once the UPF becomes operational. Once operational, the UPF and CCC would not increase water use at Y-12, as compared to the No Action Alternative, as these facilities would replace existing facilities that perform similar functions. Operations under the UPF Alternative would reduce steam usage by at least 10 percent as inefficient facilities are closed.

5.3.3 Alternative 3 – Upgrade in-Place Alternative

Construction. The Upgrade in-Place Alternative, described in Section 3.2.3, would involve internal upgrades to existing facilities, as well as construction of the CCC. Construction activities would have negligible energy and infrastructure requirements. Both Federal and DOE initiatives would require new construction to quantify and achieve energy savings.

Operation. Operations associated with the upgraded facilities and the CCC would not increase infrastructure demands beyond those of the No Action Alternative.

5.3.4 Alternative 4 – Capability-sized UPF Alternative

Construction. The Capability-sized UPF Alternative, described in Section 3.2.4, would involve construction of a 350,000 square foot UPF and the CCC. Infrastructure impacts resulting from construction of the Capability-sized UPF would be about 90 percent of those for the UPF in Alternative 2. The peak electrical energy requirement is estimated to be 1.9 megawatt electrical (MWe) per month and water usage 3.6 million gallons; both of these would be in addition to requirements under the No Action Alternative. Both Federal and DOE initiatives would require new construction to quantify and achieve energy savings.

Operation. Under the Capability-sized UPF Alternative, infrastructure requirements would be less than the No Action Alternative. Electricity and water usage would be about 60 percent of present usage due to the reduced operations (relative to current) and smaller physical size of the facility. Operation of the CCC would likely result in a reduction in infrastructure demands due to the consolidation of functions from a number of older facilities and compliance with modern-day energy efficiency and other conservation standards. The Capability-sized UPF and CCC would not entail any significant change to utilities or other site infrastructure.

5.3.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Construction. The No Net Production/Capability-sized UPF, described in Section 3.2.5, would involve construction of a 350,000 square foot UPF and a CCC. Infrastructure impacts resulting from construction of the No Net Production/Capability-sized UPF would be about 90 percent of those for the UPF in Alternative 2. The peak electrical energy requirement is estimated to be 1.9 MWe per month and water usage 3.6 million gallons; both of these would be in addition to requirements under the No Action Alternative. Both Federal and DOE initiatives would require new construction to quantify and achieve energy savings.

Operation. Under the No Net Production/Capability-sized UPF Alternative, infrastructure requirements would be less than the No Action Alternative. Electricity and water usage would be about 55 percent of present usage due to the reduced operations (relative to current) and smaller physical size of the facility. Operation of the CCC would likely result in a reduction in infrastructure demands due to the consolidation of functions from a number of older facilities and compliance with modern-day energy efficiency and other conservation standards.

5.3.6 Potential Mitigation Measures

No mitigation measures for impacts to infrastructure are anticipated for the No Action, UPF, Upgrade in-Place, Capability-sized UPF, or No Net Production/Capability-sized UPF Alternatives.

5.3.7 Summary Comparison of Alternative Impacts for Site Infrastructure

No Action Alternative. As Y-12 continues to downsize, trends indicate that energy usage and most other infrastructure requirements will continue to decrease by approximately 2 to 5 percent per year.

UPF Alternative. There would be no expected increase in demand on site infrastructure. The UPF Alternative would use less than 5 percent of available electrical capacity and less than 1 percent of current site water usage.

Upgrade in-Place Alternative. Same as the No Action Alternative.

Capability-sized UPF Alternative. The Capability-Sized Alternative would reduce infrastructure demands by a maximum of 40 percent beyond the No Action Alternative.

No Net Production/Capability-sized UPF Alternative. Demands for electrical energy, water, and other utility services would be reduced by about 45 percent from the No Action Alternative under the No Net Production/Capability-sized UPF Alternative.

5.4 TRANSPORTATION AND TRAFFIC

The traffic and transportation impacts were assessed by comparing all the alternatives. The analysis focuses on changes to traffic that may result from the alternatives. Additionally, this section analyzes the impacts associated with the transportation of radioactive material.

5.4.1 Nonradiological Transportation

5.4.1.1 *Alternative 1 – No Action Alternative*

As discussed in Section 3.2.1 under the No Action Alternative, ongoing NNSA and DOE activities would continue at Y-12. The long-range plan for Y-12 is to consolidate operations and reduce the number of excess facilities required to continue the Y-12 mission for the foreseeable future. Primary roads on the Oak Ridge Reservation (ORR) serving Y-12 include Tennessee State Routes (TSRs) 95, 58, 62, and 170 (Bethel Valley Road). Bear Creek Road has restricted access around Y-12 and no longer is a public thoroughfare. The traffic statistics associated with the No Action Alternative missions are presented in Section 4.4, Table 4.4.4-1. Average daily traffic on ORR and roads serving Y-12 range from approximately 9,000 vehicles per day on Bethel Valley Road to approximately 31,000 vehicles per day on TSR 62. Major offsite area roads for long-distance transport of materials and waste include I-40, I-75, and I-81.

Construction. Construction activities under the No Action Alternative would not cause any significant change to the current workforce of approximately 6,500 and therefore to expected traffic volume. The Level-of-Service (LOS) on area roads would not change under the No Action Alternative.

Operation. Under the No Action Alternative, the Y-12 workforce is expected to remain relatively stable at approximately 6,500 workers. Consequently, the LOS on area roads would not change due to operations under the No Action Alternative.

5.4.1.2 *Alternative 2 – Uranium Processing Facility Alternative*

Construction. Construction of the UPF and CCC would add a maximum of 950 worker vehicles per day to support construction during the peak year of construction. This increase would be similar to the increase that resulted from the HEUMF construction, which did not change the LOS on area roads.

Operation. Operations of the UPF and CCC would improve efficiency at Y-12 by consolidating operations and reducing the secure area. Approximately 750 existing workers would not be required under normal UPF operations. This would represent a workforce reduction of approximately 11 percent from the No Action Alternative, decreasing the vehicle traffic, but not changing the LOS. The UPF and CCC would reduce transportation impacts at Y-12 once operational, as these would replace existing facilities and the reduction in workers would lessen daily traffic volume.

5.4.1.3 *Alternative 3 – Upgrade in-Place Alternative*

Construction. The Upgrade in-Place Alternative, described in Section 3.2.3, would require about 300 construction workers at the peak. Based on recent experience with construction of the HEUMF, which required a much larger workforce, this additional construction worker traffic would not adversely affect traffic at or in the vicinity of Y-12. Construction of the CCC would require only 50 workers and would not affect LOS on area roads, even if it were to occur at the same time as the upgrade of existing EU facilities.

Operation. Operations associated with the upgraded facilities would result in no additional work traffic since the existing workforce would be used. Operation of the CCC would also have no impact on site traffic because it would house functions currently being performed at Y-12 with no increase in the number of workers.

5.4.1.4 *Alternative 4 – Capability-sized UPF Alternative*

Construction. Construction of the Capability-sized UPF would add a maximum of 850 worker vehicles per day to support construction during the peak year of construction. This increase would be less than the increase that resulted from the HEUMF construction, which did not change the LOS on area roads. Construction of the CCC would require only 50 workers and would not affect LOS on area roads, even if it were to occur at the same time as construction of the Capability-sized UPF.

Operation. Operations under the Capability-sized UPF Alternative would require a smaller workforce (about 3,680 monitored workers), once EU operations were transferred to the new facility in approximately 2018. Additionally, most non-EU operations at Y-12 would be unaffected. This reduction would have a minimal positive impact on traffic and transportation, but would not change the LOS on area roads. Operation of the CCC would not affect LOS on area roads because it would consolidate functions currently being performed at Y-12 and would not result in an increase in the workforce or traffic volume.

5.4.1.5 *Alternative 5 – No Net Production/Capability-sized UPF Alternative*

Construction. Because the No Net Production/Capability-sized UPF Alternative would be the same physical size as the Capability-sized UPF Alternative and the CCC would also be part of this alternative, the impacts resulting from construction would be same as noted in section 5.4.1.4.

Operation. Operations under the No Net Production/Capability-sized UPF Alternative would require a smaller workforce (about 3,300 monitored workers) once EU operations are transferred to the new facility in approximately 2018. Additionally, most non-EU operations at Y-12 would be unaffected. This reduction would have a minimal positive impact on traffic and transportation, but would not change the LOS on area roads. Operation of the CCC would not affect LOS on area roads because it would consolidate functions currently being performed at Y-12 and would not result in an increase in the workforce or traffic volume.

5.4.1.6 *Potential Mitigation Measures*

The LOS on area roads is not anticipated to be impacted by any of the alternatives. Therefore no mitigation measures would be required.

5.4.2 Radiological Transportation

For this SWEIS, NNSA evaluated the transportation impacts associated with two material types (radioactive wastes and radioactive materials) transported to and from ORR and multiple offsite locations. Section A.5 provides details on the number of shipments analyzed, transportation routes, and methodology employed. As shown in Table 5.4.2-1 and Table 5.4.2-2, offsite radiological transportation would include transport of special nuclear materials to and from Pantex, and transport of radiological waste to the Nevada Test Site (NTS).

Special Nuclear Materials Transportation. The impacts of offsite radiological transportation would be the same under the No Action Alternative, UPF Alternative, and the Upgrade in-Place Alternative because there would be no significant change in the types of operations that are conducted at Y-12 or the amounts of radiological materials transported between ORR and other sites. As displayed in Table 5.4.2-1, impacts associated with radiological transportation would be insignificant (i.e., much less than one latent cancer fatality [LCF] annually).

Table 5.4.2-1. Annual Transportation Impacts for No Action Alternative, UPF Alternative, and Upgrade in-Place Alternative.

Movement Description	Transportation Segment	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
Canned Sub-assemblies	Handling	Note 1	0.0224	0.0224
	Intersite Transportation	1.51×10^{-19}	0.00145	0.00145
	Stops		2.73×10^{-9}	2.73×10^{-9}
	MEI		1.51×10^{-9}	1.51×10^{-9}

Source: NNSA 2008.
Note 1: accident impacts associated with handling are included in the accident analyses for the Y-12 No Action Alternative.
Assumptions: All materials in metal form
ES-3100 or similar container used
Release and aerosol fractions based on West Valley Demonstration Project (WVDP) Waste Management EIS (DOE 2003c) values, which were determined to bound release fractions for pits and secondaries and cases.

For the Capability-Sized UPF and No Net Production/Capability-sized UPF Alternatives, radiological transportation impacts would be reduced relative to the other alternatives. Because of lower production rates, NNSA would ship fewer radioactive materials to and from Pantex, and Y-12 would generate less radioactive wastes. The impacts of transportation of radiological materials for the Capability-sized UPF Alternative would be approximately one-fourth as much as the impacts presented in Table 5.4.2-1, and for the No Net Production/Capability-sized UPF Alternative approximately one-twentieth as much.

With respect to accident impacts associated with transportation, RADTRAN (SNL 1992) calculates risks and consequences of potential accidents based on a number of input parameters including:

- Probability and severity fraction of accident types;
- Deposition velocity of the material;
- Release fraction from the container;
- Aerosol and respirable factors for the material; and
- Weather conditions.

DOE "Recommendations for Analyzing Accidents Under the National Environmental Policy Act," July 2002, states that "it would be appropriate to estimate and present accident consequences for both median conditions and unfavorable conditions." Because of the lack of specific design information, this SWEIS uses a conservative approach and presents impacts for the unfavorable conditions. Additional analysis of median conditions would not have produced meaningful information to help make decisions based on this SWEIS.

The inputs for the materials, containers, and vehicles were adopted from industry standards. The probability and severity fractions were taken from the West Valley Demonstration Project Waste Management EIS (DOE 2003c). The weather conditions were based on Pasquill weather stability classes. Analyses were conducted in Stability Class D (most frequently occurring weather conditions) and Class F (stable weather conditions). All results presented in this chapter are for Stability Class F, which yields the more conservative (i.e., greater estimated impact) case.

The maximally exposed individual (MEI) results represent health impacts to a theoretical person that would receive the maximum exposure due to the proposed transportation. Often the MEI represents personnel associated with the material transport, such as a vehicle escort.

Handling impacts reflect the sum total exposure impacts to crews involved in the storage, packaging, and loading/unloading of the material to be transported. The number of personnel, time spent handling the material, and distance to the material are dependent on the individual transportation campaigns. The impact results at stops are presented for two theoretical receptor groups: the worker at the truck stop and residents that live within a half-mile radius of the truck stop. An average suburban population density is assumed for the area residents results.

Table 5.4.2-2 presents the estimated nonradiological impacts of transportation of radiological materials for the No Action Alternative, UPF Alternative, and Upgrade in-Place Alternative. The nonradiological impacts of transportation for the Capability-sized UPF Alternative would be approximately one-fourth as much as the impacts presented in Table 5.4.2-2 and approximately one-twentieth as much for the No Net Production/Capability-sized UPF Alternative.

Table 5.4.2-2. Annual Nonradiological Transportation Impacts – No Action Alternative, UPF Alternative, and Upgrade in-Place Alternative.

Origin/ Destination Pair	Material Shipped	Total Mileage	Number of Accidents	Number of Accident Fatalities	Number of Nonradiological Emissions Fatalities
Pantex/Y-12	CSAs	17,700	6.06×10^{-3}	2.93×10^{-4}	3.41×10^{-5}

Source: NNSA 2008.

Low-level Radioactive Waste Transportation. The radiological health impacts due to transportation of low-level radioactive waste (LLW) from Y-12 to NTS were estimated for three different hypothetical annual waste generation levels; 7,800 cubic yards, 12,300 cubic yards, and 24,000 cubic yards, which bound the annual LLW generation rates for any of the alternatives. It is assumed that Class A 55-gallon drums would be used to transport this waste. Considering this, the number of containers and shipments of LLW provided in Table 5.4.2-3 would be required to meet the generation levels.

Table 5.4.2-3. Estimated Number of LLW Drums and Shipments.

Assumed Level of Annual Waste Generation (yd^3)	Number of Drums	Number of Shipments
7,800	30,620	383
12,300	48,300	604
24,000	94,200	1178

Source: NNSA 2008.

For this analysis, waste inventories were assumed to be similar to those provided in the West Valley Demonstration Project Waste Management (WVDP WM) EIS (DOE 2003c). Accident conditional probabilities and release fractions were also used based on WVDP WM EIS values for Class A LLW and drum containers. The estimated human health impacts for accidents and incident-free transportation of LLW in LCFs are provided in Table 5.4.2-4. Nonradiological impacts are presented in Table 5.4.2-5.

Table 5.4.2-4. Estimated Health Impacts Due to LLW Transportation (in LCF).

	Level of Annual Waste Generation (yd^3)		
	7,800	**12,300**	**24,000**
Handling	0.662	0.826	1.61
Incident-Free	0.05680599	0.09456	0.184
In-Transit Exposure			
Truck Stop Personnel	4.57 82 $\times 10^{-9}$	7.21 60 $\times 10^{-9}$	1.40 48 $\times 10^{-8}$
Resident Near Stop	6.14 48 $\times 10^{-8}$	1.029.68 $\times 10^{-7}$	1.89 99 $\times 10^{-7}$
Accident Exposure	4.122.69 $\times 10^{-8}$	6.504.24 $\times 10^{-8}$	1.278.27 $\times 10^{-8}$

Source: NNSA 2008.

Table 5.4.2-5. Estimated Nonradiological Health Impacts Due to LLW Transportation.

Assumed Level of Annual Waste Generation (yd^3)	Total Mileage	Number of Accidents	Number of Accident Fatalities	Number of Nonradiological Emissions Fatalities
7,800	837,000	0.258	0.01340152	0.00129
12,300	1,320,000	0.408	0.02110240	0.00204
24,000	2,572,000	0.0794	0.04110467	0.00397

Source: NNSA 2008.

5.4.2.1 *Commercial / Military Air Transportation*

The Y-12 Site would periodically ship domestic and foreign materials utilizing commercial airlines and military flights. Shipments would primarily move through the McGhee-Tyson airport located in Knoxville, Tennessee. Additional shipments may be routed through other domestic and foreign airports such as Atlanta, Canada, France, Korea, Argentina and other airports, as logistics warrant. Mission sensitivity may not allow for full disclosure but all shipments would be executed in strict compliance with DOE/NNSA requirements and Department of Transportation, Nuclear Regulatory Commission, and Federal Aviation Administration (FAA) regulations. Section 5.15 provides a more detailed discussion of the potential impacts of shipments in support of global threat reduction initiatives.

5.4.2.2 *Sea Transportation*

Periodic shipments may be transported by sea. U.S. ports may include Charleston on the east coast and San Francisco/Oakland on the west coast. International entry/exit points may be located in Europe, Japan, and Australia. Ports would be used on an as needed basis as required by the mission. All shipments would be made in strict accordance with all shipping regulations and maritime laws. Section 5.15 provides a more detailed discussion of the potential impacts of shipments in support of global threat reduction initiatives.

5.4.2.3 *Potential Mitigation Measures*

Per Table 5.4.2-1, the impacts of offsite radiological transportation would be small (less than one fatality) for all alternatives. Therefore, no additional mitigation measures would be required.

5.4.3 Summary Comparison of Alternative Impacts for Transportation and Traffic

No Action Alternative. Because there would be no significant change to the current workforce of approximately 6,500 or to the normal hours of employment, the LOS on area roads would not be expected to change.

UPF Alternative. Construction-related traffic would add an additional maximum of 950 worker vehicles per day to existing traffic. Increased traffic would be similar to that of the HEUMF construction, which has not significantly changed the LOS on area roads.

Upgrade in-Place Alternative. Construction-related traffic would add an additional maximum of 300 worker vehicles per day to the existing traffic. Increased traffic would be less than that of the HEUMF construction, which did not significantly change the LOS on area roads.

Capability sized UPF Alternative. Construction-related traffic would add an additional maximum of 850 worker vehicles per day. Increased traffic would be similar to that of the HEUMF construction, which did not significantly change the LOS on area roads. During operations, reduction of the Y-12 workforce by approximately 2,600 would reduce traffic volume in the area around Y-12 but would not be expected to significantly change the LOS on area roads.

No Net Production/Capability-sized UPF Alternative. Construction-related traffic would add an additional maximum of 850 worker vehicles per day. Increased traffic would be similar to that of the HEUMF construction, which did not significantly change the LOS on area roads. During operations, reduction of the Y-12 workforce by approximately 3,100 would reduce traffic volume in the area around Y-12 but would not be expected to significantly change the LOS on area roads.

5.5 GEOLOGY AND SOILS

The geology and soils analysis considers a ROI that includes the Y-12 area of analysis as well as the rest of ORR. Impacts to these resource areas were determined by assessing potential changes in existing geology and soils that could result from construction activities and operations under each of the alternatives. The impacts of the all alternatives are evaluated for geological impacts.

5.5.1 Alternative 1 – No Action Alternative

Y-12 is located within Bear Creek Valley, which is underlain by Middle to Late Cambrian strata of the Conasauga Group in the site area. The Conasauga Group consists primarily of highly fractured and jointed shale, siltstone, calcareous siltstone, and limestone in the Site area. The bedrock at Y-12 is overlain by alluvium, colluvium, man-made fill, fine-grained residuum from the weathering of the bedrock, saprolite, and weathered bedrock. The overall thickness of these materials in the Y-12 area is typically less than 40 feet.

Bear Creek Valley lies on well to moderately-well-drained soils underlain by shale, siltstone, and silty limestone. Y-12 lies on soils of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskinghum associations (DOE 2001a). Soil erosion due to past land use has ranged from slight to severe. Wind erosion is slight and shrink-swell potential is low to moderate.

The Oak Ridge area lies at the boundary between seismic Zones 1 and 2 of the Uniform Building Code, indicating that minor to moderate damage could typically be expected from an earthquake. Y-12 is cut by many inactive faults formed during the late Paleozoic Era (DOE 1996e). There is no evidence of capable faults in the immediate area of Oak Ridge, (surface movement within the past 35,000 years or movement of a recurring nature within the past 500,000 years) as defined by the Nuclear Regulatory Commission's (NRC's) "Reactor Site Criteria" (10 *Code of Federal Regulations* [CFR] Part 100). The nearest capable faults are approximately 300 miles west of ORR in the New Madrid Fault zone. No changes in seismic related impacts are expected.

Under the No Action Alternative, infrastructure reduction activities would continue to consolidate the industrialized footprint at Y-12, resulting in less runoff and less potential for soil erosion. Geological features (e.g., bedrock outcrops) at Y-12 would be unaffected by ongoing consolidation activities.

5.5.2 Alternative 2 – Uranium Processing Facility Alternative

Construction. Although it would affect about 42 acres of land, construction of a UPF and CCC would have no impact on undisturbed geological resources (e.g., bedrock outcrops), and the hazards posed by geological conditions are expected to be minor. Slopes and underlying foundation materials are generally stable at Y-12. Landslides or other non-tectonic events are unlikely to affect the construction sites. Sinkholes are present in the Knox Dolomite, but it is unlikely that they would impact the project, as the Knox Dolomite is not present in the Y-12 area.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. This should not impact the construction and operation of the UPF, or other new facilities. Past earthquake events in this area have not resulted in liquefaction of foundation soils. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1B, *Facility Safety*, and accompanying safety guidelines.

During construction activities, excavation of soil, limestone, and shale bedrock would occur. There is sufficient capacity to either stockpile these materials or dispose of them during the construction at the sites. Soil disturbance from new construction would occur at building, parking, and construction laydown areas, and lead to a possible temporary increase in erosion as a result of storm water runoff and wind action. Soil loss would depend on the frequency of storms; wind velocities; size and location of the facilities with respect to drainage and wind patterns; slopes, shape, and area of ground disturbance; and the duration of time the soil is bare. A small volume of soil, limestone, and shale bedrock may be excavated during the construction process. However, this material could be stockpiled for use as fill.

The potential for additional soil contamination from project activities at the UPF and CCC sites would be minimized by complying with waste management procedures DOE Order 435.1, Radioactive Waste Management, and DOE Order 450.1A, Environmental Protection Programs.

Operation. During operation, minor soil erosion impacts are expected, but detention basins, runoff control ditches, and cell design components would minimize impacts. The UPF, CCC, and other new facilities would have no added impact on geology or soils during operation because of site design and engineered control measures.

5.5.3 Alternative 3 – Upgrade in-Place Alternative

Construction. The Upgrade in-Place Alternative, described in Section 3.2.3, would involve internal upgrades to existing facilities, as well as construction of the CCC, which would affect about seven acres of previously disturbed soil and other geological media. Overall, the Upgrade in-Place Alternative would not change the current geological or soil impacts at Y-12.

Operation. Operation of upgraded facilities and CCC would have no impact on undisturbed geological or soil resources at Y-12.

5.5.4 Alternative 4 – Capability-sized UPF Alternative

Construction. The Capability-sized UPF Alternative, described in Section 3.2.4, would include construction of an approximately 350,000 square foot UPF and the CCC, affecting about 39 acres of previously disturbed land. Construction of this smaller UPF would have smaller albeit similar impacts to geologic and soil resources than those for the UPF in Alternative 2. The potential for additional soil contamination from project activities at the Capability-sized UPF site would be minimized by complying with DOE Order 435.1 and DOE Order 450.1 waste management procedures.

Operation. Under the Capability-sized UPF Alternative, Y-12 operations would be similar to operations under the No Action Alternative, with the addition of a 350,000 square foot UPF and the CCC. Operation of the Capability-sized UPF would be similar to, but significantly lower in intensity than operations of the UPF in Alternative 2. During operation of the Capability-sized UPF and CCC, minor soil erosion impacts are expected, but detention basins, runoff control ditches, and cell design components would minimize impacts. The Capability-sized UPF and CCC would have no added impact on undisturbed geology or soils during operation because of site design and engineered control measures.

5.5.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Construction. The No Net Production/Capability-sized UPF Alternative, described in Section 3.2.4, would include construction of an approximately 350,000 square foot UPF and the CCC. Construction of this smaller UPF would have smaller albeit similar impacts to geological and soil resources than those for the UPF in Alternative 2. The potential for additional soil contamination from project activities at the No Net Production/Capability-sized UPF and CCC sites would be minimized by complying with DOE Order 435.1 and DOE Order 450.1 waste management procedures.

Operation. Under the No Net Production/Capability-sized UPF Alternative, Y-12 operations would be similar to operations under the No Action Alternative, with the addition of a 350,000 square foot UPF and the CCC. Operation of the Capability-sized UPF would be similar to, but significantly lower in intensity than operations of the UPF in Alternative 2. During operation of the No Net Production/Capability-sized UPF and CCC, minor soil erosion impacts are expected, but detention basins, runoff control ditches, and cell design components would minimize impacts. The No Net Production/Capability-sized UPF and CCC would have no added impact on undisturbed geology or soils during operation because of site design and engineered control measures.

5.5.6 Potential Mitigation Measures

Given control measures such as use of barriers, watering to minimize fugitive dust emissions, water retention systems, and other techniques to minimize soil and geologic disturbance which would be taken by NNSA during design, construction, and operational phases, any potential impacts to geology and soils would be minimized under all alternatives. New facilities would be designed to withstand reasonably anticipated geological hazards, such as earthquakes, slope failure, etc. No additional mitigation measures would be required.

5.5.7 Summary Comparison of Alternative Impacts for Geology and Soils

No Action Alternative. No significant disturbance to geology or soils other than those resulting from ongoing environmental remediation activities.

UPF Alternative. The UPF and CCC Alternative would disturb approximately 42 acres of previously disturbed land. Appropriate mitigation measures would be employed to minimize soil erosion and other impacts to geology and soils.

Upgrade in-Place Alternative. Construction of the CCC would affect about 7 acres of previously disturbed land but otherwise impacts to geological media would be similar to the No Action Alternative

Capability-sized UPF Alternative. The Capability-sized UPF and CCC would disturb approximately 39 acres of previously disturbed land. Appropriate mitigation measures would be employed to minimize soil erosion and other impacts associated with geology and soils.

No Net Production/Capability-sized UPF Alternative. The No Net Production/Capability-sized UPF and CCC would disturb approximately 39 acres of previously disturbed land. Appropriate mitigation measures would be employed to minimize soil erosion and other impacts associated with geology and soils.

5.6 AIR QUALITY AND NOISE

The air quality and noise analysis considers a ROI that addresses the Y-12 area of responsibility, covering approximately 5,400 acres, as well as the rest of ORR (approximately 35,000 acres) and the adjoining properties of the city of Oak Ridge. The impacts of all the alternatives are evaluated for air quality and noise impacts. Nonradiological air quality impacts are presented in Section 5.6.1, radiological air quality impacts are presented in Section 5.6.2, and noise impacts are presented in Section 5.6.3.

5.6.1 Nonradiological Air Quality

The assessment of nonradiological air emissions at Y-12 is used to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) and the rules of the Tennessee Department of Environment and Conservation (TDEC) for criteria pollutants and guidelines for chemical concentrations. Nonradiological air quality impacts were determined by assessing site emissions of criteria and chemical pollutants from the applicable Y-12 facility operations. Nonradiological airborne discharges from Y-12 facilities consist of those criteria and chemical pollutant emissions from the Y-12 Steam Plant and chemical emissions that are specific to the alternative under consideration.

Criteria Pollutants. Y-12 is classified as a Major Source having the potential to emit 100 tons per year or more of regulated air pollutants in accordance with *Rules of the TDEC* Chapter 1200-3-9-.02(11)(b)(14)(ii). Allowable emissions at the Y-12 Steam Plant are greater than 100 tons per year of regulated air pollutants for particulates, sulfur oxides, and nitrogen oxides.

Maximum concentrations of the six criteria pollutants included in the primary and secondary NAAQS (40 CFR Part 50) were assessed, including carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particles with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}), sulfur dioxide (SO_2), and ozone. Gaseous fluorides such as hydrogen fluoride (HF), included in the *Rules of TDEC,* were also assessed. Ambient air monitoring data were used to supplement modeled pollutant concentrations for those pollutants for which no emission data were available.

Chemical Emissions. In accordance with *Rules of the TDEC* Chapter 1200-3-9.02(11)(b)(14)(i), Y-12 is classified as a major source under Section 112 of the *Clean Air Act* (CAA); that is, Y-12 has a potential to emit 10 tons per year or more of a hazardous air pollutant (HAP) which has been listed in Section 112(b) of the CAA, or 25 tons or more of combined HAPs. For example, Y-12 emits greater than 10 tons per year of methanol and hydrochloric acid. Additional HAPs are emitted in much smaller amounts such as HF (hydrofluoric acid), acetonitrile, and beryllium (DOE 2001a).

Chemical pollutant concentrations were compared with human health guidelines derived from occupational exposure limits and concentrations corresponding to cancer risks of 10^{-8} risk levels in lieu of established regulatory ambient air quality standards. The chemicals were categorized into two groups, non-carcinogenic chemicals and carcinogenic chemicals, to address the differences in health effects. Each group was evaluated using a screening technique comparing each chemical's estimated emission rate to a health-risk based Threshold Emission Value (TEV). Consistent with the human health impacts assessment methodology, appropriate health risk values were used in the chemical process to derive chemical-specific TEVs. Because of different health effects (non-carcinogenic and carcinogenic), two methods were applied to derive chemical-specific TEVs. Chemicals that failed the screening process were assessed in greater detail. This approach is consistent with U.S. Environmental Protection Agency (EPA) guidance and focuses detailed analyses only on those chemicals of concern that have the potential to cause adverse health effects.

5.6.1.1 *Alternative 1 – No Action Alternative*

As discussed in Section 3.2.1, under the No Action Alternative, ongoing activities associated with NNSA and DOE would continue. The long term plan for Y-12 is to consolidate operations and reduce the number of excess facilities, an ongoing mission that will continue for the foreseeable future. Airborne discharges from DOE Oak Ridge facilities, both radioactive and nonradioactive, are subject to regulation by EPA, the TDEC Division of Air Pollution Control, and DOE Orders. Each ORR facility has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne discharges meet all regulatory requirements and therefore do not adversely affect ambient air quality.

The release of nonradiological contaminants into the atmosphere at Y-12 occurs as a result of site production, maintenance, and waste management operations as well as steam generation. In October 2004, the TDEC personnel issued Y-12 its first-ever Major Source (Title V) Operating Air Permit. The permit covers 35 air emission sources and over 100 air emission points. Other emission sources at Y-12 are categorized as being insignificant and exempt from air permitting. The allowable level of air pollutant emissions from emission sources in 2005 was about 10,033 tons per year of regulated pollutants. Actual emissions are much lower than the allowable emissions (DOE 2005d). In order to evaluate the potential air quality impacts, the modeling analysis conducted for the 2001 SWEIS was reviewed for validity and application to the current

No Action Alternative operations. As discussed below, the air quality modeling performed for the 2001 SWEIS remains valid and conservative, and serves as the framework for the analysis in this section.

Criteria Pollutants. The nonradiological air quality for criteria pollutants at Y-12 under the No Action Alternative is represented by the Y-12 Steam Plant emissions as a baseline. This is due to the fact that more than 90 percent of the criteria pollutants from Y-12 can be attributed to the operation of the existing coal and natural gas fueled Y-12 Steam Plant (DOE 2001a and DOE 2008). This was true in the 2001 SWEIS and remains true today. Although the No Action Alternative provides for Y-12 to operate at planned mission and workload levels, the steam plant replacement, addressed in *Environmental Assessment for the Y-12 Steam Plant Life Extension Project-Steam Plant Replacement Subproject* (DOE/EA-1593) (YSO 2007), which is scheduled for completion in September 2010, will lower criteria pollutant emissions significantly, as discussed below.

Table 5.6.1.1-0 displays a comparison of existing Y-12 steam plant emissions, current emission limits, and estimated emissions from the new steam plant. As shown, the emissions associated with the new steam plant are expected to be significantly lower for total particulate matter, sulfur dioxide, and nitrogen oxides. In addition, both metal and non-metal hazardous air pollutant emissions associated with the combustion of coal, such as mercury, sulfur dioxide, and nitrogen oxides would be eliminated. Actual emissions under worst case fuel conditions are expected to be slightly higher, by 2 to 5 tons per year, for volatile organic compounds (VOCs). Carbon monoxide emissions are expected to be 82 tons higher with the new steam plant. Increased carbon monoxide emissions are due to the large amount of natural gas burned along with No. 2 fuel oil during natural gas curtailment, but would not violate air permits. None of the projected emission increases are considered significant for the purposes of non-attainment New Source Review or Prevention of Significant Deterioration permitting (YSO 2007).

Emissions from the Y-12 Steam Plant vary throughout the year depending on the demand for steam. To assess the maximum impact to air quality from operation of the Y-12 steam plant, the emission rates associated with operation of the facility at the calculated heat input capacity of 522 million British thermal units per hour was used as input to the ISC3 model (EPA 1995b, DOE 2001a). The calculated criteria pollutant emissions based upon this Y-12 steam plant operation are assumed to represent a reasonable upper limit for estimating criteria pollutant concentrations at or beyond the site boundary.

Table 5.6.1.1-0. Air Emissions of Existing Y-12 Steam Plant and New Steam Plant.

Pollutant	Existing Y-12 Steam Plant (Boilers)			New Steam Plant	
	CY 2006 Emissions (tons/yr)		Concentration Allowable (permit)	Worst Case Fuel Scenario Emissions (tons/yr)	
	Actual	Allowable	(lb/MM Btu)	Projected Actual	Maximum
Particulate	32	945	0.174	10	14
Sulfur Dioxide	2,286	20,803	4	13	31
Nitrogen Oxides[a]	654	5,905	–	42	60
Nitrogen Oxides (ozone season only)[b]	153.4	232	232 tpy	–	–
Volatile Organic Compounds[a]	2.3	41	–	7	9
Carbon Monoxide[a]	20	543	–	102	136

Source: YSO 2007.
Btu = British thermal unit.
a – When there is no applicable standard or enforceable permit condition for some pollutants, the allowable emissions are based on the maximum actual emissions calculation as defined in Tennessee Department of Environment and Conservation Rule 1200-3-26-.02(2)(d)3 (maximum design capacity for 8,760 hours/year). The emissions for both the actual and allowable emissions were calculated based on the latest EPA compilation of air pollutant emission factors. (EPA 1995a and 1998 *Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume 1: Stationary Point and Area Sources*. Environmental Protection Agency, Research Triangle Park, N.C. January 1995 and September 1998.)
b – Monitored emissions.
Note: The expected emissions from the new steam plant are calculated based on a maximum heat input of 99 million Btu/hr, and the projected actual emissions are based on a projected heat input of 75 million Btu/hr.

Maximum background concentrations of criteria pollutants from Tennessee air quality monitors located in Anderson, Knox, and Roane counties are presented in Table 5.6.1.1-1. These background concentrations represent concentrations from all nearby sources including the Y-12 Steam Plant. The modeled pollutant concentrations from the Y-12 steam plant emissions were added to the background concentrations for the respective pollutant to calculate the percent of standard. The maximum modeled criteria pollutant concentrations do not occur at the location of the monitor for which background concentrations are presented. Therefore, not only do the background concentrations contain contributions from the Y-12 steam plant, but the maximum modeled and background concentrations occur at different locations. The sum of the modeled and background concentrations therefore overestimates the cumulative pollutant concentrations resulting from the background and modeled Y-12 steam plant concentrations. This conservative approach bounds the potential impacts on regional air quality resulting from Y-12 activities.

As shown in Table 5.6.1.1–1, all criteria pollutant concentrations are below the national and TDEC standards, with the exception of the 8-hour ozone concentration. The 8-hour ozone concentration exceedance is not a result of ORR-specific activities. Instead, as described in Section 4.6.2.1, the EPA has designated Anderson County as a basic non-attainment area for the 8-hour ozone standard, as part of the larger Knoxville basic 8-hour ozone non-attainment area that encompasses several counties. As discussed above, the criteria pollutant concentrations listed in Table 5.6.1.1–1 represent a conservative bounding case for the No Action Alternative. DOE therefore believes that no adverse direct or indirect air quality impacts are expected for criteria pollutants from activities associated with the continuation of Y-12 missions under the No Action Alternative.

Table 5.6.1.1-1. Criteria Pollutant Concentrations – No Action Alternative Operations.

Pollutant	Averaging Time	Maximum standard (μg/m³)	Background Concentration (μg/m³)	Maximum Modeled Concentration[2] (μg/m³)	Percent of Standard
SO_2	3-hr	1,300	398[1]	523.8	71
	24-hr	365	47.1[2]	174.6	61
	Annual	80	10.5[2]	20.7	39
PM_{10}	Annual[1]	50	25.4[2]	0.2	51
	24-hr[2]	150	77[1]	1.5	52
$PM_{2.5}$	Annual[1]	15	No Data	N/A	N/A
	24-hr[2]	65	48.2[1]	N/A	74
CO	1-hr	40,000	12,712	4.30	32
	8-hr	10,000	4,466[2]	2.52	44
Ozone	1-hr	235	225[1]	N/A	96
	8-hr	157	188.4[1]	N/A	120
NO_2	Annual	100	15.1[1]	9.1	24
Lead	Calendar quarterly mean	1.5	0.009[1]	N/A	N/A
Gaseous Fluorides (as HF)	30-day	1.2	No Data	N/A	N/A
	7-day	1.6	0.114[1]	N/A	7
	24-hr	2.9	No Data	0.72	25
	12-hr	3.7	No Data	N/A	N/A

[1] Source: TDEC 2005c.
[2] Source: DOE 2001a.

Chemical Emissions. The combustion of coal produces emissions of HAPs as well as criteria pollutants. No non-carcinogenic contaminants exceeded the preliminary air quality screening of Y-12 Steam Plant emissions data (DOE 2001a). As such, no non-carcinogenic chemicals were included in the evaluation of public exposures. The carcinogenic contaminants and their associated excess cancer risks resulting from Y-12 steam plant emissions are presented in Table 5.6.1.1-2. No excess cancer risks were determined to fall within the EPA's range of concern. Thus, no non-carcinogenic or carcinogenic contaminants of concern were determined to be associated with Y-12 Steam Plant emissions.

The observed concentrations of mercury vapor at Y-12 under the No Action Alternative are well below the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value of 25 micrograms per cubic meter ($\mu g/m^3$). As shown on Table 4.6.2.2-3, average mercury vapor concentrations at Y-12 monitoring stations have declined significantly since monitoring began. Annual average mercury concentrations during 2007 at the Y-12 east and west boundary monitoring stations are comparable to reference levels measured on Chestnut Ridge in 1988 and 1989 and approach values reported for continental background (DOE 2008). These concentrations are well below current environmental and occupational health standards for inhalation exposure to mercury vapor (DOE 2005d).

Table 5.6.1.1-2. Y-12 Steam Plant Maximum Boundary Hazardous Air Pollutant Carcinogenic Chemical Concentrations.

Chemical	Maximum Boundary Concentration (μg/m^3)	Inhalation Unit Risk (mg/m^3)$^{-1a}$	Excess Cancer Risk
Arsenic	3.40×10^{-5}	0.43×10^{1}	1.46×10^{-7}
Beryllium	5.1×10^{-6}	0.24×10^{1}	1.22×10^{-8}
Nickel	8.14×10^{-5}	[b]	[c]

Source: DOE 2001a.
a – Toxicity values were obtained from the EPA's Integrated Risk Information System.
b – Toxicity values are not currently available.
c – Not calculated due to lack of toxicity values.

5.6.1.2 *Alternative 2 – Uranium Processing Facility Alternative*

Construction. Construction of the UPF and CCC would result in temporary increases in air quality impacts from construction equipment, trucks, and employee vehicles. Exhaust emissions from these sources would result in releases of sulfur dioxide, nitrogen oxide, particulate matter, total suspended particulates, and carbon monoxide. Fugitive dust generated during the clearing, grading, and other earth moving operations would also cause short-term impacts to air quality, predominantly to total suspended particulates. As shown on Table 5.6.1.1-1, the maximum modeled concentrations of these pollutants are well below maximum standards. The UPF construction would be similar in size and duration to the HEUMF construction that was recently completed at Y-12. Modeling of air quality impacts from the HEUMF construction showed that releases of sulfur dioxide, nitrogen oxide, particulate matter, total suspended particulates, and carbon monoxide impacts would not cause any significant impact to air quality at Y-12 (DOE 2001a). This conclusion would also apply to construction of the UPF.

Effective control measures commonly used to reduce fugitive dust emissions include wet suppression, wind speed reduction using barriers, vehicle speed limits, and chemical stabilization. Chemical stabilization alone could reduce emissions by up to 80 percent (DOE 2001a). Necessary control measures would be applied to ensure that PM_{10} concentrations remain below applicable standards. The temporary increases in pollutant emissions due to construction activities are too small to result in exceeding the NAAQS beyond the Y-12 boundary. Therefore, air quality impacts resulting from construction of the UPF and CCC would be small.

Operation. No significant new quantities of criteria or toxic pollutants would be generated from operation of the UPF or CCC. Once operational, the UPF Alternative would reduce steam usage by at least 10 percent as inefficient facilities are closed. Emissions under Alternative 2, including the heating requirements for the new UPF, would not exceed the level of emissions estimated for the No Action Alternative. In fact, it is expected that emissions from the newer more efficient UPF would be less. Any releases of nitrogen and argon, which are used to maintain inert atmospheres for glovebox operations in the UPF, would be less than current releases from existing EU operations. No new hazardous air emissions would result from the facility operation of the UPF or CCC.

5.6.1.3 *Alternative 3 – Upgrade in-Place Alternative*

Construction. The Upgrade in-Place Alternative, described in Section 3.2.3, would involve mainly internal upgrades to existing facilities, and thus, minimal impact to air quality at Y-12. Minor quantities of fugitive dust would be generated from CCC construction. Temporary emissions from construction equipment, trucks, and employee vehicles would be much less than the UPF Alternative presented above, due to the significantly smaller workforce (i.e., 300 versus 950) required for the upgrades.

Operation. Although there would likely be measurable reductions in air quality impacts associated with improvements to facilities and processes, because specific plans are not available, it is assumed that operation of the upgraded facilities would not change air quality impacts beyond those presented for the No Action Alternative because there would be no significant change in the operating requirements of the facilities.

5.6.1.4 *Alternative 4 – Capability-sized UPF Alternative*

Construction. The Capability-sized UPF Alternative would include construction of a 350,000 square foot UPF and the CCC. The Capability-sized UPF would be about 10 percent smaller than the UPF in Alternative 2 and would require a smaller workforce for construction (850 versus 950). For this reason, the emissions to the air from construction of the Capability-sized UPF would be similar in character but about 10 percent lower in quantity than those of the larger facility described in Section 5.6.1.2.

Operation. Under the Capability-sized UPF Alternative, no significant new quantities of criteria or toxic pollutants would be generated from the UPF. Emissions from the Y-12 Steam Plant related to providing heating for the Capability-sized UPF would likely be about 60 percent of current emission levels and would remain well within NAAQS for all criteria pollutants, with the exception of the 8- hour ozone concentrations. Reductions in EU operations are also expected to result in the reduction of carcinogenic HAPs. However, the maximum concentrations of these HAPs are small and do not have significant impacts (see Table 5.6.1.1-2). Despite these potential reductions in emissions, because there is no design information for the Capability-sized UPF, for purposes of this SWEIS, NNSA assumes the impacts to nonradiological air emissions would be the same as for the UPF in Alternative 2. Any releases of nitrogen and argon, which are used to maintain inert atmospheres for glovebox operations in the Capability-sized UPF, would be less than current releases from existing EU operations. No new hazardous air emissions would result from operations in the Capability-sized UPF.

5.6.1.5 *Alternative 5 – No Net Production/Capability-sized UPF Alternative*

Construction. The No Net Production/Capability-sized UPF Alternative would include construction of a 350,000 square foot UPF and the CCC as described in section 5.6.1.4. Therefore, the potential impacts to non-radiological air quality resulting from construction of the No Net Production/Capability-sized UPF Alternative would be the same as for the Capability-sized UPF Alternative.

Operation. Under the No Net Production/Capability-sized UPF Alternative, no significant new quantities of criteria or toxic pollutants would be generated from the UPF. Emissions from the Y-12 Steam Plant related to providing heating for the No Net Production/Capability-sized UPF Alternative would likely be about 53 percent of current emission levels (due to lower levels of operation) and would remain well within NAAQS for all criteria pollutants, with the exception of the 8- hour ozone concentrations. Reductions in EU operations are also expected to result in the reduction of carcinogenic HAPs. However, the maximum concentrations of these HAPs are small and do not have significant impacts (see Table 5.6.1.1-2). Despite these potential reductions in emissions, because there is no design information for the No Net Production/Capability-sized UPF Alternative, for purposes of this SWEIS, NNSA assumes the impacts to nonradiological air emissions would be the same as for the UPF in Alternative 2. Any releases of nitrogen and argon, which are used to maintain inert atmospheres for glovebox operations in the No Net Production/Capability-sized UPF Alternative, would be less than current releases from existing EU operations. No new hazardous air emissions would result from operations in the No Net Production/Capability-sized UPF Alternative.

5.6.1.6 *General Conformity*

The conformity process begins with an applicability review which requires the Federal agency to identify, analyze, and quantify emissions associated with the proposed action. A conformity determination is required for any action that is federally funded, licensed, permitted, or approved where the total direct and indirect emissions of one or more criteria pollutants in a non-attainment or maintenance area exceed rates specified in TDEC 1200-3-34-.02, or if the pollutant emissions are regionally significant.

Alternative 2 would cause the greatest land disturbance at Y-12, require the largest construction workforce, and contribute the largest vehicular emissions quantities. However, these temporary activities would increase pollutant emissions only in the near term. In the long term, when the bulk of construction and D&D efforts are complete, pollutant emissions would be substantially reduced, and heated building space at Y-12 would drop from about 633,000 square feet to 388,000 square feet.

Planned construction and demolition projects would potentially have an impact on the local area due to fugitive dust emissions (airborne particulate matter that escapes from a construction site). Effective engineered control measures are available to reduce fugitive dust emissions. These methods include the application of water or chemical dust suppressants, the use of barriers for wind speed reduction, reduced vehicle speed, chemical stabilization, and seeding of soil piles and exposed soils. Necessary control measures would be applied at the construction and demolition sites to minimize fugitive dust emissions. Near source capture of dust emissions by surface cover and forested areas would also reduce offsite fugitive dust concentrations.

Future demolition activities, including those under Integrated Facility Disposition Project (IFDP) and *American Recovery and Reinvestment Act* (ARRA) of 2009, would involve only small-scale projects. These projects are typically performed one at a time by small business enterprises and generally include no more than one or two medium-size bull dozers, a loader, one or two dump trucks, a small truck for errands, and no more than 20 workers that commute to the site.

Emissions associated with these activities are clearly below the NAAQS threshold of 100 tons per year and would be far below the level of regional significance. In addition, each demolished facility represents an emissions reduction associated with heat and electric power that would otherwise be required.

Construction plans for each of the alternatives are insufficiently developed to quantify emissions, and therefore do not satisfy the Tennessee Code definition of reasonably foreseeable. For this reason, a complete General Conformity Review cannot be included in the SWEIS. When the construction plans are sufficiently developed to estimate NAAQS emissions, a General Conformity Review must be performed before future planned construction activities can proceed. If there are no additional emissions for the selected alternative (above existing emissions at the site), then a General Conformity Review is not required.

5.6.1.7 *Potential Mitigation Measures*

Short-term construction impacts are expected from fugitive dust emissions. Effective engineered control measures are available to reduce fugitive dust emissions. These methods include the application of water or EPA-approved chemical dust suppressants, the use of barriers for wind speed reduction, reduced vehicle speed, chemical stabilization, and seeding of soil piles and exposed soils. Necessary control measures would be applied at the construction and demolition sites to minimize fugitive dust emissions. Near source capture of dust emissions by surface cover and forested areas would also reduce offsite fugitive dust concentrations. Air quality impacts from operation would not be regionally significant. Therefore, no additional mitigation measures are required.

5.6.1.8 *Greenhouse Gas Analysis*

Actions associated with each of the alternatives would generate greenhouse gases, and specifically carbon dioxide (CO_2). The majority of the CO_2 emissions at Y-12 have been associated with operation of the steam plant (where coal and natural gas are burned) and vehicle operations. Over the past 15 years, energy management has been an ongoing and comprehensive effort that contains a key strategy of implementing guidelines to reduce the consumption of energy and fuel (including gasoline, diesel fuel, electricity, and natural gas). Energy consumption over the past several years has continued a steady downward trend. By 2006, Y-12 achieved an overall energy usage reduction of approximately 44 percent from the previously existing 1985 baseline (DOE 2008). Improvements at the steam plant have reduced CO_2-equivalent greenhouse gas emissions by approximately 27 percent over the same time period (DOE 2007b). To estimate the greenhouse gases associated with each alternative, the analysis below focuses on three areas: (1) steam plant operations; (2) electric power usage; and (3) vehicle operations

Steam Plant. The purpose of the Steam Plant Replacement Project is to replace the existing coal fired boiler Y-12 steam plant with a new centralized steam plant using natural gas fired, packaged boiler systems. Once operational in 2010, the new steam plant should reduce greenhouse gases even further because the burning of natural gas generates only approximately 52 to 57 percent as much greenhouse gas emissions as the burning of coal (depending upon the type of coal, anthracite having the highest emissions and bituminous the lowest) (EIA 2009).

The new steam plant, scheduled to be completed in September 2010, will operate on natural gas with a fuel oil back-up. It will incorporate four package water-tube boilers with a total energy input not to exceed 100 million Btu per hour (YSO 2007). Combustion of natural gas produces 117.08 pounds of CO_2 per 1 million Btu (EIA 2009). Given a maximum Btu input of 100 million per hour, the new steam plant would emit 11,708 pounds of CO_2 per hour at full capacity. During periods when it is necessary to burn fuel oil in the boilers, the hourly CO_2 emissions would be 16,138.6 pounds. This is a bounding worst case analysis. The actual energy input for the new steam plant would most likely be somewhat less than 100 million Btu because the steam plant is not expected to operate at full capacity very often. As a comparison, if the same energy input were made with bituminous coal, the CO_2 per million Btu would be 205.3 pounds (EIA 2009), or 20,530 pounds per hour.

With respect to greenhouse gas emissions associated with the steam plant, there would not be significant operational differences among the No Action Alternative, UPF Alternative, and Upgrade in-Place Alternative, as each of these alternatives would require operation of the steam plant and would utilize motor vehicles at similar levels. The Capability-sized UPF and No Net Production/Capability-sized UPF Alternatives would operate at substantially lower levels and the steam plant is expected to operate at reduced levels. It is estimated that for the Capability-sized UPF Alternative and No Net Production/Capability-sized UPF Alternative, the steam plant would generate approximately 40 to 50 percent less greenhouse gases than the other alternatives. Table 5.6.1.8-1 provides a comparison of estimated annual CO_2 emissions for the alternatives from Y-12 steam plant operation.

Electrical Use. Y-12 electrical power is supplied by TVA. Approximately 60 percent of TVA electricity is generated by coal, while nuclear and hydroelectric generate 30 and 10 percent, respectively (TVA 2009). There are no greenhouse gas emissions from nuclear or hydroelectric generation (EIA 2009), so only 60 percent of electrical use at Y-12 would be attributed to greenhouse gas emissions. In 2008, Y-12 used approximately 252,682 MWh of electricity, or 28.9 MW per hour, which would equal about 98,676,910 Btu. Sixty percent of this—the amount of electricity used at Y-12 coming from coal—would be 59,206,146 Btu. The average heat content of a ton of U.S. coal in 2008 was 19,988,000 million Btu (EIA 2009a). It therefore required about 2.96 tons of coal to provide one hour of electrical power for Y-12 during 2008. Assuming an average CO_2 emission coefficient of 215 pounds of CO_2 per million Btu, the amount of CO_2 emission to provide electricity at Y-12 for one hour during 2008 was 6.4 tons.

With respect to greenhouse gas emissions associated with electricity use, there would not be any significant operational differences among the No Action Alternative, UPF Alternative, and Upgrade-in-Place Alternative, as each of these alternatives would use essentially the same amount of electricity. The Capability-Sized UPF Alternative and No Net Production/Capability-sized UPF Alternative would operate at substantially lower levels and would use approximately 40 to 50 percent less electricity, respectively, than the No Action Alternative, UPF Alternative, and Upgrade in-Place Alternative. Table 5.6.1.8-1 provides a comparison of estimated annual CO_2 emissions from the alternatives from electricity use.

Vehicle Operations. Increasing the use of alternative fuels and replacing gasoline-fueled vehicles with E-85–fueled vehicles will occur as funding permits. Additional fuel savings were achieved in FY 2007 as follows:

- vehicle utilization and the budget available were carefully analyzed, and 78 of 588 vehicles were removed from service;
- diesel fuel procurements were changed from No. 2 diesel fuel to a B20 (20 percent biofuel/80 percent petroleum diesel) biodiesel mix alternative fuel. Biodiesel reduces CO_2 emissions and petroleum consumption when used in place of petroleum diesel (Radich 2004, NBB 2009);
- all flex fuel-capable vehicles were operated on E85 ethanol alternative fuel. Use of ethanol can reduce greenhouse gas emissions in flex-fuel vehicles. Combustion of ethanol produces approximately 22 to 60 percent less greenhouse gas emissions than unleaded gasoline in flex-fuel vehicles (Wang 2002).;
- of all motor vehicle fuel consumed in FY 2007, 29 percent was alternative fuel;
- unleaded fuel consumed in FY 2007 was reduced 7 percent below the amount consumed in FY 2006;
- diesel fuel consumed in FY 2007 was reduced 10 percent below the amount consumed in FY 2006; and
- use of E85 ethanol was increased 55 percent above the amount consumed in FY 2006 (DOE 2008).

In addition to greenhouse gas emissions reduction from these measures affecting the Y-12 vehicle fleet, the reduction in number of employees that would accompany implementation of the UPF, Capability-sized UPF, and No Net Production/Capability-sized UPF alternatives would also produce a reduction in employee vehicle miles and subsequent greenhouse gas emissions. The U.S. EPA estimates that each gallon of gasoline produces 19.4 pounds of CO_2 emissions (EPA 2009) and EIA estimates 19.564 pounds of CO_2 emission per gallon (EIA 2009). For this analysis it is assumed that combustion of a gallon of gasoline produces about 19.5 pounds of CO_2 emissions and that each Y-12 worker drives 30 miles roundtrip to work in a vehicle with a fuel economy rating of 20 miles per gallon of gasoline. Each Y-12 worker would then generate 29.25 pounds of CO_2 in their daily commute to work. Assuming a five-day workweek and 50 working weeks per year, the annual amount of CO_2 emissions by each worker would be 7,313 pounds (about 3.66 tons). Because there are differences in number of employees among the alternatives, the total CO_2 emissions for employees commuting under each of the alternatives would be as follows:

- **No Action Alternative:** 6,500 workers × 7,313 / 2,000 = 23,767 tons
- **UPF Alternative:** 5,750 workers × 7,313 / 2,000 = 21,025 tons
- **Upgrade in-Place Alternative:** 6,500 workers × 7,313 / 2,000 = 23,767 tons
- **Capability-sized UPF Alternative:** 3,900 workers × 7,313 / 2,000 = 14,260 tons
- **Capability-sized/No Net Production UPF:** 3,400 workers×7,313/2,000 = 2,432 tons

Table 5.6.1.8-1 provides a comparison of the estimated potential CO_2 emissions for all of the alternatives addressed in the SWEIS.

Table 5.6.1.8-1. Estimated Annual CO_2 Emissions from Y-12 Operations (tons).

	No Action	UPF	Upgrade in-Place	Capability-sized UPF	No Net Production/ Capability-sized UPF
Steam Plant[a]	51,281	51,281	51,281	30,769	25,641
Electricity Use	55,757	55,757	55,757	33,454	27,879
Employee Commute	23,767	21,025	23,767	14,260	12,432
Total	130,805	128,063	130,805	78,483	65,952

[a] Estimated worst case for the new steam plant; actual emissions would likely be a fraction of these estimates.

Because of the reduced level of operations and reduction in size of the operational footprint at Y-12, the Capability-sized UPF and No Net Production/Capability-sized UPF Alternatives would have significantly lower CO_2 emissions than the No Action, UPF, and Upgrade in-Place Alternatives. However, even the highest levels of CO_2 emissions (No Action and Upgrade in-Place Alternatives) would be relatively small compared to the state-wide CO_2 emissions in Tennessee. From 1990 through 2005, CO_2 emissions in the state of Tennessee ranged from a low of 109.9 million tons in 1991 to a high of 138.8 million tons in 2005 (EIA 2009b). At its maximum CO_2 emission rate under the No Action and Upgrade in-Place Alternatives, Y-12 would contribute only 0.094 to 0.12 percent of the statewide CO_2 emissions in Tennessee. Each of the other alternatives would contribute proportionally less to statewide CO_2 emissions: UPF Alternative, 0.092 to 0.117 percent; Capability-sized UPF Alternative, 0.057 to 0.071 percent; and Capability-sized/No Net Production UPF Alternative, 0.048 to 0.060 percent.

As noted above, Y-12 has been taking steps to reduce its carbon footprint, such as replacing the coal-fired steam plant with a more efficient natural gas fired plant, reducing its use of electricity, and the vehicle fleet, and increasing the use of E85 gasoline and biodiesel. By reducing the amount of time the new steam plant must operate on fuel oil instead of natural gas, Y-12 will be able to maximize CO_2 reduction from that source. Expanding the use of E85 fuel and flex-fueled vehicles will also reduce CO_2 emissions at Y-12. Maximizing the use of a four-day workweek and allowing some employees to tele-commute one or more days each week would reduce CO_2 emissions from employee vehicle use for commuting to work. NNSA will evaluate these and other means of reducing the carbon footprint of Y-12 and implement those that are determined to be feasible and cost-effective.

5.6.1.9 Diesel Emissions

Because the combustion of diesel fuel produces relatively large amounts of particulates, particularly $PM_{2.5,}$ EPA issued guidance to assist federal agencies in analyzing diesel emissions (EPA 2009a). Diesel exhaust is a complex mixture of thousands of gases and fine particles emitted by a diesel-fueled internal combustion engine. The gaseous fraction of diesel exhaust is composed primarily of typical combustion gases such as nitrogen, oxygen, carbon dioxide, and water vapor but also includes air pollutants such as carbon monoxide (CO), sulfur oxides (SOx) nitrogen oxides (NOx), volatile hydrocarbons, and low-molecular weight polycyclic aromatic hydrocarbons and their derivatives (CARB 1998).

One of the main characteristics of diesel exhaust is the release of particles at a relative rate of about 20 time greater than from gasoline-fueled vehicles, on an equivalent energy basis. Almost all of the diesel exhaust particle mass (about 98 percent) is in the fine particle range of 10 microns or less in diameter (PM_{10}). Further, about 94 percent of the diesel exhaust particle mass is 2.5 microns or smaller ($PM_{2.5}$) (CARB 1998). Because of their small size, these particles can be inhaled and eventually trapped into the bronchial and alveolar regions of the lung.

Y-12 uses 43 stationary and portable diesel fueled emergency and/or standby generators ranging in horsepower from 19 to 235 (Johnson 2009). Emissions from these generators were calculated using AP-42 emission factors (EPA 1995). The emissions estimates were calculated by multiplying the horsepower of each generator by the AP-42 appropriate AP-42 emission factor then multiplying by hours of operations, which yields pounds of a pollutant per period of operation. The emissions for each generator were summed for each pollutant then divided by 2,000 to determine total tons of each pollutant. The calculations are based on an assumed 500 hours of operation per year for each generator. These emission estimates are already incorporated into the emissions reported for Y-12 in Table 5.6.1.1-1. Table 5.6.1.9-1 shows the results of the emission calculations for the Y-12 diesel-fueled generators. These emissions are representative of the emissions associated with diesel sources for Alternatives 1-3. While Alternatives 4 and 5 should have reduced diesel emissions, due to reduced operations, the reduction cannot be quantified.

Table 5.6.1.9-1. Estimated Emission from Diesel-fueled Sources at Y-12.

Pollutant	NOx	SO_2	CO	PM_{10}	$PM_{2.5}$	Total Organic Compounds	Aldehydes
Estimated Emissions (tons)	5.87	2.42	7.87	2.59	2.48 [a]	2.91	0.55

[a] Based on $PM_{2.5}$ being 94 percent of total particle mass in diesel exhaust.

5.6.2 Radiological Air Impacts

Radiological discharges to the atmosphere would occur as a result of the operation of facilities at Y-12. To analyze the impacts of these emissions by alternative, NNSA identified the facilities with the potential for radiological emissions and then estimated the amount of emissions that could result based on the projected use of the facilities. As described in Section 5.6.1.1, the results of this analysis are considered to be a bounding case.

After determining the emissions rates, the CAP88 computer code (EPA 2008) was used to estimate radiological doses to the MEI, the populations surrounding Y-12, and Y-12 workers. The CAP88 code is a Gaussian plume dispersion model used to demonstrate compliance with the radionuclide National Emissions Standards for Hazardous Air Pollutants (NESHAP) (40 CFR Part 61). Subpart H of 40 CFR Part 61 specifically addresses emissions of radionuclides other than radon from DOE facilities. Y-12-specific parameters including meteorological data, source characteristics, and population data were used to estimate the radiological doses. Detailed information on the CAP88 dispersion modeling is presented in Appendix D.

In the United States, the average person is exposed to an effective dose equivalent of approximately 360 millirem (mrem) (whole-body exposure) per year from all sources (EPA 2009). For more information, see “Radiation Basics” and “Average Annual Radiation Dose from Natural and Manmade Sources” text boxes. The potential risks to human health associated with the radiation dose, from Y-12 operations under all of the alternatives considered in the SWEIS are addressed in the Occupational and Public Health and Safety (Section 5.12).

5.6.2.1 *Alternative 1 – No Action Alternative*

The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 under the No Action Alternative occurs almost exclusively as a result of Y-12 production, maintenance, and waste management activities. An estimated 0.01 Curies (Ci) of uranium was released into the atmosphere in 2007 as a result of Y-12 activities (DOE 2008).

The total dose received by the hypothetical MEI for Y-12 under the No Action Alternative was calculated to be 0.15 mrem based on both monitored and estimated effluent data. This is approximately 1.5 percent of the 10 mrem per year NESHAP standard. This individual is postulated to be located about 7,579 feet northeast of Y-12 (DOE 2008). Statistically, an annual dose of 0.15 mrem would result in a LCF risk of 9.0×10^{-8}. The total dose to the population residing within 50 miles of ORR from Y-12 emissions under the No Action Alternative was calculated to be approximately 1.5 person-rem (DOE 2008). Statistically, a dose of 1.5 person-rem would result in 0.0009 LCFs annually.

5.6.2.2 *Alternative 2 – Uranium Processing Facility Alternative*

Construction. Construction of the UPF and CCC would not result in the release of any radiological emissions and there would be no associated impacts.

Operation. Operation of the UPF would result in some radiological airborne emissions. The current design calls for appropriately sized filtered heating, ventilating, and air conditioning (HVAC) systems (see Section 3.2.2). Under normal operations, radiological airborne emissions would be less than radiological airborne emissions from the existing EU facilities due to the incorporation of newer technology into the facility design.

Radiation Basics

What is radiation? Radiation is energy emitted from unstable (radioactive) atoms in the form of atomic particles or electromagnetic waves. This type of radiation is also known as ionizing radiation because it can produce charged particles (ions) in matter.

What is radioactivity? Radioactivity is produced by the process of unstable (radioactive) atoms trying to become stable. Radiation is emitted in the process. In the United States radioactivity is measured in units of curies (Ci). Smaller fractions of the curie are the millicurie (1mCi = 1/1,000 Ci), the microcurie (μCi = 1/1,000,000 Ci), and the picocurie (1pCi = 1/1,000,000,000,000 Ci).

What is radioactive material? Radioactive material is any material containing unstable atoms that emits radiation.

What are the four basic types of ionizing radiation?

Alpha (α) – Alpha particles consist of two protons and two neutrons. They can travel only a few centimeters in air and can be stopped easily by a sheet of paper or by the skin's surface.

Beta (β) – Beta particles are smaller and lighter than alpha particles and have the mass of a single electron. A high-energy beta particle can travel a few meters in the air. Beta particles can pass through a sheet of paper but may be stopped by a thin sheet of aluminum foil or glass.

Gamma (γ) – Gamma rays (and x-rays), unlike alpha or beta particles, are waves of pure energy. Gamma radiation is very penetrating and can travel several hundred feet in air. Gamma radiation requires a thick wall of concrete, lead, or steel to stop it.

Neutrons (n) – A neutron is an atomic particle that has about one-quarter the weight of an alpha particle. Like gamma radiation, it can easily travel several hundred feet in air. Neutron radiation is most effectively stopped by materials with high hydrogen content, such as water or plastic.

Not all radioactive materials emit all four types of ionizing radiation.

What are the sources of radiation?

Natural sources of radiation – 1) Cosmic radiation from the sun and outer space; 2) natural radioactive elements in the earth's crust; 3) natural radioactive elements in the human body; and 4) radon gas from the radioactive decay of uranium naturally present in the soil.

Man-made sources of radiation – Medical radiation (x-rays, medical isotopes), consumer products (TVs, luminous dial watches, smoke detectors), nuclear technology (nuclear power plants, industrial x-ray machines), and fallout from past worldwide nuclear weapons tests or accidents (Chernobyl).

What is radiation dose? Radiation dose is the amount of energy of ionizing radiation absorbed per unit mass of any material. For people, radiation dose is the amount of energy absorbed in human tissue. In the United States, radiation dose is measured in units of rad or rem. Smaller fractions of the rem are the millirem (1mrem = 1/1,000 rem) and the microrem (1μrem = 1/1,000,000 rem).

Average Annual Radiation Dose from Natural and Manmade Sources

Globally, humans are exposed constantly to radiation from the solar system and the Earth's rocks and soil. This radiation contributes to the natural background radiation that always surrounds us. Manmade sources of radiation also exist, including medical and dental x-rays, household smoke detectors, granite countertops, and materials released from nuclear and coal-fired power plants. The following table shows average annual radiation in the United States.

Source	**Average Annual Dose (mrem)**
Cosmic Radiation (from outer space)	
If you live at sea level your cosmic radiation dose is	26
If you live above sea level your dose must be adjusted by the addition of the following amounts:	
Elevation up to 1,000 ft	2
Elevation 1,000 to 2,000 ft	5
Elevation 2,000 to 3,000 ft	9
Elevation 3,000 to 4,000 ft	15
Elevation 4,000 to 5,000 ft	21
Elevation 5,000 to 6,000 ft	29
Elevation 6,000 to 7,000 ft	40
Elevation 7,000 to 8,000 ft	53
Elevation above 8,000 ft	70
Terrestrial radiation (from the ground; varies by location):	
Gulf States or Atlantic Coast regions	23
Colorado Plateau	90
Elsewhere in the United States	46
Internal radiation (in your body)	
From food and water (e.g., potassium)	40
From air (radon)	200
Plutonium-powered pacemaker	100
Porcelain crowns or false teeth	0.07
Travel-related sources	
For each 1,000 miles traveled by jet:	1
Miscellaneous sources	
Nuclear weapons test fallout (global)	1
Brick, stone, or concrete home construction	7
Luminous wrist watch	0.06
Watching television	1
Computer use	0.1
Home smoke detector	0.08
Each medical x-ray	40
Each nuclear medicine procedure	14
Living within 50 miles of a nuclear power plant	0.009
Living within 50 miles of a coal-fired power plant	0.03

Note: The amount of radiation exposure is usually expressed in millirem (mrem). In the United States the average person is exposed to an effective dose equivalent of approximately 360 mrem (whole-body exposure) per year from all sources (NCRP Report # 93). These doses are based on the American Nuclear Society's brochure, "Personal Radiation Dose Chart." The primary sources of information are the National Council on Radiation Protection and Measurements Reports #92-#95, and #100. Values in the table are general averages and do not provide data for precise individual dose calculations.

Source: U.S. EPA website at http://www.epa.gov/radiation/students/calculate.html

NNSA estimates that the uranium emissions from the UPF would decrease from 0.01 Ci to approximately 0.007Ci. This approximately 30 percent reduction in uranium emissions would reduce the MEI dose to 0.1 mrem would result in an LCF risk of 6.0×10^{-8}. The total dose to the population residing within 50 miles of ORR from Y-12 emissions was calculated to be approximately 1.0 person-rem. Statistically, a dose of 1.0 person-rem would result in 0.0006 LCFs annually. Operation of the CCC would not produce radiological air emissions.

5.6.2.3 *Alternative 3 – Upgrade in-Place Alternative*

Construction. Construction activities associated with the Upgrade in-Place Alternative would not result in the release of any radiological emissions and there would be no associated impacts.

Operation. Under normal operations, radiological airborne emissions would be no greater than radiological airborne emissions from the existing EU facilities, and would likely be less due to the incorporation of newer technology into the facility design. Because detailed design information does not yet exist for upgrading EU facilities, reductions in emissions cannot be quantified. As a result, for purposes of this SWEIS analysis, the radiological airborne emissions and resulting impacts from upgraded EU facilities would remain unchanged from the No Action Alternative.

5.6.2.4 *Alternative 4 – Capability-sized UPF Alternative*

Construction. Construction of the Capability-sized UPF would not result in the release of any radiological emissions and there would be no associated impacts.

Operation. Under the Capability-sized UPF Alternative, operation of the UPF would result in reduced radiological airborne emissions compared to Alternatives 1, 2, or 3. NNSA estimates that the uranium emissions from the Capability-sized UPF would decrease from 0.01 Ci to approximately 0.006 Ci. This approximately 40 percent reduction in uranium emissions would reduce the MEI dose to 0.09 mrem would result in an LCF risk of 5.0×10^{-8}. The total dose to the population residing within 50 miles of ORR from Y-12 emissions was calculated to be approximately 0.9 person-rem. Statistically, a dose of 0.9 person-rem would result in 0.0005 LCFs annually.

5.6.2.5 *Alternative 5 – No Net Production/Capability-sized UPF Alternative*

Construction. Construction of the No Net Production/Capability-sized UPF Alternative would not result in the release of any radiological emissions and there would be no associated impacts.

Operation. Under the No Net Production/Capability-sized UPF Alternative, operation of the UPF would result in reduced radiological airborne emissions compared to the other alternatives considered in the SWEIS. NNSA estimates that the uranium emissions from the No Net Production/Capability-sized UPF Alternative would decrease from 0.01 Ci to approximately 0.005 Ci. This approximately 50 percent reduction in uranium emissions would reduce the MEI dose to 0.08 mrem would result in an LCF risk of 4.0×10^{-8}. The total dose to the population residing within 50 miles of ORR from Y-12 emissions was calculated to be approximately 0.8 person-rem. Statistically, a dose of 0.8 person-rem would result in 0.0005 LCFs annually.

5.6.2.6 *Potential Mitigation Measures*

DOE standards for construction and operation of radiological facilities incorporate engineered and administrative controls to reduce potential releases of radioactive materials to the extent practicable. Because the potential impacts of radioactive impacts under all of the alternatives would be well below all applicable standards, no further mitigation measures would be necessary.

5.6.2.7 *Summary Comparison of Alternative Impacts for Air Quality*

No Action Alternative. The Steam Plant would continue to be the primary source of criteria pollutants. All criteria pollutant concentrations would be expected to remain below national and TDEC standards, except 8-hour ozone and $PM_{2.5}$, which exceed standards throughout the region. Radiological air emissions under the No Action Alternative would remain relatively constant at approximately 0.01 Ci of uranium per year.

UPF Alternative. Temporary increases in criteria air pollutants would result from the use of construction equipment, trucks, and employee vehicles; emissions would be expected to be less than one-half of regulatory thresholds for all criteria pollutants. No significant new quantities of criteria or toxic pollutants would be expected to be generated during operations. Compared to the No Action Alternative, radiological air emissions would decrease by approximately 30 percent to approximately 0.007 Ci of uranium per year.

Upgrade in-Place Alternative. Same as No Action Alternative.

Capability-sized UPF Alternative. Temporary increases in pollutants would result from the use of construction equipment, trucks, and employee vehicles; emissions would be expected to be less than one-half of regulatory thresholds for all criteria pollutants. No significant new quantities of criteria or toxic pollutants would be expected to be generated during operations. Compared to the No Action Alternative, radiological air emissions would decrease by approximately 40 percent to approximately 0.006 Ci of uranium per year.

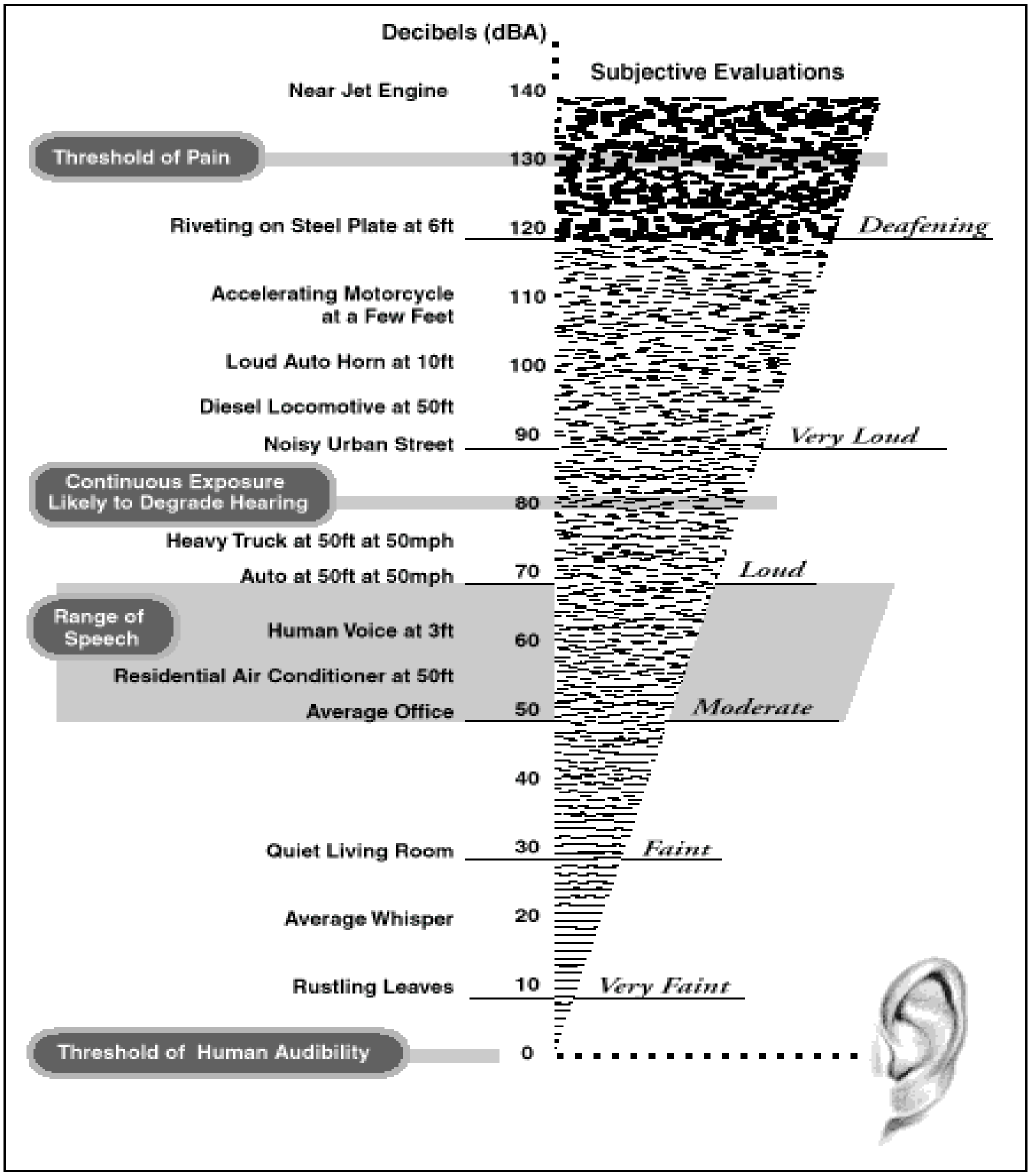
No Net Production/Capability-sized UPF Alternative. Temporary increases in pollutants would result from the use of construction equipment, trucks, and employee vehicles; emissions would be expected to be less than one-half of regulatory thresholds for all criteria pollutants. No significant new quantities of criteria or toxic pollutants would be expected to be generated during operations. Compared to the No Action Alternative, radiological air emissions would decrease by approximately 50 percent to approximately 0.005 Ci of uranium per year.

5.6.3 Noise

The process of quantifying the effects of sound begins with establishing a unit of measure that accurately compares sound levels. The physical unit most commonly used is the decibel (dB).

The decibel represents a relative measure or ratio to a reference pressure. The reference pressure is a sound approximating the weakest sound that a person with very good hearing can hear in an extremely quiet room. The reference pressure is 20 micropascals, which is equal to 0 (zero) decibels (dB).

A-weighted sound levels (dBA) are typically used to account for the response of the human ear. A-weighted sound levels represent adjusted sound levels that are made according to the frequency content of the sound. Figure 5.6.3-1 presents a comparison of decibel levels of everyday events with the threshold of human audibility.



Source: DOE 2001a.

Figure 5.6.3-1. Decibel Levels Compared to the Threshold of Human Audibility.

5.6.3.1 *Alternative 1 – No Action Alternative*

Major noise emission sources within Y-12 include various industrial facilities, equipment and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most Y-12 industrial facilities are at a sufficient distance from the site boundary that noise levels at the boundary from these sources would not be distinguishable from background noise levels.

Industrial and construction activities are another source of noise. Some of these activities could affect the occupational health of Y-12 personnel, but measures are in effect to ensure that hearing damage to personnel does not occur. These measures include regulations contained within the *Noise Control Act* of 1972 (42 *United States Code* [U.S.C.] §4901), *Contractor Industrial Hygiene Program* (DOE Order 5480.10), and *Occupational Noise Exposure* (29 CFR Part 1910.95).

For Y-12 personnel, protection against effects of noise exposure is provided when the sound levels exceed those shown in Table 5.6.3.1-1. When employees are subjected to sound exceeding those listed in Table 5.6.3.1-1, feasible administrative or engineered controls are used. If such controls fail to reduce sound levels to within the levels of the table, personal protective equipment (e.g., ear plugs) is provided and used to reduce sound levels to within the levels of the table.

Table 5.6.3.1-1. Permissible Noise Exposure.

Duration Per Day, hours	Sound Level dBA Slow Response
8.0	90
6.0	92
4.0	95
3.0	97
2.0	100
1.5	102
1.0	105
0.5	110
0.25 or less	115

Note: When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

Continued compliance measures would be taken to ensure that hearing damage to personnel does not occur. Noise from traffic sources in and around Y-12 would continue unchanged under the No Action Alternative.

The acoustic environment along ORR site boundary in rural areas and at nearby residences away from traffic noise is typical of a rural location, with the day-average sound level in the range of 35 to 50 dBA. Areas near the site within the city of Oak Ridge are typical of a suburban area, with the average day-night sound level in the range of 53 to 62 dBA. The primary source of noise at the site boundary and at residences located near roads is traffic. No change in noise impacts is expected during the 10-year planning period under the No Action Alternative.

5.6.3.2 *Alternative 2 – Uranium Processing Facility Alternative*

Construction. The onsite and offsite acoustical environments may be impacted during construction of the proposed UPF and CCC. Construction activities would generate noise produced by heavy construction equipment, trucks, power tools, and percussion from pile drivers, hammers, and dropped objects. In addition, traffic and construction noise is expected to increase during construction onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site. The levels of noise would be representative of levels at large-scale building sites. Table 5.6.3.2-1 describes peak attenuated noise levels expected from operation of construction equipment.

Relatively high and continuous levels of noise in the range of 89 to 108 dBA would be produced by heavy equipment operations during the site preparation phase of construction. However, after this time, heavy equipment noise would become more sporadic and brief in duration. The noise from trucks, power tools, and percussion would be sustained through most of the building construction and equipment installation activities on the proposed facility site. As construction activities reach their conclusion, sound levels on the proposed facility site would decrease to levels typical of daily facility operations (50 to 70 dBA). These construction noise levels would contribute to the ambient background noise levels for the duration of construction, after which ambient background noise levels would return to pre-construction levels.

The site for the UPF is approximately 1,700 feet from the Y-12 Site boundary. The proposed site for the CCC is even farther from the Y-12 site boundary. Peak attenuated noise levels from construction of the UPF would be below background noise levels (53 to 62 dBA) at offsite locations within the city of Oak Ridge, as shown in Table 5.6.3.2–1.

Operation. Operation of the UPF and CCC would generate some noise, caused particularly by site traffic and mechanical systems associated with operation of the facility (e.g., cooling systems, transformers, engines, pumps, paging systems, and materials-handling equipment). In general, sound levels are expected to be characteristic of a light industrial setting within the range of 50 to 70 dBA and would be within existing No Action levels. Effects upon residential areas would be attenuated by the distance from the facility, topography, and by a vegetated buffer zone.

Table 5.6.3.2-1. Peak Attenuated Noise Levels (in dBA) Expected from Operation of Construction Equipment.

Source	Peak Noise Level	Distance from Source						
		15 m (50 ft)	30 m (100 ft)	61 m (200 ft)	100 m (400 ft)	305 m (1,000 ft)	518 m (1,700 ft)	762 m (2,500 ft)
Heavy trucks	95	84-89	78-83	72-77	66-71	58-63	54-59	50-55
Dump trucks	108	88	82	76	70	62	58	54
Concrete mixer	108	85	79	73	67	59	55	51
Jackhammer	108	88	82	76	70	62	58	54
Scraper	93	80-89	74-82	68-77	60-71	54-63	50-59	46-55
Bulldozer	107	87-102	81-96	75-90	69-84	61-76	57-72	53-68
Generator	96	76	70	64	58	50	46	42
Crane	104	75-88	69-82	63-76	55-70	49-62	45-48	41-54
Loader	104	73-86	67-80	61-74	55-68	47-60	43-56	39-52
Grader	108	88-91	82-85	76-79	70-73	62-65	58-61	54-57
Dragline	105	85	79	73	67	59	55	51
Pile driver	105	95	89	83	77	69	65	61
Forklift	100	95	89	83	77	69	65	61

Note: 1ft = 0.305 m.
Source: Golden et al. 1980

5.6.3.3 *Alternative 3 – Upgrade in-Place Alternative*

Construction. The onsite and offsite acoustical environments may be impacted during upgrades to existing EU facilities and construction of the CCC. Construction activities would generate noise produced by heavy construction equipment, trucks, power tools, and percussion from hammers, and dropped objects. In addition, traffic and construction noise is expected to increase during construction onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site. The levels of noise would be representative of levels at large-scale building sites. In general, activities associated with the Upgrade in-Place Alternative would cause less noise impacts than the UPF Alternative because construction would take place within the facilities, and the facilities are slightly further from the site boundary than the UPF site.

Operation. Operation of the upgraded EU facilities would continue to generate the same types and intensities of noises that currently occur under the No Action Alternative.

5.6.3.4 *Alternative 4 – Capability-Sized UPF Alternative*

Construction. The onsite and offsite acoustical environments may be impacted during construction of an approximately 350,000 square foot UPF and the CCC. Construction activities would generate noise produced by heavy construction equipment, trucks, power tools, and percussion from pile drivers, hammers, and dropped objects. In addition, traffic and construction noise is expected to increase during construction onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site. The levels of noise would be representative of levels at large-scale building sites. Table 5.6.3.2-1 describes peak attenuated noise levels expected from operation of construction equipment.

Relatively high and continuous levels of noise in the range of 89 to 108 dBA would be produced by heavy equipment operations during the site preparation phase of construction. However, after this time, heavy equipment noise would become more sporadic and brief in duration. The noise from trucks, power tools, and percussion would be sustained through most of the building construction and equipment installation activities on the proposed facility site. As construction activities reach their conclusion, sound levels on the proposed facility site would decrease to levels typical of daily facility operations (50 to 70 dBA). These construction noise levels would contribute to the ambient background noise levels for the duration of construction, after which ambient background noise levels would return to pre-construction levels.

The site for the Capability-sized UPF is approximately 1,700 feet from the Y-12 site boundary. The proposed site for the CCC is even farther from the Y-12 site boundary. Peak attenuated noise levels from construction of the Capability-sized UPF would be below background noise levels (53 to 62 dBA) at offsite locations within the city of Oak Ridge as shown in Table 5.6.3.2-1.

Operation. Under the Capability-sized UPF Alternative, operation of the UPF would generate some noise, caused particularly by site traffic and mechanical systems associated with operation of the facility (e.g., cooling systems, transformers, engines, pumps, paging systems, and materials-handling equipment). In general, sound levels are expected to be characteristic of a light industrial setting within the range of 50 to 70 dBA and would be within existing No Action levels. Effects upon residential areas would be attenuated by the distance from the facility, topography, and by a vegetated buffer zone.

5.6.3.5 *Alternative 5 – No Net Production/Capability-sized UPF Alternative*

Construction. Noise impacts resulting from construction activities under the No Net Production/Capability-sized UPF Alternative would be the same as under the Capability-sized UPF Alternative.

Operation. Noise impacts resulting from operations under the No Net Production/Capability-sized UPF Alternative would be essentially the same as under the Capability-sized UPF Alternative

5.6.3.6 *Potential Mitigation Measures*

Noise-generating activity levels and conditions for Alternatives 2, 3, 4, and 5 are not expected to be significantly different from the No Action Alternative. With the relatively large spatial area and perimeter buffer zone, noise from most activities would not be expected to be discernible in offsite areas. Noise levels are not expected to conflict with land use guidelines or adversely impact the offsite community. Workers are required to comply with applicable hearing protection standards to reduce impacts from noise in the workplace. No additional mitigation measures would be required.

5.6.3.7 *Summary Comparison of Alternative Impacts for Noise*

No Action Alternative. Most Y-12 facilities are at sufficient distance from the site boundary so that noise levels are not distinguishable from background noise levels.

UPF Alternative. Activities and additional traffic associated with construction of the UPF and the CCC would generate temporary increases in noise. These noise levels would be representative of typical, large-scale building sites. Due to the distance to the site boundary, noise levels for both proposed projects would be expected to be at or below background noise levels at offsite locations within the city of Oak Ridge.

Upgrade in-Place Alternative. Minor additional noise impacts would be expected as a result of the construction taking place within facilities which are slightly further from the site boundaries than the UPF site. Construction of the CCC would generate temporary increases in noise but would not likely be noticeable offsite.

Capability-sized UPF Alternative. Construction activities and additional traffic associated with the Capability-sized UPF and the CCC would be expected to generate temporary increases in noise. These noise levels would be representative of typical large-scale building sites. Noise levels would be expected to be at or below background noise levels at offsite locations within the city of Oak Ridge.

No Net Production/Capability-sized UPF Alternative. Construction activities and additional traffic associated with the No Net Production/Capability-sized UPF and the CCC would be expected to generate temporary increases in noise. These noise levels would be representative of typical large-scale building sites. Noise levels would be expected to be at or below background noise levels at offsite locations within the city of Oak Ridge.

5.7 WATER RESOURCES

This section analyzes the impacts to water resources associated with the No Action and action alternatives.

5.7.1 Alternative 1 – No Action Alternative

Under the No Action Alternative there would be no change in current plans, including approved projects, at Y-12. Under this alternative, Y-12 would continue to support major DOE and NNSA programs.

5.7.1.1 *Groundwater*

This analysis focuses on the Upper East Fork Poplar Creek (UEFPC) groundwater regime because it is considered the most relevant to Y-12 operations. Under the No Action Alternative, overall groundwater quality should continue to improve from ongoing remediation at treatment facilities. Groundwater monitoring data collected to date indicate that volatile organic compounds (VOCs) are the primary class of contaminants that are migrating through the exit pathways in the UEFPC regime. The compounds are migrating at depths of almost 500 feet. The deep fractures and solution channels that constitute the flow paths appear to be well connected, resulting in contaminant migration for substantial distances off ORR into Union Valley to the east of the complex.

In addition to the intermediate to deep pathways monitored, shallow groundwater within the water table interval near the UEFPC, New Hope Pond, and Lake Reality is also monitored. Observed concentrations of VOCs at the New Hope Pond distribution channel remain low. This may be because of the continued operation of the groundwater plume capture system which may be reducing the levels of VOCs in the area.

The plume capture system pumps groundwater from the intermediate bedrock depth to mitigate offsite migration of volatile organic compounds. Groundwater is continuously pumped and passes through a treatment system to remove the VOCs, and then discharges to the UEFPC.

Three other wells, located in Pine Ridge through which the UEFPC exits Y-12, are also used to monitor shallow, intermediate, and deep groundwater intervals. Continued monitoring of the wells since 1990 has not shown that any contaminants are moving via this exit pathway. Monitoring of wells indicates that operation of the plume capture system is decreasing VOCs (DOE 2005a).

Since the initiation of remedial action, concentrations of VOCs directly downgradient of pumping wells have fallen from approximately 500 to 110 micrograms per liter (μg/L). In shallower intervals, VOC concentrations have remained similar to remediation baseline levels. A plume of contaminated groundwater that extends from the UEFPC through Union Valley, where it discharges to springs in the Scarboro Creek headwaters has shown continued detections of VOCs in groundwater. However, data shows a downward trend for signature VOCs (ORR 2003).

As described in Section 3.2.1, some minor construction would occur under the No Action Alternative. Although this construction could have an adverse impact on groundwater due to contaminant releases, previous NEPA studies for the construction activities do not indicate any significant impacts would result. Contaminant sources include construction material (e.g. concrete and asphalt), spills of oil and diesel fuel, and releases from transportation or waste handling accidents. Compliance with approved erosion and sedimentation control plans and a spill prevention, control, and countermeasures plan would mitigate potential impacts from surface spills. Y-12 would follow prevention and mitigation steps in the event of a hazardous material spill. Ongoing downsizing of Y-12 would result in more facilities being declared surplus and recommended for D&D. D&D of such facilities would have the potential to degrade groundwater quality by contaminant releases similar to those from construction, mentioned above. However, successful D&D of surplus facilities could also reduce some potential sources of groundwater contamination.

5.7.1.2 *Surface Water*

Y-12's primary water source is the Clinch River, which borders Y-12 to the south and west. Treated water usage at Y-12 averages 4.2 million gallons per day or 1,538 million gallons per year. Treated water is used to supply water for fire protection, process operations, sanitary sewage requirement, and boiler feed at the steam plant.

The water quality of surface water in the vicinity of Y-12 is affected by current and past operations. Among the three hydrogeologic regimes at Y-12, the UEFPC regime contains most of the known and potential sources of surface water contamination with mercury discharge being the leading contaminant. The UEFPC is the primary surface water exit pathway and exits Y-12 at Station 17. The natural flow path was altered during construction of the plant site, including rerouting of the natural streams, development of the underground utility system, and building of the dewatering sumps.

Cleanup actions that addressed a number of waste sources and contaminated media in the UEFPC under CERCLA and other authorities have been completed or are ongoing. Principal actions include:

- National Pollutant Discharge Elimination System (NPDES) Permit Compliance Program Phase 1 Actions
- NPDES Permit Compliance Program Phase 2 Actions
- UEFPC Stream Bank Stabilization Study
- Flow Management
- Basin 9822 Early Action
- Firing Range Early Action
- Union Valley Interim Action
- East End VOC Plume Early Action
- Record of Decision (ROD) for Phase I Interim Source Control Actions

In addition, two "no further action" decisions and one removal action have been accomplished within the UEFPC:

- Plating Shop Container Areas
- Abandoned Nitric Acid Pipeline
- Building 9201-4 Exterior Process Piping Removal Action

These actions have contributed to the removal or reduction of many point sources of mercury (>90 percent) since the early 1990s resulting in reducing mercury loading to the UEFPC (ROD for Phase II Interim Remedial Actions 2005) (DOE 2005f). Average water usage and treated water use is expected to remain the same under the No Action Alternative. Under the No Action Alternative, surface water monitoring would continue in accordance with DOE's NPDES Permit TN0002968 (DOE 2008).

Y-12 maintains a good record for compliance with respect to its NPDES Permit. Y-12 was issued a NPDES Permit from TDEC on March 13, 2006, with an effective date of May 1, 2006, which was renewed in December 2008. Certain provisions of this permit were appealed by the Department of Energy. The appeal primarily affected permit limitations set for legacy contaminants such as mercury and PCBs which are to be addressed through the CERCLA programs. Resolution of some issues has been completed, while others are being negotiated.

A number of contaminants are present and monitored in East Fork Poplar Creek (EFPC). Levels of mercury do remain above ambient water quality criteria in the EFPC. Nickel levels were well below the Tennessee General Water Quality Criteria. In 2003, the maximum nickel concentration was below the detection level of 0.05 milligrams per liter (mg/L), and the current maximum criteria for fish and aquatic life is 0.470 mg/L. Thallium is consistently below the analytical detection level of 0.2 mg/L. While the current water quality criteria for recreation for thallium is 0.0017 mg/L, this level is below the detection limit so the data does not indicate whether this parameter is either above or below this criterion. VOC concentrations have not been routinely measured since 1991, because the levels were consistently below analytical detection limits (B&W 2006b).

Discharges to surface water allowed under the NPDES permit include storm drainage, cooling water, cooling tower blowdown, steam condensate, and treated process wastewaters, including effluents from wastewater treatment facilities. Groundwater inflow into sumps in building basements and infiltration to the storm drain system are also permitted for discharge to the creek. The monitoring data collected by the sampling and analysis of permitted discharges are compared with NPDES limits if a limit exists for each parameter. Some parameters, defined as "monitor only," have no specified limits (DOE 2008).

The water quality of surface streams in the vicinity of the Y-12 Complex is affected by current and historical legacy operations. Discharges from the Y-12 Complex processes flow into EFPC before the water exits the Y-12 Complex. EFPC eventually flows through the city of Oak Ridge to Poplar Creek and into the Clinch River. Bear Creek water quality is affected by area source runoff and groundwater discharges. The NPDES permit requires regular monitoring and storm water characterization in Bear Creek and several of its tributaries. Requirements of the NPDES permit have been satisfied and monitoring of outfalls and instream locations have indicated excellent compliance. Data obtained as part of the NPDES program are provided in a monthly report to the TDEC. The percentage of compliance to the permit for 2007 was greater than 99.9 percent. The only NPDES permit excursion for 2007 occurred on February 12, 2007, when a computer software program being used to run analysis of an oil and grease sample failed to save the data result. The sample taken from outfall 200 was consumed in the analysis (hexane extractable material) and no data could be reported for the required weekly sample. Analytical laboratory personnel evaluated the situation, and corrective actions were put into place to avoid a recurrence (DOE 2008).

Y-12 is required to operate in compliance with DOE Order 5400.5, which contains requirements for control of residual radioactive material (Section II.5 and Chapter IV). The purpose of the order is to "… establish standards and requirements for operations of the DOE and DOE contractors with respect to protection of members of the public and the environment against undue risk from radiation." The order contains derived concentration guidelines (DCG's). These guidelines are defined as, "…the concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation), would result in an effective dose equivalent of 100 mrem." The DCG's are provided as reference values for conducting radiological environmental protection programs at operational DOE facilities and sites. Technetium-99 (^{99}Tc) and uranium isotope values at Station 17 during 2003 were well below the applicable guideline. The maximum ^{99}Tc value was 24.0 picocuries per liter (pCi/L) while the DCG is 100,000. The maximum value for U-234 was 3.3 compared to a DCG of 500. The maximum value for U-235 was 0.22 with a guideline of 600, the U-236 maximum was 0.18 with a guideline of 500, and the U-238 maximum was 11.0 with a guideline of 600 (B&W 2006b).

Mercury and other legacy contamination are to be addressed under the authority of CERCLA. Remedies for mercury contamination focus on source removal to restore surface water in EFPC to risk based human health values. This process has set a performance value of 0.0002 mg/L in EFPC at monitoring location Station 17. Long term trends over ten or more years indicate steadily decreasing mercury levels (B&W 2006b). Waterborne mercury concentrations in the upper reaches of EFPC decreased substantially following the 2005 start-up of the Big Spring Treatment System at a mercury-contaminated spring; however, mercury concentrations in fish have not yet decreased in response (DOE 2008).

The CERCLA remediation process under the Phase I ROD, Interim Source Control, has completed several actions including the construction and operation of several mercury water treatment facilities (Central Mercury and East End Mercury), stream stabilization in the upper reaches of EFPC, and construction of the Big Spring Water Treatment Facility. This facility began operation in the fall of 2005 and treats mercury contaminated water from a spring also known as Outfall 51 on the present permit. Plans are to incorporate basement sump water from Building 9201-2 into this new treatment facility. Other actions planned under the Phase I ROD include, asphalt caps over mercury runoff areas, flush of contaminated sediment from storm drains and reline as needed, removal of contaminated sediments/soil in UEFPC and Lake Reality, and continued monitoring to evaluate reductions in mercury (B&W 2006b).

Under the No Action Alternative, surface water quality could be degraded by contaminant releases during construction and could include construction materials; hydraulic fluid, oil, and diesel fuel; and releases from transportation or waste-handling accidents. DOE/NNSA goes to great lengths to minimize such occurrences through aggressive vehicle and machinery maintenance, worker training and enforcement of safe construction practice requirements. Storm water pollution prevention plans have been devised to identify pollutant sources that could affect the quality of industrial stormwater discharges and to describe implementation practices to reduce pollutants in these discharges. In the event of a hazardous spill, necessary equipment to implement cleanup is available, and personnel are trained in proper response, containment, and cleanup of spills. Compliance with an approved erosion and sedimentation control plan during construction would also prevent impacts to surface water from construction-induced erosion. Prior to any new construction activities, any suspect areas of soil contamination that may contain sufficient mass to be a continuing source to surface water contamination would be assessed and action taken (i.e. soil removal) (DOE 2005f). Ongoing downsizing of Y-12 would result in more facilities being declared surplus and recommended for D&D. D&D of such facilities would have the potential to degrade surface water quality by contaminant releases similar to those from construction. However, successful D&D of surplus facilities could also reduce some potential sources of surface water contamination.

No facilities would be located in either the 100-year or 500-year floodplain; therefore, no impact from flooding would be expected. No additional adverse impacts to surface water are expected under the No Action Alternative.

5.7.2 Alternative 2 – Uranium Processing Facility Alternative

This alternative includes the No Action Alternative and the construction and operation of a modern UPF sized to support the smaller nuclear stockpiles of the future and construction and operation of a new CCC. The proposed UPF site is located in the Y-12 West Portal Parking Lot adjacent to the HEUMF and the proposed CCC site is located on the eastern end of Y-12.

5.7.2.1 *Groundwater*

Construction. Impacts to groundwater from construction activities under Alternative 2 would be similar to those described under the No Action Alternative in Section 5.7.1.1. Some groundwater may be extracted during construction activities to remove water from excavations. Appropriate construction techniques would be implemented to minimize the seepage of groundwater into excavation sites. No impact on groundwater direction or flow would be expected during construction activities of the UPF or CCC.

Minimal impacts to groundwater quality are expected because extracted groundwater would be collected and treated in onsite treatment facilities to meet the discharge limits of the NPDES permit prior to release to surface water. To limit further contamination of the UEFPC, utility and sanitary wastewater would be treated prior to discharge in accordance with the applicable permits. Additional impacts from construction activities would not be beyond impacts described for the No Action Alternative. Ongoing downsizing of Y-12 would result in more facilities being declared surplus and recommended for D&D. D&D of such facilities would have the potential to degrade groundwater quality by contaminant releases similar to those from construction. However, successful D&D of surplus facilities could also reduce some potential sources of groundwater contamination

Operation. Impacts to groundwater from operation activities under Alternative 2 would be similar to those described under the No Action Alternative in Section 5.7.1.1. Minimal impacts to groundwater quality are expected from the operation of the UPF or CCC because all contaminated water would be collected and treated in onsite treatment facilities to meet the discharge limits of the NPDES permit prior to release to surface water. Utility and sanitary wastewater would be treated prior to discharge in accordance with the applicable permits. Additional impacts would not be beyond impacts described for the No Action Alternative.

5.7.2.2 *Surface Water*

Construction. Y-12 surface water withdrawals and discharges would not increase substantially during construction of the UPF. Construction water requirements for the UPF and other new facilities (approximately 4 million gallons per year) would not raise the average annual water use for Y-12 (approximately 2 billion gallons per year). The proposed sites for new facilities are not located within either the 100-year or 500-year floodplains.

Federal, state and local governments have passed laws and regulations to address the problem of polluted runoff, especially from construction. Phase I EPA storm water regulations initiated a national storm water permitting program in 1990, that applied to industrial activities, to construction sites of five acres or more and to urban runoff from larger cities. Phase II regulations in 1999 addressed additional urbanized areas, certain cities with population over 10,000, and construction activities of one to five acres. The Tennessee Department of Environment and Conservation, Division of Water Pollution Control implements the EPA Phase I and Phase II regulations in Tennessee.

Surface water quality could be degraded by construction activities. In order to avoid this, storm water control and erosion control measures would be implemented to minimize soil erosion and transport to the UEFPC. This would include control of surface water runoff from any new parking lots and any lay down areas. Actions described in Section 5.7.1.2 could also contribute to the continued mitigation of mercury discharge to the UEFPC. Prior to the construction of any new facility, any suspect areas of soil contamination that may be a source of surface water contamination would be removed. Analysis conducted in the *Record of Decision for Phase II Interim Remedial Actions for Contaminated Soils and Scrapyard in Upper East Fork Poplar Creek*, dated August 9, 2005 (DOE 2005f) indicated that the proposed site of the UPF is not in an area of soil remediation. Therefore, it is not anticipated that the construction of the UPF would degrade surface water quality.

Construction activities would not appreciably raise the average annual water use for Y-12. No impact from flooding would be expected. No adverse impacts to surface water resources or surface water quality are expected because all discharges would be maintained to comply with NPDES permit limits and minimized by actions described in Section 5.7.1.2. Additional impacts to surface water from construction activities would be similar to those described for the No Action Alternative. Ongoing downsizing of Y-12 would result in more facilities being declared surplus and recommended for D&D. D&D of such facilities would have the potential to degrade surface water quality by contaminant releases similar to those from construction. However, successful D&D of surplus facilities could also reduce some potential sources of surface water contamination

Operation. UPF operation would require an estimated 105 million gallons per year, about 5 percent of the water usage under the No Action Alternative (approximately 2 billion gallons per year). Overall site water use would decrease from 2 billion gallons per year to approximately 1.3 billion gallons per year under the UPF Alternative. It is not anticipated that operation of the UPF would impact surface water quality beyond impacts described for the No Action Alternative.

Operation of the UPF or CCC would not raise the average annual water use for Y-12 because both of these facilities would consolidate ongoing functions from numerous separate facilities and would not represent new uses of water. No adverse impacts to surface water resources or surface water quality are expected because all discharges would be maintained to comply with NPDES permit limits and minimized by actions described in Section 5.7.1.2. Additional impacts to surface water would be similar to those described for the No Action Alternative.

5.7.3 Alternative 3 – Upgrade in-Place Alternative

Under this alternative, NNSA would continue the No Action Alternative and upgrade the existing EU and nonnuclear processing facilities to contemporary environmental, safety, and security standards to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations.

5.7.3.1 *Groundwater*

Construction. Construction water requirements for the Upgrade in-Place Alternative would be minimal because construction activities would consist mainly of internal facility modifications, as well as construction of the CCC. The water requirements would not raise the average annual water use for Y-12 (approximately 2 billion gallons per year), or cause any appreciable water resource impacts or changes beyond those described for the No Action Alternative. Ongoing downsizing of Y-12 would result in more facilities being declared surplus and recommended for D&D. D&D of such facilities would have the potential to degrade groundwater quality by contaminant releases similar to those from construction. However, successful D&D of surplus facilities could also reduce some potential sources of groundwater contamination

Operation. Operation of the upgraded EU and other processing facilities and the CCC would not change current water usage (approximately 2 billion gallons per year). Operation of the new and upgraded EU facilities would not impact groundwater quality beyond current conditions because there would be no appreciable increase in output of upgraded facilities. No adverse impacts to groundwater resources are expected because all discharges would be maintained to comply with NPDES permit limits and minimized by actions described in Section 5.7.1.2. Additional impacts would not be beyond impacts described for the No Action Alternative.

5.7.3.2 *Surface Water*

Construction. Construction water requirements for the Upgrade in-Place Alternative would be minimal because activities would consist mainly of internal facility modifications, as well as construction of the CCC. Water requirements would not raise the average annual water use for Y-12 (approximately 2 billion gallons per year), nor cause any appreciable water resource impacts or changes beyond those described for the No Action Alternative. Ongoing downsizing of Y-12 would result in more facilities being declared surplus and recommended for D&D. D&D of such facilities would have the potential to degrade surface water quality by contaminant releases similar to those from construction. However, successful D&D of surplus facilities could also reduce some potential sources of surface water contamination.

Operation. Operation of the upgraded facilities and CCC would not change current water usage; therefore operation of the upgraded facilities would not raise the average annual water use for Y-12. Operation of the upgraded facilities would not impact surface water quality beyond current conditions because there would be no appreciable increase in output of facilities. No adverse impacts to surface water resources or surface water quality are expected because all discharges would be maintained to comply with NPDES permit limits and minimized by actions described in Section 5.7.1.2. Additional impacts would not be beyond impacts described for the No Action Alternative.

5.7.4 Alternative 4 – Capability-sized UPF Alternative

Under this alternative, NNSA would construct a Capability-sized UPF and the CCC. The Capability-sized UPF would be constructed at the same location as the UPF in Alternative 2. This would result in the transfer of activities currently conducted in existing EU facilities to the UPF and other functions from other areas of Y-12 to the CCC. All other activities under this alternative would be similar to No Action.

5.7.4.1 *Groundwater*

Construction. The Capability-sized UPF would be about 10 percent smaller than the UPF in Alternative 2 and would likely have proportionately less impact on groundwater. However, because the design for the smaller facility has not been completed, it is not possible to accurately project the impacts of its construction on groundwater. Therefore, for purposes of this SWEIS, the impacts projected under Alternative 2 for the UPF are used to assess the impact of the Capability-sized UPF.

Operation. For the reasons cited in the preceding paragraph, for purposes of this SWEIS, the groundwater impacts projected under Alternative 2 for the UPF are used to assess the impact of the Capability-sized UPF.

5.7.4.2 *Surface Water*

Construction. The Capability-sized UPF would likely be about 350,000 square feet, or about 10 percent smaller than the UPF in Alternative 2 and its construction would likely have proportionately less impact on surface water quantity and quality. Because the design for the smaller facility has not been completed, however, it is not possible to precisely project the impacts its construction could have on surface water. Therefore, for purposes of this SWEIS, the impacts projected under Alternative 2 for the UPF in Alternative 2 are used to assess the impact of the Capability-sized UPF.

Operation. The reduced operations associated with the Capability-sized UPF would reduce water use at Y-12. Water requirements would decrease from approximately 2 billion gallons per year to approximately 1.2 billion gallons per year.

5.7.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Under this alternative, NNSA would construct a No Net Production/Capability-sized UPF and the CCC. The No Net Production/Capability-sized UPF would be constructed at the same location as the UPF in Alternative 2. The No Net Production/Capability-sized UPF would be the same size as the Capability-sized UPF (Alternative 3). Implementation of this alternative would result in the transfer of activities currently conducted in existing EU facilities to the UPF and other functions from other areas of Y-12 to the CCC. All other activities under this alternative would be similar to No Action.

5.7.5.1 *Groundwater*

Construction. Construction activities under the No Net Production/Capability-sized UPF Alternative would be the same as those for Alternative 4. For this reason and those cited in Section 5.7.4.1, for purposes of this SWEIS, the impacts to groundwater projected under Alternative 2 for the UPF are used to assess the impact of the No Net Production/Capability-sized UPF Alternative.

Operation. For the reasons cited in the preceding paragraph, for purposes of this SWEIS, the groundwater impacts to groundwater projected under Alternative 2 for the UPF are used to assess the impact of the No Net Production/Capability-sized UPF Alternative.

5.7.5.2 *Surface Water*

Construction. Construction activities under the No Net Production/Capability-sized UPF Alternative would be the same as those for Alternative 4. For this reason and those cited in Section 5.7.4.1, for purposes of this SWEIS, the impacts to surface water projected under Alternative 2 for the UPF are used to assess the impact of the No Net Production/Capability-sized UPF Alternative.

Operation. The reduced operations associated with the No Net Production/Capability-sized UPF Alternative would reduce water use at Y-12. Water requirements would decrease from approximately 2 billion gallons per year to approximately 1.08 billion gallons per year.

5.7.6 Potential Mitigation Measures

Water resources could be degraded by contaminant releases during construction of some facilities. Contaminant sources include construction materials; hydraulic fluid, oil, and diesel fuel; and releases from transportation or waste handling accidents. If a spill occurred, Y-12 stormwater pollution prevention plans are in place to identify pollutant sources that affect the quality of industrial stormwater discharges and to describe implementation practices to reduce pollutants in the discharges. Stormwater management techniques, such as silt fences and runoff diversion ditches, would be used to prevent erosion and potential water pollutants from being washed from the construction site during rainfall events. Y-12 will continue to remove contaminants from ground and surface water through a series of treatment facilities at Y-12.

5.7.7 Summary Comparison of Alternative Impacts for Water Resources

No Action Alternative. Current water usage of 2 billion gallons per year would be expected to continue. Discharges would be expected to be within NPDES requirements. Ongoing stormwater runoff and erosion control management would continue. No additional impacts to groundwater would be expected.

UPF Alternative. Water usage for operations would be the same as the No Action Alternative, with the addition of an increased water usage of approximately 4.0 million gallons during the construction of the UPF.

Upgrade in-Place Alternative. Same as No Action Alternative.

Capability-sized UPF Alternative. Water usage for operations would be the same as the No Action Alternative, with the addition of an increased water usage of approximately 3.6 million gallons during construction of the Capability-sized UPF Alternative. Operational water use for the Y-12 Site is expected to be reduced from about 2 billion gallons per year under the No Action Alternative to approximately 1.2 billion gallons per year under the Capability-sized UPF Alternative.

No Net Production/Capability-sized UPF Alternative. Water usage for operations would be the same as the No Action Alternative, with the addition of an increased water usage of approximately 3.6 million gallons during construction of the No Net Production/Capability-sized UPF. Operational water use for the Y-12 Site is expected to be reduced from about 2 billion gallons per year under the No Action Alternative to approximately 1.08 billion gallons per year under the No Net Production/Capability-sized UPF Alternative.

5.8 ECOLOGICAL RESOURCES

This analysis focuses on Y-12 and the area within this SWEIS study area boundary. Ecological resources at ORR include terrestrial and aquatic resources, threatened and endangered (T&E) species, state species of concern, and floodplains and wetlands. Potential impacts are assessed based on the degree to which various habitats or species could be affected by Y-12 proposed actions and alternatives. Where possible, impacts are evaluated with respect to Federal and state protection regulations and standards.

Impacts to wildlife are evaluated in terms of disturbance, displacement, or loss of wildlife. Impacts to wetlands are assessed based on their proximity to Y-12 current mission operations, the proposed construction and operation of new facilities, and any related discharge. A list of species potentially present at Y-12 will be obtained from the U.S. Fish and Wildlife Service (USFWS) and used in the process of assessing whether Y-12 current mission operations or proposed new facilities would impact any plant or animal under Section 7 of the *Endangered Species Act* (USFWS 2006) and will be included in the Final SWEIS. For a full discussion of Federal- and state-listed threatened, endangered, and animal species of concern that may occur at ORR, see Section 4.8.1.

5.8.1 Alternative 1 – No Action Alternative

The main area of Y-12 (approximately 800 acres) is a fenced area, which is largely developed, paved, cleared, and landscaped. Buildings and parking lots dominate the landscape in Y-12, with limited vegetation present. The land surrounding the main area of Y-12 is used in part to conserve ecological resources. Under the No Action Alternative, continued implementation of planned modernization actions announced in the 2002 ROD would continue. The Y-12 Site has been categorized as industrial and contains no suitable habitat for species. However, conservation easements exist and will continue in order to protect, restore, and enhance wildlife and suitable habitat.

Within the fenced, developed portion of Y-12, grassy and de-vegetated areas surround the entire facility. Fauna within the Y-12 area is limited by the lack of large areas of natural habitat. Impacts on terrestrial resources are minimal under the No Action Alternative.

At ORR, DOE has set aside large tracts of land for conservation, including approximately 3,000 acres set-aside in April 2005. This conservation land is located on the western end of ORR and features mature forests, wetlands, river bluffs, cliffs and caves and is home to several rare species. Another conservation easement is Parcel G which contains a palustrine emergent/scrub-shrub wetland system totaling approximately 3.4 acres. Under the No Action Alternative, conservation activities on large portions of ORR would continue. Although wetlands have been identified on ORR, no wetlands have been observed in close proximity to the project area.

Under the No Action Alternative, fish and other organisms in local waterways in Y-12, including EFPC, would continue to be monitored as an indicator of the health of the ecosystem and the efficacy of Y-12's pollution prevention measures. Overall trends to date suggest a measurable improvement in fish health. However, fish would continue to have higher levels of contaminants than those found in reference streams, and bioaccumulation is still a concern. Mercury levels in Largemouth bass (*Micropterus salmoides*) and other species collected from UEFPC indicate that Y-12, even under the No Action Alternative, would continue to remain a source of mercury and PCB contamination in the local fauna.

A Biological Monitoring and Abatement Program (BMAP) was established in conjunction with the NPDES permit issued to Y-12 in 1995. The Environmental Monitoring and Compliance program is overseen by TDEC. The program includes toxicity monitoring, bioaccumulation studies, biological indicator studies, and ecological surveys (TDEC 2005a).

Threatened and Endangered Species. As described in Section 4.8.1, twenty Federal- and state-listed threatened, endangered, and other special status species have been identified on ORR. The gray bat (*Myotis grisescens*) is the only Federally-listed endangered animal species that is known to occur at ORR. There are no federally-listed T&E plant species. Under the No Action Alternative, impacts to T&E species or special status species would continue to be minimal on Y-12. Monitoring to assure that T&E species and other special status species, such as the gray bat, which has been observed in other parts of ORR, but not on Y-12, would continue.

5.8.2 Alternative 2 – Uranium Processing Facility Alternative

Construction. Under Alternative 2, most ecological impacts at the Y-12 site would remain the same as in the No Action Alternative. However, there could be some short-term impacts due to construction of new facilities.

The UPF and CCC would be constructed on approximately 42 acres of land, which include laydown areas and a temporary parking lot. There would be some disturbance to terrestrial biotic resources due to associated utility hook-ups and rerouting, site access by construction vehicles, and parking lot relocations. Some dislocation of small urban type species (i.e., rodents) could be expected. Large animals would be largely excluded from controlled areas. However, because the areas on which these facilities would be constructed are largely developed and paved, terrestrial biotic impacts would be few.

Rain events occurring during construction could cause erosion and transport of soil and other materials from the construction site. NNSA would utilize appropriate stormwater management techniques to prevent pollutants from entering local waterways, and thus aquatic resources should not be negatively impacted beyond what is discussed in the No Action Alternative. There are wetlands along EFPC, located to the southeast of the proposed site for UPF, but the stormwater management measures would help protect them from any impacts. The BMAP, described above, would continue to monitor effects in both wetlands and waterways from the construction of UPF and other Y-12 activities. Although wetlands have been identified on ORR, no wetlands have been observed in close proximity to the UPF project area. In addition, mitigation measures discussed in Section 5.8.5 are intended to minimize the impacts to ecological resources that might occur during construction activities associated with this alternative.

Operation. Impacts to terrestrial biotic resources from the operation of UPF and other new facilities would be similar to those currently observed under the No Action Alternative. The proposed UPF site is developed and paved and the proposed CCC would be located in a previously developed area, and thus if the facilities become operational, similar impacts would be seen as those discussed in the No Action Alternative. The BMAP would continue and would be used to ascertain any impacts from the UPF and CCC on local biota. In addition, mitigation measures discussed in Section 5.8.5 are intended to minimize the impacts to ecological resources that might occur during operational activities associated with this alternative.

Threatened and Endangered Species. Impacts to T&E species and special status species would be the same as in the No Action Alternative. The land to be used for UPF and CCC is already developed and is accessible via existing roads. Monitoring to assure that T&E species and other special status species, such as the gray bat, which is present in other parts of ORR but not Y-12, would continue as in the No Action Alternative.

On January 19, 2007, NNSA conducted consultations with the USFWS to discuss the potential impacts of the UPF on the Indiana bat and gray bat. As a result of that consultation, NNSA agreed to prepare a biological assessment (BA) to specifically address the potential impacts to the habitats of these bats. A Draft BA was completed and is included in Appendix C of this SWEIS. Based on the information presented in the Draft BA the actions proposed in this SWEIS are not likely to adversely affect the Indiana bat or gray bat (Stair 2008). The BA will be submitted to the USFWS for review and concurrence. Following the submittal of the BA, the USFWS will issue a Biological Opinion (BO) regarding the potential impacts. NNSA would not make any decisions under this SWEIS that could potentially impact either the Indiana bat or gray bat until conclusion of the consultation with USFWS and in compliance with all applicable provisions of the BO. A copy of the USFWS BO will be included in the final SWEIS, if available at that time.

5.8.3 Alternative 3 – Upgrade in-Place Alternative

Construction. Under this alternative, ecological impacts at the Y-12 site would be the same as those described under the No Action Alternative, and the CCC above. Construction activities would consist of internal modifications to existing facilities, as well as the CCC. No impacts to ecological resources from the Upgrade in-Place Alternative are expected because land disturbance would be minimal (7 acres) and areas associated with the Upgrade in-Place Alternative have been previously disturbed.

Operation. Operation of the CCC and upgraded facilities would have no impact on the current ecological resources at Y-12, as there would be no significant change to facility operations compared to the No Action Alternative.

Threatened and Endangered Species. Impacts to T&E species and other special status species would be the same as in the No Action Alternative, as modifications would be mainly internal to structures on Y-12 and no changes in operation would be expected. NNSA would not make any decisions under this SWEIS that could potentially impact either the Indiana bat or gray bat until conclusion of the consultation with USFWS and in compliance with all applicable provisions of the BO. A copy of the USFWS BO will be included in the final SWEIS, if available at that time.

5.8.4 Alternative 4 – Capability-sized UPF Alternative

Under this alternative, NNSA would construct and operate a Capability-sized UPF and the CCC at the same locations as proposed in Alternative 2. Construction and operation impacts from the Capability-sized UPF would be similar, if not slightly less than for the UPF in Alternative 2. Under the Capability-Sized UPF Alternative, ecological monitoring would continue to assess levels of pollutants in soil, waterways, and wildlife.

Threatened and Endangered Species. With the Capability-sized Alternative, impacts to federally- and state-listed T&E species and other special status species would be expected to be essentially the same as for Alternative 2. NNSA would not make any decisions under this SWEIS that could potentially impact either the Indiana bat or gray bat until conclusion of the consultation with USFWS and in compliance with all applicable provisions of the BO. A copy of the USFWS BO will be included in the final SWEIS, if available at that time.

5.8.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Under this alternative, NNSA would construct and operate a No Net Production/Capability-sized UPF and the CCC at the same locations as proposed in Alternative 2. Construction and operation impacts from the No Net Production/Capability-sized UPF Alternative would be similar, if not slightly less than for the UPF in Alternative 2. Under the No Net Production/Capability-sized UPF Alternative, ecological monitoring would continue to assess levels of pollutants in soil, waterways, and wildlife.

Threatened and Endangered Species. With the No Net Production/Capability-sized UPF Alternative, impacts to federally- and state-listed T&E species and other special status species would be expected to be essentially the same as for Alternative 2. NNSA would not make any decisions under this SWEIS that could potentially impact either the Indiana bat or gray bat until conclusion of the consultation with USFWS and in compliance with all applicable provisions of the BO. A copy of the USFWS BO will be included in the final SWEIS, if available at that time.

5.8.6 Potential Mitigation Measures

For any of the alternatives discussed above, potential impacts to terrestrial plant and animal species and wetland areas would be mitigated to avoid or minimize potential impacts. Proposed construction sites would be surveyed for the presence of special status species before construction begins, and mitigation actions would be developed. Appropriate runoff and siltation controls would be implemented to minimize potential impacts to adjacent wetland areas during construction and operation. Following construction, temporary structures would be removed and the sites reclaimed. However, no T&E or species of concern have been identified at Y-12. In addition, the developed portions of Y-12 do not contain suitable species habitat. Conservation easements exist at Y-12 and will continue in order to protect, restore, and enhance wildlife and suitable habitat.

5.8.7 Summary Comparison of Alternative Impacts for Ecological Resources

No Action Alternative. The existing Y-12 Site is highly developed, consisting mainly of disturbed habitat. Wildlife diversity is low. Continued minor impacts to terrestrial resources would be expected due to continued operations and human activities.

UPF Alternative. Construction would not be expected to significantly impact ecological resources because new facilities would be sited on previously disturbed land. Operations of the new facilities would not impact ecological resources because activities would be located in previously disturbed or heavily industrialized portions of Y-12 that do not contain habitat sufficient to support a biologically diverse species mix.

Upgrade in-Place Alternative. Impacts to ecological resources beyond those for the No Action Alternative would not be expected because construction activities would consist mostly of internal building modifications in areas previously disturbed that do not contain habitat sufficient to support ecological resources.

Capability-sized UPF Alternative. Construction would not be expected to impact ecological resources because new facilities would be sited on previously disturbed land. Operations would not be expected to impact ecological resources because activities would be located in previously disturbed or heavily industrialized portions of Y-12 that do not contain habitat sufficient to support a biologically diverse species mix.

No Net Production/Capability-sized UPF Alternative. Construction would not be expected to impact ecological resources because new facilities would be sited on previously disturbed land. Operations would not be expected to impact ecological resources because activities would be located in previously disturbed or heavily industrialized portions of Y-12 that do not contain habitat sufficient to support a biologically diverse species mix.

5.9 CULTURAL RESOURCES

Potential impacts to cultural resources are assessed by applying the criteria of adverse effect as defined in 36 CFR Part 800.5[a]. An adverse effect is found when an action may alter the characteristics of a historic property that qualifies it for inclusion in the National Register of Historic Places (NRHP) in a manner that would diminish the integrity of the property's location, design, setting, workmanship, feeling, or association. Some examples of adverse effect to cultural resources include: physical destruction or damage; alterations not consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (DOI 1990); relocation of a property; isolation and restriction of access; introduction of visible, audible, or atmospheric elements out of character with the resource; neglect resulting in deterioration; or transfer, lease or sale of historic properties without adequate protections. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be farther removed in distance, or be cumulative. Activities conducted under the alternatives considered are measured against the criteria of adverse effect to determine the potential for, and intensity of, impacts to cultural resources.

While DOE, as the Federal agency, makes the determination of adverse effect, consultation with the State Historic Preservation Officer (SHPO) and other parties is required regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts. For certain activities specifically outlined in the Cultural Resources Management Plan (CRMP), DOE Oak Ridge Office (DOE-ORO) may apply the criteria of adverse effect without consultation, but if there is an adverse effect, it must be resolved via consultation with the SHPO (36 CFR Part 800.6, Souza et al. 1997).

Ancestors of the Cherokee Nation of Oklahoma may be culturally affiliated with the prehistoric use of the Y-12 area. No Native American traditional use areas or religious sites are known to be present on the Y-12 site. Also, no artifacts of Native American religious significance are known to exist or to have been removed from Y-12 (DOE 2001a).

5.9.1 Alternative 1 – No Action Alternative

Y-12 currently has 76 existing historic properties (NNSA 2005c). These 76 properties are also contributing elements to the proposed Y-12 Plant Historic District for their historical association with the Manhattan Project. The Y-12 National Security Complex *National Historic Preservation Act Historic Preservation Plan* details the historic significance of these properties and their contribution to the proposed historic district. Preservation of cultural resources at Y-12, including these historic buildings, would continue under the No Action Alternative. As discussed in Section 4.9.4, any alterations to these historic buildings would be in accordance with the historic prevention plan and programmatic agreement.

5.9.2 Alternative 2 – Uranium Processing Facility Alternative

Construction. Alternative 2, described in Section 3.2.2, would be compatible and consistent with the current status of cultural resources at Y-12. Construction activities for new facilities would take place in areas outside of the proposed historic district and there would be no appreciable impacts or changes beyond those described for the No Action Alternative. Should suspected cultural artifacts be encountered during the construction process, all construction activities would cease and the situation would be resolved via consultation with the SHPO (36 CFR Part 800.6, Souza 1997).

Operation. Operation of the UPF and CCC would have no impact on the current cultural resources at Y-12.

5.9.3 Alternative 3 – Upgrade in-Place Alternative

Construction. The Upgrade in-Place Alternative, described in Section 3.2.3, would be compatible and consistent with the current status of cultural resources at Y-12. Activities would consist of internal modifications to existing facilities, as well as construction of the CCC. There would be no appreciable impacts or changes to cultural or historic resources.

Operation. Operation of the CCC and upgraded facilities would not have any additional impact on the current cultural resources at Y-12, as all operations under Alternative 3 would be similar to existing operations.

5.9.4 Alternative 4 – Capability-sized UPF Alternative

Under this alternative, NNSA would include construction and operation of a Capability-sized UPF and the CCC at the same locations as Alternative 2. Impacts to significant cultural resources from the Capability-sized UPF Alternative would be appreciably the same as Alternative 2. Should suspected cultural artifacts be encountered during the construction process, all construction activities would cease and the situation would be resolved via consultation with the SHPO (36 CFR Part 800.6, Souza et al. 1997).

5.9.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Under this alternative, NNSA would include construction and operation of a No Net Production/Capability-sized UPF and the CCC at the same locations as Alternative 2. Impacts to significant cultural resources from the No Net Production/Capability-sized Alternative would be appreciably the same as Alternative 2. Should suspected cultural artifacts be encountered during the construction process, all construction activities would cease and the situation would be resolved via consultation with the SHPO (36 CFR Part 800.6, Souza et al. 1997).

5.9.6 Potential Mitigation Measures

If adverse impacts to NRHP-eligible sites were to be expected and could not be avoided through project design or siting, a Memorandum of Agreement would need to be negotiated among DOE, the Tennessee SHPO, and the Advisory Council on Historic Preservation. The Memorandum of Agreement would formalize mitigation measures agreed to by these consulting parties. Mitigation measures could include describing and implementing intensive inventory and evaluation studies, data recovery plans, site treatments, and monitoring programs. No Native American resources were identified at Y-12.

5.9.7 Summary Comparison of Alternative Impacts for Cultural Resources

Y-12 currently has a proposed National Register Historic District comprised of historic buildings associated with the Manhattan Project that are eligible for listing in the NRHP. Preservation of cultural resources at Y-12, including the buildings in this proposed historic district, would continue under all alternatives. None of the alternatives would impact significant cultural resources at Y-12.

5.10 SOCIOECONOMICS

The socioeconomic analysis considers a ROI where more than 90 percent of ORR workforce resides. The ROI is a four-county area in Tennessee comprised of Anderson, Knox, Loudon, and Roane Counties. The socioeconomic impacts of all the alternatives are addressed in terms of both direct and indirect impacts.

5.10.1 Alternative 1 – No Action Alternative

Section 4.10 describes the existing socioeconomic characteristics of the ROI. Although there have been fluctuations in these estimates, the ROI labor force grew by approximately 11 percent from 280,986 in 2000 to 312,211 in 2007 (BLS 2007).The ROI unemployment rate was 3.7 percent in 2007, continuing on a downward trend after a 5-year high of 4.5 percent in 2005, as shown in Table 4.10.1–2. In 2007, unemployment rates within the ROI ranged from a low of 3.4 percent in Knox County to a high of 5.3 percent in Roane County. The unemployment rate in Tennessee was 4.7 percent (BLS 2007).

The average per capita income in the ROI was $31,493 in 2006, a 21.7 percent increase from the 2001 level of $25,880. Per capita income in 2006 in the ROI ranged from a low of $29,074 in Roane County to a high of $33,963 in Knox County. The per capita income in Tennessee was $32,172 in 2006 (BEA 2007).

Y-12 employs approximately 6,500 workers, including DOE employees and multiple contractors (NNSA 2005c). This represents approximately 3.1 percent of area employment. DOE has a significant impact on the economies both of the ROI and of Tennessee. As a whole, DOE employees and contractors number more than 11,900 individuals in Tennessee, primarily in the ROI. These jobs have an average salary of approximately $54,800 in comparison to the statewide average of approximately $32,900 (UTenn 2005, BEA 2007). The total spending generated in Tennessee as a result of DOE operations supported a total of more than 62,000 jobs in the state, most in the ROI. This means that for every direct DOE-related job, an additional 4.2 jobs were supported in other sectors of the state's economy. This relatively high implied employment multiplier reflects, in part, the high average annual salary of DOE-related employees in the state (UTenn 2005, BEA 2007). Under the No Action Alternative, the workforce at Y-12 is projected to remain at a relatively stable level over the next ten years (NNSA 2005c).

From 2000 to 2007, the population of the ROI increased 3 percent from 544,358 to 596,192 in 2007. Loudon County experienced the largest population growth within the ROI between 2000 and 2007 with an increase of 16 percent. Roane County experienced the lowest growth rate with an increase of 2.9 percent (USCB 2007).

Knox County is the largest county in the ROI with a 2007 population of 423,874. Knox County includes the city of Knoxville, the largest city in the ROI. Loudon County is the smallest county in the ROI with a total population of 45,448 in 2007. The city of Oak Ridge and ORR are located in both Roane and Anderson Counties which had 2003 populations of 53,399 and 73,471, respectively (USCB 2007). In 2000, the total number of housing units in the ROI was 244,537 with 224,796 occupied (91.9 percent). There were 156,219 owner-occupied housing units and 68,577 rental units. The median value of owner-occupied units in Loudon County was the greatest of the counties in the Y-12 ROI ($97,300). The vacancy rate was the lowest in Loudon County (7.7 percent) and the highest in Roane County (9.3 percent) (USCB 2007).

There would be no appreciable changes in the regional socioeconomic characteristics over the 10-year planning period resulting from continuation of the No Action Alternative.

5.10.2 Alternative 2 – Uranium Processing Facility Alternative

Construction. The construction of the new UPF and other new facilities, described in Section 3.2.2, would require approximately 950 workers during the peak year of construction (see Table 3.2.2.1-1). A total of 3,990 additional jobs (950 direct and 3,040 indirect, using the multiplier of 4.2 indirect jobs for every DOE-related direct job) would be created in the ROI during the peak year of construction. The total new jobs would represent an increase of less than 1 percent in ROI employment. The number of direct jobs at Y-12 could increase by approximately 14 percent during the peak year of construction. Overall, these changes would be temporary, lasting only the duration of the 6-year construction period for the UPF and 3-year construction period for the CCC, and would be similar in magnitude to the socioeconomic impacts that were experienced at Y-12 with construction of the HEUMF. Similar to the HEUMF, the existing ROI labor force could likely fill all of the jobs generated by the increased employment and expenditures. Therefore, there would be no impacts to the ROI's population or housing sector. Because there would be no change in the ROI population, there would be no change to the level of community services utilized in the ROI.

Based on the ROI average earnings of $26,100 for the construction industry, direct income would increase by approximately $25 million annually. This would also generate additional indirect income in supporting industries (this analysis uses the average ROI earnings of $31,493 for other indirect jobs). The total impact to the ROI income would be approximately $120 million ($25 million direct and $96 million indirect). Table 5.10.2-1 illustrates the impacts to socioeconomic resources from construction under Alternative 2.

Table 5.10.2-1. Socioeconomic Impacts from Construction under Alternatives 2, 3, 4 and 5.

Socioeconomic Resource	Alternative 2	Alternative 3	Alternatives 4 and 5
Peak Workers	950	300	850
Indirect Jobs Created	3040	960	2720
Total Jobs Created	3990	1260	3570
ROI Average Earning (direct)	$26,100	$26,100	$26,100
ROI Average Earning (indirect)	$31,493	$31,493	$31,493
Direct Income Increase	$24,795,000	$7,830,000	$22,185,000
Indirect Income Increase	$95,738,720	$31,851,180	$85,660,960
Total Impact to the ROI	$120,795,000	$39,681,180	$107,845,960

Operation. Upon completion of all new construction in approximately 2016, the operational workforce for the UPF is expected to be smaller than the existing EU workforce due to efficiencies associated with the new facility. NNSA estimates that the total number of EU workers should decrease by approximately 35 percent, to approximately 950, which is a reduction of approximately 350 workers. The consolidation of the Protected Area from 150 acres to 15 acres is also expected to reduce the security forces at Y-12 by approximately 400 workers. The total workforce reduction should be approximately 750 workers, which is approximately 11 percent of the total Y-12 workforce. These reductions are expected to be met through normal attrition/retirements since 50 percent of the work force at Y-12 is eligible to retire within the next 5 years. The change from baseline Y-12 employment would be minor and no noticeable impacts to ROI employment, income, population, housing, or community services would be expected.

Once the UPF is operational, the current EU facilities may be declared excess and evaluated for D&D. Section 5.16 of this SWEIS provides a qualitative assessment of the types of impacts that might result from the D&D of these facilities. Although the ultimate disposition of these facilities would be determined by a NEPA proposal and determination in the future, when such actions are ready for decisionmaking, this SWEIS acknowledges that approximately 633,000 square feet of facilities could require D&D, which could result in socioeconomic impacts to include impacts on employment and population in the ROI. Y-12 is a CERCLA Superfund listed site. D&D and site clean-up will be done according to CERCLA requirements which include input from state and Federal regulators and the public. The impacts from these actions would occur in 2018 or beyond, which is outside of the planning period for this SWEIS, analysis of these impacts, at this time, would be premature.

5.10.3 Alternative 3 – Upgrade in-Place Alternative

Construction. The Upgrade in-Place Alternative, described in Section 3.2.3, would require approximately 300 workers (see Table 3.2.3-1), generating a total of 1,260 jobs (300 direct and 960 indirect, using the multiplier of 4.2 indirect jobs for every DOE-related direct job) in the ROI during the peak year of construction. The total jobs would represent an increase of less than 0.5 percent in ROI employment, while the direct jobs would increase the employment at Y-12 by approximately 5 percent. These changes would be temporary, lasting only the duration of the 10-year construction period, and would be much less in magnitude than the socioeconomic impacts that were experienced at Y-12 with construction of the HEUMF. The existing ROI labor force could likely fill all of the jobs generated by the increased employment and expenditures. Therefore, there would be no impacts to the ROI's population or housing sector. Because there would be no change in the ROI population, there would be no change to the level of community services provided in the ROI.

Based on the ROI average earnings of $26,100 for the construction industry, direct income would increase by approximately $8 million annually. This would also generate additional indirect income in supporting industries (this analysis uses the average ROI earnings of $31,493 for other indirect jobs). The total impact to the ROI income would be approximately $40 million ($8 million direct and $32 million indirect). Table 5.10.2-1 illustrates the impacts to socioeconomic resources from construction under Alternative 3.

Operation. Upon completion of the upgrades and any new construction in approximately 2015, operation of the upgraded facilities would not result in any significant change in Y-12 workforce requirements and the facilities would be staffed by the existing Y-12 workforce. Therefore, there would be no change from the baseline employment, and no impacts to ROI employment, income, population, housing, or community services. Upgrading the existing facilities would not allow the Protected Area at Y-12 to be reduced from approximately 150 acres to 15 acres, and would not reduce security force requirements.

5.10.4 Alternative 4 – Capability-sized UPF Alternative

Construction. As described in Section 3.2.4, NNSA would construct and operate a 350,000 square foot UPF and the CCC under the Capability-sized UPF Alternative. The socioeconomic impacts associated with construction would likely be similar although slightly less than the construction discussed in Section 5.10.2 and shown in Table 5.10.2-1.

Operation. Operations under the Capability-sized UPF Alternative would require a smaller workforce compared to Alternative 2. NNSA estimates that the site employment would decrease to approximately 3,900 workers. This would represent a decrease of approximately 2,600 jobs; a reduction of approximately 40 percent compared to the No Action Alternative baseline. Combined with the indirect jobs that would be lost (10,900) the ROI employment would be reduced by approximately 4.6 percent.

5.10.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Construction. As described in Section 3.2.5, NNSA would construct and operate a 350,000 square foot UPF and the CCC under the No Net Production/Capability-sized UPF Alternative. The socioeconomic impacts associated with construction would the same as discussed in Section 5.10.4 and shown in Table 5.10.2-1.

Operation. Operations under the No Net Production/Capability-sized UPF Alternative would require a smaller workforce compared to Alternative 2. NNSA estimates that the site employment would decrease to approximately 3,400 workers. This would represent a decrease of approximately 3,100 jobs; a reduction of approximately 48 percent compared to the No Action Alternative baseline. Combined with the indirect jobs that would be lost (13,020) the ROI employment would be reduced by approximately 5.5 percent.

5.10.6 Potential Mitigation Measures

Construction and operation under the alternatives analyzed would cause changes to employment, however, changes would generally be short-term. For the Capability-sized UPF and No Net Production/Capability-sized UPF alternatives, NNSA would minimize socioeconomic impacts by attempting to meet employment goals through normal attrition and workforce retraining. Outsourcing resources would be established for workers. Such resources would include counseling, up-to-date job listings for the ROI, resume assistance, and office space with telephones and word processors. Early retirement packages and offers could be instituted to lessen the severity of forced job losses and priority hiring for positions elsewhere at other NNSA facilities could be instituted. In addition, D&D activities could be started earlier and workers losing their positions at the Y-12 production facilities could be given priority hiring opportunities for jobs associated with the D&D of phased out facilities.

5.10.7 Summary Comparison of Alternative Impacts for Socioeconomics

No Action Alternative. The operational workforce at Y-12 would be expected to remain stable with no significant increase or decrease. No appreciable changes in the regional socioeconomic characteristics over the 10-year planning period would be expected.

UPF Alternative. There would be an increase of 950 construction workers during the peak year of construction. A total of 3,990 jobs (950 direct and 3,040 indirect) would be created in the ROI, which would affect present employment levels by less than a 2 percent increase. An 11 percent decrease in the current operational workforce level would be expected due to more efficient operations of the UPF and reduced security requirements resulting from a decrease in the footprint of facilities requiring high level security.

Upgrade in-Place Alternative. There would be an increase in 300 workers during the peak year of construction. A total of 1,560 jobs (300 direct and 1,260 indirect) created in the ROI, which would be expected to increase current employment levels by less than 1 percent. There would no expected changes to the current level of the operational workforce.

Capability-sized UPF Alternative. There would be an increase in 850 workers during the peak year of construction. A total of 3,570 jobs (850 direct and 2,720 indirect) created in the ROI by construction work, which would be expected to increase current employment levels by less than 2 percent. The operational workforce would be expected to decrease by about 2,600 jobs, which would result in the number of indirect jobs decreasing by about 8,320 in the ROI.

No Net Production/Capability-sized UPF Alternative. There would be an increase in 850 workers during the peak year of construction. A total of 3,570 jobs (850 direct and 2,720 indirect) created in the ROI by construction work, which would be expected to increase current employment levels by less than 2 percent. The operational workforce would be expected to decrease by about 3,100 jobs, which would result in the number of indirect jobs decreasing by about 9,920 in the ROI.

5.11 ENVIRONMENTAL JUSTICE

Section 4.11 describes the existing environmental justice characteristics of the ROI, including census tracts for minority, low-income populations, and American Indian groups with a cultural affiliation with the Y-12 area. For each of the alternatives, the offsite health and safety impacts described in Section 5.12 do not differ significantly. As such, the analysis in this section discusses potential environmental justice impacts for all of the alternatives.

In 2000, minority populations comprised 7.4 percent of the ROI population surrounding Y-12. In 2000, minorities comprised 30.9 percent of the population nationally and 20.8 percent of the population in Tennessee. The percentage of persons within the ROI below the poverty level at the time of the 2000 Census was 13.4 percent, which is higher than the 2000 national average of 12.4 percent, but slightly lower than the statewide figure of 13.5 percent.

Based on the analysis of impacts for resource areas, no significant adverse effects are expected from construction and operation activities at Y-12 under any of the alternatives. For those impacts that would occur, NNSA expects the impacts to affect all populations in the area equally. There would be no discernable adverse impacts to land uses, visual resources, noise, water, air quality, geology and soils, biological resources, socioeconomic resources, or cultural and archeological resources. As shown in Section 5.12, Occupational Public Safety and Health, it is not expected that there would be large adverse impacts to any populations.

Construction. The short-term socioeconomic impacts during any construction activities would be positive and not result in any disproportionately high and adverse effects on minority populations, low-income, or American Indian populations. With respect to human health, occupational impacts during construction would be expected (see Health and Safety, 5.12), but would not be significant (i.e., statistically, no fatal injuries during construction, and no more than 27 non-fatal occupational injuries). Therefore, no disproportionately high and adverse effects on minority populations, low-income, or American Indian populations would be expected during construction for any alternative.

Operation. None of the proposed alternatives would pose significant health risks to the public and radiological emissions would remain below the annual dose limit of 10 mrem (the maximum MEI dose is 0.15 mrem per year). Results from ORR ambient air monitoring program show that the hypothetical dose received within the Scarboro Community (a small urban minority community which is the nearest residential community to active DOE operations or property at ORR) is typically similar to, or lower than, other monitoring stations of Y-12 (DOE 2005a). Consequently, there are no special circumstances that would result in any greater impact on minority, low-income or American Indian populations than the population as a whole. As discussed in Section 4.11, an EPA study has concluded that residents of Scarboro Community are not currently being exposed to substances that pose an unreasonable risk to health or the environment (EPA 2003). None of the alternatives would be expected to change that conclusion.

5.11.1 Potential Mitigation Measures

There would be no negative, disproportionately high or adverse effects to minority populations or low-income populations; therefore, no mitigation measures are identified.

5.11.2 Summary Comparison of Alternative Impacts for Environmental Justice

Under all alternatives, no significant health risks to the public would be expected. The radiological dose to the MEI would remain well below the annual dose limit of 10 mrem. Results from the monitoring program and modeling show that the maximum exposed individual would not be located in a minority or low-income population area. No special circumstances that would result in greater impact on minority, low-income, or American Indian populations than the population as a whole, would be expected.

5.12 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

This section describes potential human health impacts associated with radiation exposures, chemical exposures, and worker safety issues due to Y-12 operations under each of the alternatives. A comprehensive evaluation of the potential risks associated with human exposure to environmental media (air, surface water, soil, sediment, and groundwater) was conducted.

5.12.1 Radiological Impacts

5.12.1.1 *Public Health*

The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by DOE for its facilities. Environmental radiation protection is currently regulated by DOE Order 5400.5. This Order sets annual dose standards to members of the public from routine DOE operations of 100 mrem through all exposure pathways. The Order requires that no member of the public receives an effective dose equivalent (EDE) in a year greater than 10 mrem from airborne emissions of radionuclides and 4 mrem from ingestion of drinking water. In addition, the dose requirements in the *National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities* (40 CFR Part 61, Subpart H) limit exposure to the MEI of the public from all air emissions to 10 mrem per year.

The dose received by the hypothetical MEI for Y-12 under the No Action Alternative was calculated to be 0.15 mrem based on both monitored and estimated emissions data (DOE 2008). This dose would be well below the NESHAP standard of 10 mrem for protection of the public (DOE 2008). The major radionuclide emissions from Y-12 are U-234, U-235, U-236, and U-238. The total dose to the population residing within 50 miles of ORR during 2007 (approximately 1,040,041 people) from Y-12 air emissions under the No Action Alternative was calculated to be about 1.5 person-rem (DOE 2008). For the Upgrade in-Place Alternative, the radiological airborne emissions and resulting impacts from upgraded EU facilities would remain unchanged from the No Action Alternative.

Although the design for a UPF is not completed, it is anticipated that implementation of the UPF Alternative would reduce the airborne emissions concentrations for Y-12 from those under the No Action Alternative and Upgrade-in Place Alternative. NNSA has estimated that uranium emissions from the UPF would be reduced by approximately 30 percent compared to the No Action Alternative. Under the Capability-sized UPF Alternative and the No Net Production/Capability-sized UPF Alternative, activities that release radiological emissions would be reduced, resulting in lower emission levels relative to the No Action Alternative. NNSA estimates that uranium emissions would decrease by approximately 40 percent for the Capability-sized UPF Alternative and approximately 50 percent for the No Net Production/Capability-sized UPF Alternative. The potential radiological doses and impacts to the MEI of the public and the population within 50 miles from Y-12 air emissions for all alternatives are presented in Tables 5.12.1.1–1 and 5.12.1.1-2.

Table 5.12.1.1-1. Annual Radiation Doses from Y-12 Air Emissions.

	Alternatives				
	No Action	**UPF**	**Upgrade in-Place**	**Capability-sized UPF**	**No Net Production/Capability-sized UPF**
Dose to the MEI (mrem/year)	0.15	0.1	0.15	0.09	0.08
Offsite Population Dose (person-rem/year) [ab]	1.5	1.0	1.5	1.0	0.8

[a] Population residing within 50 miles of ORR
[b] Based on total of airborne emissions and liquid effluents

Table 5.12.1.1-2. Annual Radiation Health Impacts from Y-12 Air Emissions.

	Alternatives				
	No Action	**UPF**	**Upgrade in-Place**	**Capability-sized UPF**	**No Net Production/Capability-sized UPF**
Latent Cancer Fatality to the MEI	9.0×10^{-8}	6.0×10^{-8}	9.0×10^{-8}	5.0×10^{-8}	4.0×10^{-8}
Latent Cancer Fatalities in the Offsite Population [ab]	0.0009	0.0006	0.0009	0.0005	0.0005

[a] Population residing within 50 miles of ORR.
[b] Based on total of airborne emissions and liquid effluents

For liquid effluents, the MEI dose to a member of the public from consumption of fish, drinking water, and participation in other water uses from the Clinch River would not be expected to change for all alternatives. For liquid effluents, the MEI dose to a member of the public would be approximately 0.006 mrem per year (DOE 2008). Statistically, an annual dose of 0.006 mrem would result in a latent cancer fatality (LCF) risk of 4.0×10^{-9}. The committed collective EDE to the population residing within a 50-mile radius of ORR from liquid effluents would be about 6.3 person-rem per year (DOE 2008). Statistically, a dose of 6.3 person-rem would result in 0.004 LCFs annually.

5.12.1.2 *Y-12 Worker Health Impacts*

Occupational radiation protection is regulated by the Occupational Radiation Protection Rule (10 CFR Part 835), which limits the occupational dose for an individual worker at 5,000 mrem per year. DOE/NNSA has set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material "as low as reasonable achievable" (ALARA). The worker radiation dose projected in this SWEIS is the total effective dose equivalent incurred by workers as a result of routine operations. This dose is the sum of the external whole body dose as monitored by personnel dosimeters, including dose from both photons and neutrons, and internal dose, as required by 10 CFR Part 835.

The projected health impacts to workers for major production operations under the No Action Alternative are presented in Table 5.12.1.2–1. These doses are based on the most recent data available (NNSA 2008b) and expected to be representative of doses for these operations under the No Action Alternative.

The 2007 Radiation Exposure and Monitoring System (REMS) 2007 Annual Report indicates that Y-12 personnel received a total internal dose of 49.4 person-rem. Statistically, this would result in 0.03 annual LCFs under the No Action Alternative. The Y-12 internal dose is spread across approximately 2,400 workers. About 10 percent of those workers account for about half the total exposure, mainly hands-on production and maintenance workers. None of the internal exposures exceeded the site's 1.0 rem administrative limit. The exposures ranged from 0 to 0.936 rem (REMS 2007, Gorman 2009).

The implementation of the UPF Alternative would decrease the number of radiation workers due to more efficient operations. NNSA has estimated that approximately 900 operating and maintenance (O&M) personnel would be required to conduct UPF operations, which represents a reduction of approximately 350 radiation workers (approximately 35 percent) compared to the current workforce. Operations in the UPF are also expected to improve worker radiation protection and NNSA estimates that the total dose to workers associated with the UPF operations would be approximately 21.1 person-rem. Statistically, a total dose of 21.1 person-rem would result in 0.013 annual LCFs to the UPF workforce (see Table 5.12.1.2-1).

For the Upgrade in-Place Alternative, there would be no change in either the number of radiation workers at Y-12 or the radiation dose compared to the No Action Alternative because the level and type of work is expected to be similar to current activities. All work would be conducted in full compliance with applicable health, safety, and environmental protection standards. Consequently, the potential health impacts for the Upgrade in-Place Alternative would be the same as the No Action Alternative.

Under the Capability-sized UPF Alternative, the number of radiation workers at Y-12 and the radiation dose would decrease with reduced workload. NNSA estimates that the monitored workforce at Y-12 would be 1,825 under this alternative. The total dose to the Y-12 monitored workforce would be 18.8 person-rem, which would equate to approximately 0.01 LCFs annually. The resulting radiation doses and projected health effects for all alternatives are presented in Table 5.12.1.2-1.

Table 5.12.1.2-1. Annual Radiation Doses and Health Impact to the Total Monitored Workers at Y-12 for the Alternatives.

	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized UPF Alternative	No Net Production/ Capability-sized UPF Alternative
Y-12 Monitored Workers	2,400	2,050 [a]	2,400	1,825[c]	1,600[d]
Average Individual Worker Dose (mrem)	20.6	10.3 [b]	20.6	10.3	10.3
Collective Worker Dose (person-rem)	49.4	21.1 [e]	49.4	18.8 [e]	16.5 [e]
Latent Cancer Fatalities	0.03	0.013	0.03	0.01	0.009

a - The total number of monitored workers at Y-12 for the UPF Alternative was derived by reducing the No Action Alternative workforce by 635 to reflect the reductions associated with more efficient operations in the UPF (less 235 workers) and other reductions (400 workers), including the consolidation of the Protected Area from 150 acres to 15 acres. Of these 635 fewer workers, 350 are "radiation workers".
b - Average dose for UPF assumes the internal dose is reduced by 50 percent.
c – Capability-sized UPF Alternative assumes an approximately 25 percent reduction in UPF personnel, which would reduce the total Y-12 monitored workers to 1,825 (see Section 3.2.4).
d – No Net Production/Capability-sized UPF Alternative assumes an approximately 33 percent reduction in UPF personnel, which would reduce the total Y-12 monitored workers to 1,600 (see Section 3.2.5).
e – After UPF becomes operational, NNSA has estimated that the total dose associated with Y-12 operations could be reduced to approximately 2 person-rem (Gorman 2009). For the bounding analysis, this SWEIS assumes the average worker dose would be reduced by 50 percent, but acknowledges that the dose could be even smaller.
Source: REMS 2007, Gorman 2009.

Under the No Net Production/Capability-sized UPF Alternative, the number of radiation workers at Y-12 and the radiation dose would decrease with reduced workload. NNSA estimates that the monitored workforce at Y-12 would be 1,600 under this alternative. The total dose to the Y-12 monitored workforce would be 16.5 person-rem, which would equate to approximately 0.009 LCFs annually. The resulting radiation doses and projected health effects for all alternatives are presented in Table 5.12.1.2-1.

5.12.2 Non-radiological Hazardous Chemical Impacts

Airborne emissions of chemicals used at Y-12 occur as a result of plant production, maintenance, waste management operations, and steam generation. Most process operations are served by ventilation systems that remove air contaminants from the workplace. Non-radionuclide emissions at Y-12 include chemical processing aids (hydrochloric and nitric acids), cleaning and cooling aids (methanol), refrigerants (Freon 11, 12, 22, 13, and 502), and emissions from the Y-12 Steam Plant (particulates, SO_2, carbon monoxide, VOCs, and NO_2). More than 90 percent of the pollutants emitted from Y-12 have been the result of the existing Y-12 Steam Plant operations. When the new Y-12 Steam Plant becomes operational, the emissions for all criteria pollutants except for VOCs and carbon monoxide are expected to decrease significantly from past levels. Chemical use at Y-12 would not vary significantly under any of the alternatives being considered in the SWEIS. Implementation of the Capability-sized UPF or No Net Production/Capability-sized UPF alternatives would result in reduced production of canned assemblies and other work currently conducted in existing EU facilities and therefore some reduction in chemical usage associated with those processes. Although there would be some reduction in chemical use under the Capability-sized UPF and No Net Production/Capability-sized UPF alternatives, the majority of the chemicals are used due to the production and daily clean-up resulting from the production of the first unit and the rest of the chemical usage is directly proportional to number of the units produced.

5.12.2.1 *Impacts to Workers*

Mercury. A study of mortality patterns of all workers employed at least 5 months at Y-12 between January 1, 1953, and April 30, 1958 was published in 1984 (Cragle et al. 1984). Mercury was used during this timeframe to produce enriched lithium. The group was divided into mercury-exposed and non-mercury-exposed by results of urinalysis supplied by the site. Vital status follow-up was complete through the end of 1978 and standard mortality ratios (SMRs) were calculated. There were no differences in mortality patterns for the mercury-exposed, when compared to the non-mercury exposed. Excesses of lung cancer mortality were observed in both groups of workers and were not related to the mercury exposure (exposed SMR=1.34; 42 observed, 31.36 expected; non-exposed SMR=1.34, 71 observed, 52.9 expected). The authors stated that mortality is not the optimal end point to assess mercury-related health effects.

Another study of mercury workers (Albers et al. 1988) assessed neurological function and mercury exposure. The clinical study examined 502 Y-12 workers, 247 of whom worked in the mercury process 20 to 35 years prior to the examination. Several correlations between increasing mercury exposure and declining neurological function were discovered. An exposure assessment was determined for each mercury worker during the time of employment in the mercury process. Workers with at least one urinalysis equal to or greater than 0.6 mg/L of mercury showed decreased strength, coordination, and sensation along with increased tremor and prevalence of Babinski and snout reflexes when compared to the 255 non-exposed workers. Clinical polyneuropathy was associated with the level of the highest exposure but not with the duration of exposure.

Under any of the alternatives considered in this SWEIS, exposure of Y-12 workers to mercury would remain at levels below those described above. Workplace controls would continue to be employed to further control the exposures to levels that comply with all applicable regulatory limits. Therefore, there would be no adverse impacts to Y-12 workers from exposure to mercury under any of the alternatives.

Beryllium. Because of the heightened sensitivity and awareness associated with worker exposure to beryllium, a detailed evaluation of the impact of exposure to beryllium is presented below.

Since the 1950s, processing beryllium metals and alloys has been an important part of the Y-12 mission. Beryllium materials have been used for research and development (R&D), testing, and manufacturing operations at multiple locations throughout the plant. Included in the beryllium operations have been melting and molding, grinding, and machine tooling of parts. Recent studies and experience with the manufacture of beryllium-containing compounds indicated a potential significant hazard to employees. As such, much emphasis has been placed on evaluating, communicating, and mitigating the health effects of occupational exposure to ensure worker protection and public safety.

Beryllium and beryllium compounds enter the environment as a result of the release and/or disposal of beryllium contaminated wastewater, dust, or a solid waste component. Once beryllium has been released to the environment, exposure to beryllium can occur by breathing air, eating food, or drinking water that contains beryllium. Dermal contact with metal containing beryllium or water containing dissolved beryllium salts will result in only a small fraction of the beryllium actually entering the body. A portion of beryllium dust breathed into the lungs will dissolve and eventually result in the transfer of the beryllium into the bloodstream; some may be transferred to the mouth then swallowed, and the rest will remain in the lungs for a long time. Of the beryllium ingested via contaminated foodstuffs or water, or swallowed subsequent to inhalation, about 1 percent will pass from the stomach and intestines into the bloodstream. Therefore, most of the beryllium that is swallowed leaves the body through the feces without entering the bloodstream. Of the beryllium that enters the bloodstream, some is routed to the kidneys and is eliminated from the body in urine. Some beryllium can also be carried by the blood to the liver and bones where it may remain for a long period of time. If beryllium is swallowed, it leaves the body in a few days. However, if beryllium is inhaled, it may take months to years before the body rids itself of beryllium.

As with any contaminant, the health effects resulting from exposure to beryllium are dependent on the exposure concentration, frequency and duration. Inhalation of large amounts of soluble beryllium compounds can result in acute beryllium disease. Acute beryllium disease results in lung damage that resembles pneumonia with reddening and swelling of the lungs. Lung damage may heal provided exposure does not continue, or the exposed individual may become sensitive to beryllium. The increased sensitivity of some individuals to beryllium results in an immune or inflammatory reaction when subsequent low level exposures occur. This condition is called chronic beryllium disease. This disease can occur long after exposure to either the soluble or the insoluble forms of beryllium. Studies linking exposure to beryllium or beryllium compounds with an increased incidence of cancer (in particular, lung cancer) have been performed on laboratory animals. However, these studies are not considered reliable predictors of human health effects and ongoing efforts are currently underway to evaluate workers who have been known to be exposed.

In 1997, DOE initiated an Interim Chronic Beryllium Disease Prevention Program. The purpose of the program was to enhance, supplement, and integrate a worker protection program to reduce the number of current workers exposed, minimize the levels of beryllium exposure and the potential for exposure to beryllium, and to establish medical surveillance protocols to ensure early detection of disease. In December of 1999, DOE published a final rule to establish the chronic beryllium disease prevention program that became effective on January 7, 2000 (10 CFR Part 850). The final rule establishes:

- An airborne beryllium concentration action level as 0.2 μg/m^3
- A requirement for employers to ensure that workers use respirators in areas where the concentration of beryllium is at or above the action level and to provide a respirator to any employee who requests one regardless of the concentration of airborne beryllium
- Criteria and requirements governing the release of beryllium-contaminated equipment and other items at DOE sites for use by other DOE facilities or the public
- Requirements for offering medical surveillance to any “beryllium-associated worker”
- Medical removal protection and multiple physician review provisions

Under any of the alternatives considered in this EIS, these requirements would continue to be employed to minimize the levels of beryllium exposure and the potential for exposure to beryllium. Therefore, adverse impacts to Y-12 workers from exposure to beryllium under any of the alternatives would be minimized to the extent practicable.

5.12.2.2 *Impacts to Members of the Public*

Mercury. The Y-12 ambient air monitoring program for mercury was established in 1986 as a best management practice. The objectives of the program have been to maintain a database of mercury concentration in ambient air, to identify long term spatial and temporal trends in ambient mercury vapor, and to demonstrate protection of the environment and human health from releases of mercury at Y-12 to the atmosphere. Originally, four monitoring stations were operated at Y-12, including two within the former mercury- use area. The two atmospheric mercury monitoring stations currently operating at Y-12 are located near the east and west boundaries of the complex, respectively. Since their establishment in 1986, these stations have monitored mercury in ambient air continuously with the exception of short periods of downtime because of electrical or equipment outages.

At the two monitoring sites, airborne mercury vapor is collected by pulling ambient air through a sampling train consisting of a Teflon filter, a flow-limiting orifice, and an iodated charcoal-filled sampling trap. The average concentration of mercury vapor in the ambient air for each 7-day sampling period is calculated by dividing the total quantity of mercury collected on the charcoal by the total volume of air pulled through the charcoal trap.

Table 5.12.2.2-1 summarizes the 2007 mercury results and the results from the 1986 through 1988 period for comparison. Annual average mercury concentrations during 2007 at the Y-12 east and west boundary monitoring stations are comparable to reference levels measured on Chestnut Ridge in 1988 and 1989 and approach values reported for continental background (DOE 2008). These concentrations are well below current environmental and occupational health standards for inhalation exposure to mercury vapor; for example, the National Institute for Occupational Safety and Health recommended exposure limit of 50 μg/m^3 (time weighted average for an 8-hour workday), the American Conference of Governmental Industrial Hygienists workplace threshold limit value of 25 μg/m^3 (time-weighted average for an 8- hour workday and 40-hour work week), the Agency for Toxic Substances and Disease Registry minimal risk level for inhalation exposure (0.2 μg/m^3), and the current EPA reference concentration for elemental mercury for daily inhalation exposure without appreciable risk of harmful effects during a lifetime (0.3 μg/m^3). Table 5.12.2.2-2 presents the hazard quotients (HQ), the ratio of the estimated exposure (e.g., daily intake rate) to be expected to have no adverse effects, calculated for each location and demonstrates that the measured concentrations are below (i.e., HQ < 1.0) both the threshold for continuous public and occupational exposure.

Although there would likely be some differences in the levels of mercury emissions among the alternatives, it is anticipated that these measured concentrations would continue to be consistently much lower than all applicable standards under any of the alternatives.

Table 5.12.2.2-1. Summary Results for the Y-12 Mercury in Ambient Air Monitoring Program during 2004.

Ambient air monitoring stations	Mercury Vapor Concentration ($\mu g/m^3$) 2007 Average	2007 Maximum	2007 Minimum	1986–1988[a] Average
AAS2 (east end of Y-12)	0.0036	0.0066	0.0010	0.010
AAS8 (west end of Y-12)	0.0057	0.0143	0.0017	0.033
Reference Site, Rain Gauge No.2 (1988[b])	N/A	N/A	N/A	0.006
Reference Site, Rain Gauge No.2 (1988[c])	N/A	N/A	N/A	0.005

Source: DOE 2008.
a – Period in late-80s with elevated ambient air Hg levels.
b – Data for period from February 9 through December 31, 1988.
c – Data for period from January 1 through October 31, 1989.

Table 5.12.2.2-2. Y-12 Maximum Boundary Chemical Hazard Quotients for Mercury.

Location	Maximum Vapor Concentration ($\mu g/m^3$)	Inhalation RfD – Chronic ($\mu g/m^3$)	Hazard Quotient
AAS2 (east end of Y-12)	0.0066	0.3	0.02
AAS8 (west end of Y-12)	0.0143	0.3	0.048

Fluorides. State of Tennessee regulation 1200-3-3-.01 does not define primary standards (affecting public health) for hydrogen fluoride. However, secondary standards (affecting public welfare, i.e., vegetation, aesthetics) are defined in 1200-3-3-.02 for gaseous fluorides expressed as hydrogen fluoride. In anticipation of the startup of the hydrogen fluoride system in EU Building during 2005, arrangements were made to monitor the community adjacent to Y-12 for the presence of fluorides. This monitoring capability, which began in November 2004, was added to the already existent Oak Ridge National Laboratory (ORNL) monitoring station used in NESHAP radionuclide monitoring for ORR.

Table 5.12.2.2-3 presents the annual maximum measured concentrations of HF in the Scarborough Community from the beginning of the monitoring program in November 2004 through 2007. The table also presents the regulatory secondary standard for the seven-day average (1.6 $\mu g/m^3$) and the hazard quotients calculated for the maximum concentrations. The hazard quotients demonstrate that the measured concentrations are below (i.e., Hazard Quotient <1.0) the thresholds for both continuous public and occupational exposures. It is anticipated that the measured concentrations would remain consistently low under any of the alternatives.

Table 5.12.2.2-3. Annual Maximum HF Measured as Fluorides (7-day average) in the Scarborough Community, 2004 through 2007.

Year	Maximum Measured Concentration ($\mu g/m^3$)	Standard ($\mu g/m^3$)	Hazard Quotient
2004	0.114[ab]	1.6	0.053
2005	0.102[a]	1.6	0.064
2006	0.048[a]	1.6	0.030
2007	0.048[a]	1.6	0.030

a Source: ORR Annual Site Environmental Reports for 2004 (DOE 2005a), 2005 (DOE 2006c), 2006 (DOE 2007b), and 2007 (DOE 2008).
b Monitoring began in November 2004. This result is based on a partial annual sampling cycle (8 weeks).

Beryllium. On September 16, 1996, Y-12 initiated a request to DOE to discontinue beryllium stack sampling on the basis that continuous sampling was not required for regulatory compliance at Y-12. The regulations required that the combined beryllium emissions for all beryllium sources be less than 10 grams over a 24-hour period. In addition, the regulations required that stack tests be conducted to determine emissions. This requirement was fulfilled for Y-12 in 1990 and 1991 when EPA Method 104 sampling, the regulatory required sampling, was conducted. Since that time and through 1996, beryllium stack sampling was conducted at Y-12 as a Best Management Practice (BMP). The BMP data indicated that combined emissions from monitored beryllium sources were less than one gram per year. With DOE concurrence, BMP sampling for the beryllium stacks was discontinued on October 1, 1996 (NNSA 2006b). A previous study of the potential human health effects of beryllium emissions from Y-12 showed that no adverse health impacts are associated with normal beryllium operations (DOE 2001a).

Other Chemicals. To evaluate the drinking water pathway, risk estimates for carcinogens (HQs) were estimated upstream and downstream of ORR discharge points. HQs were less than one for detected chemical analytes for which there are reference doses or maximum contaminant levels. Acceptable risk levels for carcinogens typically range from 10^{-4} to 10^{-6}. Chemicals in water can be accumulated by aquatic organisms that may be consumed by humans. To evaluate the potential health effects from the fish consumption pathway, HQs were estimated for the consumption of non-carcinogens, and risk values were estimated for the consumption of carcinogens detected in sunfish and catfish collected both upstream and downstream of ORR discharge points. For consumption of sunfish and catfish, HQ values of less than one were calculated for all detected analytes except for Aroclor-1260 at all three locations. For carcinogens in sunfish and catfish, risk values greater than 10^{-5} were calculated for the intake of arsenic and Aroclor-1260 collected at all three locations. TDEC issued a fish advisory for East Tennessee (see Table 5.12.2.2-4) (TDEC 2006).

Table 5.12.2.2-4. Current Fish Advisories.

Stream	County	Portion	Pollutant	Comments
East Tennessee				
Boone Reservoir	Sullivan, Washington	Entirety	PCB's chlordane	Precautionary advisory for carp and catfish.
Chattanooga Creek	Hamilton	Mouth to GA line	PCBs, chlordane	Fish should not be eaten. Avoid contact with water also.
E. Fork of Poplar Creek, incl. Poplar Creek embayment	Anderson, Roane	Mile 0.0-15.0	Mercury, PCBs	Fish should not be eaten. Avoid contact with water also.
Melton Hill Reservoir	Loudon, Knox, Blount	Entirety (46 miles)	PCBs	Commercial fishing for catfish prohibited by TWRA. Catfish, largemouth bass over two pounds, or any largemouth bass from the Little River embayment should not be eaten.
Nickajack Reservoir	Knox, Anderson	Entirety	PCBs	Catfish should not be eaten
N.Fork Holston River	Hamilton, Marion	Entirety	PCBs	Precautionary advisory for catfish.
Tellico Lake	Sullivan, Hawkins	Mile 0.0-6.2	Mercury	Fish should not be eaten. Advisory goes to TN/VA line.
Watts Bar Reservoir	Loudon, Monroe	Entirety	PCBs	Catfish should not be eaten.
Watts Bar Reservoir	Roaner, Meigs Rhea, Loundon	TN River portion	PCBs	Catfish, striped bass, and hybrid striped bass should not be eaten. Precautionary advisory for sauger, carp, smallmouth buffalo, white bass, and largemouth bass.
	Roane, Anderson	Clinch River arm	PCBs	Striped bass should not be eaten. Precautionary advisory for catfish and sauger.

Source: DOE 2008.

5.12.3 Worker Safety

The Y-12 worker non-fatal injury/illness rates for Federal, management and operating (M&O) contractor, site security, and subcontractor personnel were used to calculate the 4-year average (2005–2008) injury/illness rate per 100 workers (or 200,000 hours). These 4-year averages are expressed in terms of Total Recordable Cases (TRCs) and Days Away, Restricted or on Job Transfer (DART) (formerly Lost Workdays [LWDs]). At Y-12, from 2005 through 2008, there was an average of almost 116 TRCs and 3,571 DARTs each year (DOE 2009a). Dividing the TRCs each year by the total number hours worked and then multiplying by 200,000, the TRC Rate (TRCR) was obtained for each year and then the average TRCR was derived for the 4-year period. The average TRCR for Y-12 is 2.02; which means that 2.02 TRCs may be expected per 100 workers each year. Using a similar calculation for DARTs, the average DART Rate for Y-12 from 2005 through 2008 is 63.18 per 100 workers each year.

The 4-year average injury/illness rate was used to calculate the total number of Y-12 worker non-fatal injury/illness per year, assuming the 4-year average rate would remain constant. Table

5.12.3-1 presents the recordable cases of injuries that would be expected for the entire Y-12 workforce under each of the alternatives during operations.

During the 4-year averaging period there were no fatalities at Y-12, although there was one fatality reported for Oak Ridge Operations, which includes Y-12 (DOE 2009a). So, while the calculated annual fatality rate per 100 workers at Y-12 is zero, the calculated rate for Oak Ridge Operations is 0.00035 fatalities per year per 100 workers. Because there is always the potential for a worker fatality, Table 5.12.3-1 shows less than one worker fatality per year.

Table 5.12.3-1. Annual Calculated Nonfatal TRCs and DART for the Y-12 Workforce During Operations.

	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized UPF Alternative	No Net Production/ Capability-sized UPF Alternative
Number of Workers	6,500	5,950	6,500	3,900	3,400
Total Recordable Cases	131	120	131	79	69
DART	4,107	3,759	4,107	2,464	2,148
Fatalities	<1	<1	<1	<1	<1

During construction, the UPF would have the highest potential for occupational injuries due to the fact that the UPF would require the greatest construction workforce. For the total construction duration, approximately 2,900 worker-years would be required to construct the UPF. The TRCR for construction in the state of Tennessee during 2007 was 5.2 and the DART rate was 2.7 (BLS 2009). The worker fatality rate for construction in Tennessee during 2007 was 10.5 per 100,000 workers (BLS 2009a); that would be equivalent to 0.011 fatalities per 100 workers. Table 5.12.3-2 presents the TRC, DART, and worker fatality rates that would be expected based on statewide statistics during construction based on the largest applicable workforce for each alternative. It should be noted that the worker fatality record for Y-12 for construction is significantly better than for the state as a whole, given that there have been no construction-related fatalities during construction of the HEUMF.

Table 5.12.3-2. Annual Calculated Nonfatal TRCs and DART for the Y-12 Construction Workforce.

	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized UPF Alternative	No Net Production/ Capability-sized UPF Alternative
Number of Workers	0	950	300	850	850
Total Recordable Cases[a]	0	49	16	44	44
DART[a]	0	26	8	23	23
Fatalities[a]	0	0.105	0.033	0.093	0.093

[a] TRC, DART, and fatalities rates for construction in the state of Tennessee in 2007 were 5.2, 2.7, and 0.011, respectively (BLS 2009, BLS 2009a)

5.12.4 Potential Mitigation Measures

Radioactive and chemical airborne emissions to the general population and onsite exposures to workers could be reduced by using improved technologies related to process and design improvements. Each of the alternatives addressed in this SWEIS would provide varying opportunities to implement this mitigation. Under the No Action Alternative, implementing these technologies would be pursued within the limitations of existing facilities and other infrastructure. Implementation of the Upgrade in-Place Alternative would provide an opportunity for NNSA to make changes to facilities and infrastructure to use the majority of the latest technology for process and design improvements but would be somewhat limited by the use of existing, albeit upgraded, facilities. The UPF, Capability-sized UPF, and No Net Production/Capability-sized UPF Alternatives would allow full implementation of the latest technology for process and design improvements.

5.12.5 Summary Comparison of Alternative Impacts for Health and Safety

Under all of the alternatives there would be no adverse impacts to Y-12 workers from exposure to mercury and impacts from beryllium would be minimized. Although there would likely be some differences in the levels of mercury emissions among the alternatives, it is anticipated that these measured concentrations would continue to be consistently much lower than all applicable standards under any of the alternatives and there would be no impacts to members of the public. Based on the demonstrated hazard quotients for HF (i.e., Hazard Quotient <1.0) it is anticipated that the measured concentrations would remain consistently low under any of the alternatives and there would be no adverse impacts to the public.

No Action Alternative. Radiological impacts to workers and the public would occur. All radiation doses from normal operations would be below regulatory standards with no statistically significant impact on the health and safety of workers or public. The MEI dose would be expected to be 0.15 mrem per year (9.0×10^{-8} LCFs). The population dose would be expected to be 25.8 person-rem per year (0.015 LCFs). The total worker dose would be expected to be 49.4 person-rem per year (0.03 LCFs). Worker safety impacts would likely continue at their current rates, i.e., 131 TRCs, 4,107 DARTs, and significantly less than one fatality each year. There would be no worker safety impacts for new construction under the No Action Alternative.

UPF Alternative. MEI and Population dose would be same as No Action Alternative. There would be an expected reduction in radiological impacts to workers due to more efficient operations in a modern facility. The total worker dose would be expected to be 21.1 person-rem per year (0.013 LCFs). Worker safety impacts would be expected to be less than the No Action Alternative, i.e., 120 TRCs, 3,759 DARTs, and significantly less than one fatality per year. In addition, construction of the UPF and CCC would likely result in about 49 TRCs, 26 DARTs, and 0.105 fatalities during the peak year of construction.

Upgrade in-Place Alternative. Radiological and worker safety impacts would be about the same as the No Action Alternative. Construction under the Upgrade in-Place Alternative would result in about 16 TRCs, 8 DARTs, and 0.033 worker fatalities during the peak year of construction.

Capability-sized UPF Alternative. There would be an expected 50 percent reduction in radiological emissions, which would reduce MEI and population dose. The MEI dose would be expected to be 0.08 mrem per year (5×10^{-8} LCFs). The population dose would be expected to be 10 person-rem per year (6.0×10^{-3} LCFs). The total worker dose would be expected to be 18.8 person-rem per year (0.01 LCFs). Worker safety impacts would be expected to be less than under either the No Action, UPF, or Upgrade in-Place alternatives. Under the Capability-sized UPF Alternative, operations at Y-12 would be expected to result in about 79 TRCs, 2,464 DARTS, and significantly less than one worker fatality per year. Construction of the Capability-sized UPF and CCC would result in about 44 TRCs, 23 DARTs, and 0.093 worker fatalities during the peak year of construction.

No Net Production/Capability-sized UPF Alternative. There would be an expected 80 percent reduction in radiological emissions, which would reduce MEI and population dose. The MEI dose would be expected to be 0.0016 mrem per year (1×10^{-8} LCFs). The population dose would be expected to be 2 person-rem per year (1.2×10^{-3} LCFs). The total worker dose would be expected to be 16.5 person-rem per year (0.009 LCFs). Operations under the No Net Production/Capability-sized UPF Alternative would be expected to result in lower worker safety impacts than any of the other alternatives. Operational worker safety impacts would be about 69 TRCs, 2,148 DARTs, and significantly less than one worker fatality per year. Worker safety impacts from construction of the No Net Production/Capability-sized UPF and CCC would be the same as the Capability-sized UPF Alternative.

5.13 WASTE MANAGEMENT

Waste streams currently generated at Y-12 may be broadly grouped to include: LLW, mixed-LLW (MLLW), hazardous waste, and sanitary/industrial (nonhazardous) waste. These waste streams would continue to be generated by implementation of each of the alternatives, however, quantities and relative proportions of the waste would vary by alternative. Wastes generated during routine operations are discussed for all the alternatives. Table 5.13-1 provides a comparison of the waste volumes anticipated to be generated by the alternatives during construction and Table 5.13-2 provides a comparison of estimated Y-12 annual waste volumes during routine operations.

Table 5.13-1. Summary of Annual Waste Generation during Construction at Y-12 by Alternative.

Waste Type	No Action[a]	UPF	Upgrade in-Place	Capability-sized UPF	No Net Production/ Capability-sized UPF
LLW Liquid (gal.)	713	None	None	None	None
LLW Solid (yd^3)	9,405	70	None	63	63
Mixed LLW Liquid (gal)	1,096	None	None	None	None
Mixed LLW Solid (yd^3)	126	None	None	None	None
Hazardous (tons)	12	4	None	3.6	3.6
Nonhazardous Sanitary (tons)	10,374	800	400	720	720

Source: Jackson 2008.

a No Action waste volumes are the 2007 baseline. The waste volumes for the action alternatives represent only the estimated amount of waste that would be generated during each year of construction.

Table 5.13-2. Summary of Annual Waste Generation during Routine Operations at Y-12 by Alternative.

Waste Type	No Action[a]	UPF	Upgrade in-Place	Capability-sized UPF	No Net Production/ Capability-sized UPF
LLW Liquid (gal)	713	476	713	428	403
LLW Solid (yd^3)	9,405	5,943	9,405	5,643	5,314
Mixed LLW Liquid (gal)	1,096	679	1,096	640	619
Mixed LLW Solid (yd^3)	126	81	126	76	71
Hazardous (tons)	12	12	12	7.2	7.2
Nonhazardous Sanitary (tons)	10,374	9,337	10,374	6,224	5,705

Source: Jackson 2008.

Some wastes generated by Y-12 activities are not specifically assessed in the analysis in this section. For example, as part of the environmental cleanup strategic planning, DOE and NNSA are developing an IFDP. The IFDP is a strategic plan for disposing of legacy materials and facilities at ORNL and Y-12 that uses an integrated approach. Under the IFDP, the D&D of approximately 112 facilities at ORNL and 19 facilities at Y-12, and the remediation of soil and groundwater contamination at Y-12, would occur over the next 30 to 40 years. Per agreement among DOE, the State of Tennessee and the EPA, D&D of facilities on ORR will be primarily addressed as removal actions through the CERCLA process because facilities are often contaminated and present a risk to human health and the environment. This agreement allows DOE and the regulators to prioritize D&D of these facilities based on the level of risk posed by the facility and available funding. Waste generated by D&D of these surplus facilities is addressed through the CERCLA process. CERCLA waste streams are included in a discussion of cumulative impacts in Chapter 6.

As discussed in Section 4.13.5, wastes containing residual radioactive materials below approved authorized limits are currently disposed of at the onsite sanitary/industrial landfill and construction/demolition landfills. Potential radiological impacts to onsite workers and offsite members of the public must be evaluated during the development of such authorized limits per DOE Order 5400.5 and associated guidance. Requirements for the approval of authorized limits for any specified waste stream at these facilities include analyses demonstrating that: (1) the potential radiation dose to workers or the public would be as far below 25 mrem per year as reasonably achievable (and typically below 1 mrem per year); (2) groundwater would be protected in accordance with the Site Groundwater Protection Program and applicable Federal and state regulations (40 CFR Part 131.11 and Rules of the TDEC Chapter 1200-4-3); and (3) any future release of the landfill property would not be expected to require future remediation under DOE Order 5400.5 requirements. These requirements are designed to provide reasonable assurance that potential radiological impacts from residual radioactive materials below authorized limits at these facilities would be negligible.

Implementation of any alternative could result in the potential for future D&D impacts. The potential impacts from D&D are addressed in Section 5.16 of this SWEIS. D&D can range from performing a simple radiological survey to completely dismantling and removing a radioactively contaminated facility. The potential reuse of a facility or the outcome of its disposition must be known to predict waste volumes for its D&D, but could be conservatively bounded by a demolition scenario and discussed on a relative basis.

5.13.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, Y-12 would continue to generate and manage wastes, at levels similar to those in 2007 (see Table 5.13-1). MLLW and LLW in solid form are currently stored onsite pending treatment and storage. Disposal of radioactive waste generated at Y-12 has been restricted by either a lack of onsite facilities or by administrative barriers to approval of transporting and disposing of radioactive waste off site since onsite disposal ceased in the 1980s. As a result, significant quantities of LLW and MLLW have accumulated in storage at Y-12. Quantities of accumulated, legacy MLLW and LLW are being shipped off site for treatment and disposal because some approvals have been obtained to use existing DOE or licensed-commercial facilities. As of June 2005, the inventory of legacy LLW on ORR was about 7,455 cubic yards. Since the beginning of FY 2005, DOE has reduced its legacy LLW inventory by about 80 percent. During FY 2003, over 150 metric tons of depleted uranium-alloyed metal waste was shipped to the NTS for disposal. An additional 300 metric tons of depleted uranium was shipped during FY 2004 (NNSA 2005c). DOE must meet milestones to disposition MLLW as set forth in an ORR Site Treatment Plan for Mixed Waste as mandated by a State Commissioner's Order and to comply with the Federal Facilities Compliance Act (FFCA). Liquid LLW and MLLW are either treated on site and disposed of, or treated and subsequently managed as solids.

DOE issued a ROD covering treatment and disposal of MLLW and LLW (65 FR 10061, February 25, 2000) as one of a series of RODs for the Waste Management PEIS. In the ROD, DOE decided to continue minimum treatment of LLW generated at ORR onsite and dispose of the LLW at the NTS. For management of MLLW, DOE decided to treat the MLLW generated at ORR onsite and dispose of the mixed LLW at the NTS. Adverse impacts related to storage of legacy MLLW and LLW are expected to be reduced as the goals for legacy waste set forth under the Site Treatment Plan and the ROD are met.

No new adverse impacts to the environment are anticipated from the generation of hazardous and sanitary/industrial waste by continuing current operations at No Action levels. RCRA-permitted units for the storage and treatment of hazardous waste would continue to operate in support of routine operations at Y-12. Adequate permitted and approved offsite facilities are available to meet any additional treatment requirements and for disposal of the hazardous waste. Sanitary and process waste liquids would continue to be treated by the city of Oak Ridge sewage treatment plant or Y-12 treatment facilities. Current facilities have a combined capacity to handle approximately 10 times the waste volumes generated by current operations. The resultant solids would be disposed of with other nonhazardous waste in existing, permitted landfills with an adequate capacity to handle projected waste volumes. Landfill V, a sanitary/industrial landfill at Y-12, would continue to accept general refuse and asbestos, medical (non-infectious), and other special waste as approved on a case-by-case basis by the state regulatory authorities. Landfill VII is permitted for disposal of construction and demolition waste and has ample disposal capacity for well beyond the 10-year planning period.

5.13.2 Alternative 2 – Uranium Processing Facility Alternative

Construction. Under the UPF Alternative, waste generated during construction would be minimal with respect to the waste production of the entire Y-12. During the construction phase period, LLW would increase by a total of 70 cubic yards per year, which is less than 1 percent of the LLW currently generated annually at Y-12. There would be no increase in MLLW. Hazardous wastes would increase by approximately four tons or 34 percent per year during construction, but would not exceed waste disposal capabilities. Nonhazardous sanitary wastes would increase by approximately 800 tons, or about 7 percent, as a result of the additional construction workforce required for the UPF. Sanitary wastes would continue to be treated by the city of Oak Ridge sewage treatment plant or Y-12 treatment facilities. The current facilities have a combined capacity to handle approximately 10 times the waste volumes generated by current operations.

Operation. Under the UPF alternative, waste generation would be reduced compared to the No Action Alternative operations, as shown in Table 5.13-2. This is due to the increased efficiency associated with UPF operations in a modern facility. Because employment would decrease by approximately 10 percent once the UPF becomes operational, nonhazardous sanitary wastes would be expected to decrease from 10,374 tons per year by approximately 10 percent to 9,337 tons per year.

5.13.3 Alternative 3 – Upgrade in-Place Alternative

Under this alternative, NNSA would upgrade the existing EU and other processing facilities to contemporary environmental, safety, and security standards to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations. NNSA would also construct the CCC. Compared to the No Action Alternative, no significant changes in waste quantities are expected from these upgrades, either during construction or operation, except for non-hazardous sanitary waste, which would increase by 400 tons per year during the construction phase.

5.13.4 Alternative 4 – Capability-sized UPF Alternative

Construction. The Capability-sized UPF Alternative, described in Section 3.2.4, would include construction and operation of a UPF and the CCC. The Capability-sized UPF would be about 10 percent smaller than the UPF described in Alternative 2. Therefore, for purposes of this SWEIS, waste generated during construction of the Capability-sized UPF would be expected to be about 10 percent less than the UPF in Alternative 2, as shown in Table 5.13-1

Operations. During operation of the Capability-sized UPF and the CCC under this alternative, generation of LLW and MLLW would decrease compared to the No Action Alternative due to the reduction in operations. Annual volumes of solid LLW generation would be about 5,643 cubic yards, a decrease of 3,762 cubic yards from the No Action Alternative. Liquid LLW volumes would be about 285 gallons less each year. Generation of solid MLLW would decline by about 50 cubic yards and liquid mixed LLW would decline by about 456 gallons per year.

Comparable decreases in other waste streams are also expected due to reduced operations and reduced employment under the Capability-Sized UPF Alternative.

5.13.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Construction. Waste Generation during construction of the No Net Production/Capability-sized UPF and the CCC, would be the same as the Capability-sized UPF.

Operations. During operation of the No Net Production/Capability-sized UPF and the CCC LLW and MLLW would decrease compared to the No Action Alternative. Annual volumes of solid LLW would be about 5,314 cubic yards or 4,091 cubic yards less each year than the No Action Alternative. Liquid LLW volumes would be about 310 gallons less each year. Solid MLLW generation would be about 71 cubic yards, a decrease of 55 cubic yards. Liquid mixed LLW would decline by about 477 gallons per year. Comparable decreases in other waste streams are also expected due to reduced operations and reduced employment under the No Net Production/Capability-sized UPF Alternative.

5.13.6 Potential Mitigation Measures

Waste generation projects would not exceed waste treatment and disposal capacities for any alternative. To minimize wastes, Y-12 would continue to implement pollution prevention and waste minimization initiatives, as discussed in Section 4.13.6.

5.13.7 Summary Comparison of Alternative Impacts for Waste Management

No Action Alternative. Although the volume of any waste type generation may vary from year to year, it is estimated for purposes of this SWEIS that future waste generation at Y-12 under the No Action Alternative would continue to approximate the 2007 baseline displayed in Table 5.13-1.

UPF Alternative. Under the UPF Alternative, during construction of the UPF and CCC there would be modest increases in annual generation of solid LLW (70 cubic yards), hazardous waste (4 tons), and nonhazardous sanitary waste (800 tons). Once the UPF became operational nonhazardous sanitary waste generation at Y-12 would be somewhat lower than under No Action. Generation of all other waste types would also be less than No Action.

Upgrade in-Place Alternative. During construction, under the Upgrade in-Place Alternative, only nonhazardous sanitary waste generation would increase by about 400 tons. Generation of all categories of waste would be the same as the No Action Alternative once the upgraded facilities become operational.

Capability–sized UPF Alternative. Construction of the Capability-sized UPF would cause a slightly smaller increase than the UPF Alternative in the generation at Y-12 of solid LLW (63 cubic yards), hazardous waste (3.6 tons), and nonhazardous sanitary waste (720 tons). Operation of the Capability-sized UPF would result in total Y-12 waste volumes being substantially less than under the No Action Alternative i.e., solid LLW 5,643 cubic yards, liquid

LLW 428 gallons, solid mixed LLW 76 cubic yards, liquid mixed LLW 640 gallons, hazardous waste 7.2 tons, and nonhazardous sanitary waste 6,224 tons.

No Net Production/Capability-sized UPF Alternative. Under this alternative, generation of waste during construction would be the same as the Capability-sized UPF Alternative. Waste generation at Y-12 would be slightly less for the No Net Production/Capability-sized UPF during operations than for the Capability-sized UPF i.e., solid LLW 5,314 cubic yards, liquid LLW 403 gallons, solid mixed LLW 71 cubic yards, liquid mixed LLW 619 gallons, hazardous waste 7.2 tons, and nonhazardous sanitary waste 5,705 tons.

5.14 ACCIDENTS

NEPA requires that an agency evaluate reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement. This section of the SWEIS informs the decision maker and the public about the chances that reasonably foreseeable accidents associated with the proposed action and alternatives could occur, and their potential adverse consequences. An accident is considered bounding if no reasonably foreseeable accident can be found with greater consequences. An accident is reasonably foreseeable if the analysis of occurrence is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason (40 CFR Part 1502.22[b][4]).

This section presents the potential impacts on workers (both involved and noninvolved) and the public due to potential accidents associated with operation of Y-12. Additional details supporting the information presented here are provided in Appendix D.

An accident is a sequence of one or more unplanned events with potential outcomes that endanger the health and safety of workers and the public. An accident can involve a combined release of energy and hazardous materials (radiological or chemical) that might cause prompt or latent health effects. The sequence usually begins with an initiating event, such as a human error, equipment failure, or earthquake, followed by a succession of other events that could be dependent or independent of the initial event, which dictates the accident's progression and the extent of materials released. Initiating events fall into three categories:

- *Internal initiators* normally originate in and around the facility, but are always a result of facility operations. Examples include equipment or structural failures and human errors.
- *External initiators* are independent of facility operations and normally originate from outside the facility. Some external initiators affect the ability of the facility to maintain its confinement of hazardous materials because of potential structural damage. Examples include aircraft crashes, vehicle crashes, nearby explosions, and toxic chemical releases at nearby facilities that affect worker performance.
- *Natural phenomena initiators* are natural occurrences that are independent of facility operations and occurrences at nearby facilities or operations. Examples include earthquakes, high winds, floods, lightning, and snow. Natural phenomena can cause accidents to, and within, facilities and compound the progression of an accident.

If an accident were to occur involving the release of radioactive or chemical materials, workers, members of the public, and the environment would be at risk. Workers in the facility where the accident occurs would be particularly vulnerable to the adverse effects of the accident because of their proximity. The non-involved workers and the offsite public would also be at risk of exposure to the extent that meteorological conditions exist for the atmospheric dispersion of released hazardous materials. Using approved computer models, NNSA predicted the dispersion of released hazardous materials and their effects. However, prediction of latent potential health effects becomes increasingly difficult to quantify for facility workers as the distance between the accident location and the worker decreases. This is because the individual worker exposure cannot be precisely defined with respect to the presence of shielding and other protective features. For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

Most of the accidents analyzed in this SWEIS do not vary by alternative because the same facilities are potentially involved in the accidents and subsequent consequences; therefore, this SWEIS presents first the accident analysis that pertains to all the alternatives. A section is also included which discusses the consideration of accidents unique to the other alternatives compared to the No Action Alternative.

5.14.1 Radiological Accident Scenarios

5.14.1.1 *Methodology*

Selection Process. The selection process for radiological accident scenarios used a multistep screening process to identify bounding events. For accidents associated with specific Y-12 facilities, the screening process began with a review of all Y-12 facilities with emphasis on building hazard classification, radionuclide inventories, including type, quantity, and physical form, and storage and use conditions.

For each of these facilities, the next step was to identify the most current documentation describing and quantifying the risks associated with its operation. Current safety documentation was obtained for all of these facilities. From these documents, the next step was to identify potential accident scenarios and source terms (release rates and frequencies) associated with those facilities. Table D.9.3-1 in Appendix D lists the results of this process and serves as the basis for the subsequent consequence analysis described below.

Consequence Analysis. Consequences of accidental radiological releases were determined using the MELCOR Accident Consequence Code Systems 2 (MACCS2) computer code (Chanin and Young 1998). MACCS2 is a DOE/Nuclear Regulatory Commission (NRC)-sponsored computer code that has been widely used in support of probabilistic risk assessments for the nuclear power industry and in support of safety and NEPA documentation for facilities throughout the DOE complex. The MACCS2 computer code includes as part of the analysis groundshine and food pathway exposures.

Because of assumptions used in this SWEIS analysis, not all of the code's capabilities were used. It was conservatively assumed that no special actions would be taken to avoid or mitigate exposure to the general population following an accidental release of radionuclides. For example, there would be no evacuation or protection of the surrounding population nor would there be interdiction to prevent ingestion of food grown downwind of the release. Another conservative assumption was that wet and dry depositions of all radioactive material were set to zero for individual receptors (maximally exposed individual and non-involved worker). These receptors are exposed for the duration of the release; suppressing deposition increases inhalation dose (increasing negative health effects) by keeping the radioactive material airborne (rather than depleting the plume by deposition) and available for inhalation.

NNSA estimated radiological impacts to three receptors: (1) the maximally exposed individual at the Y-12 boundary, (2) a non-involved worker approximately 3,300 feet from the accident location, and (3) the offsite population within 50 miles of Y-12. Because all alternatives would perform similar operations, bounding results are presented for all alternatives. Section 5.14.3 discusses qualitative differences among the alternatives.

DOE "Recommendations for Analyzing Accidents Under the National Environmental Policy Act," July 2002, states that "it would be appropriate to estimate and present accident consequences for both median conditions and unfavorable conditions." Because of the lack of specific design information for new facilities, this SWEIS uses a conservative approach and presents impacts for the unfavorable conditions. Additional analysis of median conditions would not have produced meaningful information to help make decisions based on this SWEIS.

Results. The accident with the highest potential consequences to the offsite population (see Table 5.14.1-1) is the aircraft crash into the EU facilities (HEUMF and UPF). Approximately 0.4 LCFs in the offsite population could result from such an accident in the absence of mitigation. An offsite MEI would receive a maximum dose of 0.3 rem. Statistically, this MEI would have a 2×10^{-4} chance of developing a LCF, or about 1 in 5,000. This accident has a probability of occurring approximately once every 100,000 years. When probabilities are taken into account (see Table 5.14.1-2), the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be 4.4×10^{-7}, or about 1 in 2 million. For the population, the LCF risk would be 4.0×10^{-4}, or about 1 in 2,500.

Table 5.14.1-1. Radiological Accident Frequency and Consequences: All Alternatives.

Accident		Maximally Exposed Individual [a]		Offsite Population [b]		Noninvolved Worker [c]	
	Frequency (per year)	Dose (rem)	Latent Cancer Fatalities[d]	Dose (Person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[d]
Major fire	$10^{-4} – 10^{-6}$	0.59	0.00036	520	0.31	16.3	0.0098
Explosion	$10^{-4} – 10^{-6}$	0.058	0.000035	51.2	0.031	1.18	0.00071
Fire in UPF Warehouse	$10^{-4} – 10^{-6}$	0.69	0.00041	608	0.36	17.4	0.010
Design-basis fires for HEU Storage [d]	$10^{-2} – 10^{-4}$	0.073	0.000044	66.1	0.04	1.08	0.00065
Aircraft crash	$10^{-4} – 10^{-6}$	0.3	0.0002	665	0.4	0.39	0.00023

Source: Tetra Tech 2008.
a – At site boundary, approximately 1.3 miles from release.
b – Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.
c – At approximately 3,300 feet from release.
d – The conversion factor used for dose to latent cancer fatalities is 0.0006; any discrepancies are due to rounding.
[d] - The accident analysis includes accidents for all major facilities/operations at Y-12. Impacts are addressed for UPF, HEUMF, EU processing facilities, and other facilities (see Appendix D (Section D.9.3). A design basis fire in EU facilities (including the UPF) is included in Table D.9.3-1. However, the source term for this accident is less than that of the HEU Storage Facility, which is presented in the table above.

Table 5.14.1-2. Annual Cancer Risks: All Alternatives.

Accident	Maximally Exposed Individual [a]	Offsite Population[b]	Noninvolved Worker [c]
Major fire	3.6×10^{-8}	3.1×10^{-5}	9.8×10^{-7}
Explosion	3.5×10^{-9}	3.1×10^{-6}	7.1×10^{-8}
Fire in UPF Warehouse	4.1×10^{-8}	3.6×10^{-5}	1.0×10^{-6}
Design-basis fires for HEU Storage [d]	4.4×10^{-7}	4.0×10^{-4}	6.5×10^{-6}
Aircraft crash	2.0×10^{-8}	4.0×10^{-5}	2.3×10^{-8}

Source: Tetra Tech 2008.
a – At site boundary, approximately 1.3 miles from release.
b – Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.
c – At approximately 3,300 feet from release.
d -- The accident analysis includes accidents for all major facilities/operations at Y-12. Impacts are addressed for UPF, HEUMF, EU processing facilities, and other facilities (see Appendix D (Section D.9.3). A design basis fire in EU facilities (including the UPF) is included; however, the source term for this accident is less than that of the HEU Storage Facility, which is presented in the table above.

5.14.2 Chemical Accident Scenarios

Under all alternatives, Y-12 would store and use a variety of hazardous chemicals. The quantities of chemicals vary, ranging from small amounts in individual laboratories to bulk amounts in processes and specially designed storage areas. In addition, the effects of chemical exposure on personnel would depend upon its characteristics and could range from minor to fatal. Minor accidents within a laboratory room, such as a spill, could result in injury to workers in the immediate vicinity. A catastrophic accident such as a large uncontrolled fire, explosion, earthquake, or aircraft crash could have the potential for more serious impacts to workers and the public.

The adverse effects of exposure vary greatly among chemicals. They range from physical discomfort and skin irritation to respiratory tract tissue damage and, at the extreme, death. For this reason, allowable exposure levels differ from substance to substance. For this analysis, Emergency Response Planning Guideline (ERPG) values are used to develop hazard indices for chemical exposures. ERPG definitions are provided below.

ERPG DEFINITIONS

ERPG-1 *is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.*

ERPG-2 *is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.*

ERPG-3 *is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.*

As required by DOE Order 151.1B, NNSA estimated the impacts of the potential releases of the most hazardous chemicals used at Y-12. Potential chemical accidents used in this SWEIS were obtained from review of the Y-12 chemical accident scenarios reported in previous NEPA documents. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical's hazard. Determination of a chemical's hazardous ranking takes into account quantities available for release, protective concentration limits (ERPG-2) and evaporation rate. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. The chemical analyzed for release was nitric acid.

DOE "Recommendations for Analyzing Accidents Under the National Environmental Policy Act," July 2002, states that "it would be appropriate to estimate and present accident consequences for both median conditions and unfavorable conditions." Because of the lack of specific design information for new facilities, this SWEIS uses a conservative approach and presents impacts for the unfavorable conditions. Additional analysis of median conditions would not have produced meaningful information to help make decisions based on this SWEIS.

Both Gaussian Plume and Aerial Locations of Hazardous Atmospheres (ALOHA) methodologies were used to evaluate the potential consequences associated with a release of each chemical in an accident situation. Table 5.14.2-1 shows the consequences of the dominant loss of containment accident scenario. The impacts of a nitric acid release are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at approximately 3,300 feet from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of a chemical release over the period of one-hour was developed based on accident analysis used for the Complex Transformation SPEIS. This model was based on a spill and a subsequent pool with evaporation and the resulting down-wind concentrations calculated.

Table 5.14.2-1. Chemical Accident Frequency and Consequences: All Alternatives.

Chemical Released	Quantity Released (lbs)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (ft)	At 3,300 ft (ppm)	At Site Boundary (ppm) [a]	
Nitric acid	23,148	6	919	0.5	0.01	10^{-4}

Source: Tetra Tech 2008.
a – Site boundary is at a distance of approximately 1.3 miles.

5.14.3 Accidents for the UPF Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative and No Net Production/Capability-sized UPF Alternative Compared to the No Action Alternative

The UPF Alternative would decrease the overall Y-12 facility accident risks presented above. This is because many of the operations and materials in the existing Y-12 nuclear facilities would be consolidated into the UPF, reducing the accident risks associated with those older facilities. However, detailed design descriptions for the UPF are not available. Without these detailed descriptions, this reduction in accident risks cannot be quantified. New facilities such as the UPF would be constructed to current building design standards and would be designed and built to withstand higher seismic accelerations and thus would be more resistant to earthquake damage. These new facilities would experience damage from earthquakes and other external initiators less frequently. Also, controls would be incorporated into the design of new Y-12 facilities to reduce the frequency and consequence of internally initiated accidents. Therefore, the risks presented above for the current Y-12 facilities (both individually and additive) would be bounding for the UPF.

Under the Upgrade in-Place Alternative, the overall Y-12 facility accident risks would also decrease. This is because the existing enriched uranium and nonnuclear processing facilities would be upgraded to contemporary environmental, safety, and security standards to the extent possible. The upgrade projects would include upgrade of a number of building structures to comply with current natural phenomena criteria. Existing fire protection systems for many of the enriched uranium facilities would also be replaced. All of these actions would have the effect of reducing the frequency and consequences of the accident scenarios presented above.

Under the Capability-sized UPF, and No Net Production/Capability-sized UPF alternatives, the discussion pertaining to the UPF Alternative would also be applicable. In addition, operations of some Y-12 facilities would be reduced under these two alternatives. As a result, accident consequences and risks associated with some operations could decrease. However, since facilities would not be de-inventoried (i.e., the amount of material present in the facilities might not change), many of the accidents and their consequences would still be valid under reduced operations.

5.14.4 Malevolent, Terrorist, or Intentional Destructive Acts

NNSA has prepared a classified appendix to this SWEIS that evaluates the potential impacts of malevolent, terrorist, or intentional destructive acts. Substantive details of terrorist attack scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Appendix E (Section E.2.14) discusses the methodology used to evaluate potential impacts associated with a terrorist threat and the methodology by which NNSA assesses the vulnerability of its sites to terrorist threats and then designs its response systems. As discussed in that section, NNSA's strategy for the mitigation of environmental impacts resulting from extreme events, including intentional destructive acts, has three distinct components: (1) prevent or deter successful attacks; (2) plan and provide timely and adequate response to emergency situations; and (3) progressive recovery through long term response in the form of monitoring, remediation, and support for affected communities and their environment.

Depending on the intentional destructive acts, impacts would be similar to or exceed the impacts of accidents analyzed in the SWEIS. These analyses provide NNSA with information upon which to base, in part, decisions regarding transformation of the Complex. The classified appendix evaluates several scenarios involving intentional destructive acts for alternatives at Y-12 and calculates consequences to the noninvolved worker, MEI, and population in terms of physical injuries, radiation doses, and LCFs. Although the results of the analyses cannot be disclosed, the following general conclusion can be drawn: the potential consequences of intentional destructive acts are highly dependent upon distance to the site boundary and size of the surrounding population, the closer and higher the surrounding population, the higher the consequences. In addition, it is generally easier and more cost-effective to protect new facilities, as new security features can be incorporated into their design. In other words, protection forces needed to defend new facilities may be smaller due to the inherent security features of a new facility. New facilities can, as a result of design features, better prevent attacks and reduce the impacts of attacks.

5.14.5 Summary Comparison of Alternative Impacts Facility Accidents

No Action Alternative. For consequences, the bounding accident is an aircraft crash into the EU facilities. Approximately 0.4 LCFs in the offsite population could result from such an accident. The MEI dose from such an accident would be expected to be 0.3 rem. The MEI LCF risk would be expected to be a 2×10^{-4} chance of developing a LCF, or about 1 in 5,000. When probabilities are taken into consideration, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be expected to be 4.4×10^{-7}, or about 1 in 2 million. For the population, the LCF risk would be 3.97×10^{-4}, or about 1 in 2,500.

UPF Alternative. No greater impacts than the No Action Alternative would be expected. Accident risks would likely decrease compared to the No Action Alternative, because many of the operations and materials in the existing Y-12 nuclear facilities would be consolidated into the UPF. This consolidation would reduce the accident risks associated with these older facilities.

Upgrade in-Place Alternative. No greater impacts than the No Action Alternative would be expected. Accident risks would likely decrease compared to the No Action Alternative because the existing EU facilities would be upgraded to contemporary environmental, safety, and security standards, to the extent possible.

Capability-sized UPF Alternative and No Net Production/Capability-sized UPF Alternative. No greater impacts than the No Action Alternative would be expected. Because facilities would not be de-inventoried (i.e., the amount of material present in the facilities might not change), many of the accidents and their consequences for the No Action Alternative would still be valid.

5.15 ENVIRONMENTAL IMPACTS OF CONTINUED RECEIPT AND TRANSPORTATION OF NUCLEAR MATERIALS IN SUPPORT OF GLOBAL THREAT REDUCTION INITIATIVES

As described in Section 2.1.2.2 under the "Global Threat Reduction Initiative," Y-12 is expected to continue to receive nuclear material from both foreign and domestic sources and to provide safe and secure storage for such material. Such a mission is independent of the alternatives in this SWEIS (i.e., under all alternatives, Y-12 would continue to receive and store nuclear materials). This section describes the basic environmental impacts that are expected from continuing this receipt and storage mission. The continued mission to receive and store nuclear materials requires a certain amount of flexibility. Although the GTRI program has a list of possible future shipments, it is not possible to know with any degree of certainty: (1) the locations from where all future nuclear materials would come; (2) the exact quantities of future nuclear materials; and (3) the specific radionuclides of the future nuclear materials. Because of these uncertainties, the environmental analysis in this section summarizes the information in recent relevant environmental analyses to provide an environmental baseline of continuing this mission. In the future, prior to the receipt and storage of any new nuclear materials, proposals would be compared against this baseline to determine whether additional NEPA documentation would be required or to provide an indication of what level document may need to be prepared.

DOE/NNSA has prepared many NEPA documents, some of which are classified, related to the transportation and storage of nuclear materials at Y-12. These documents include the following:

1. *Environmental Assessment for the Interim Storage of Highly Enriched Uranium at the Y-12 Plant, Oak Ridge, Tennessee Acquired from Kazakhstan by the United States and Finding of No Significant Impact* (FONSI) (also known as the *Project Sapphire Environmental Assessment* (EA) (DOE/EA-1006, May 1995) (DOE 1995), which assessed transporting a large quantity of enriched uranium (1,245 pounds) from the Republic of Kazakhstan to the United States for interim storage and processing to low enriched uranium for use as commercial nuclear fuel.

2. *Environmental Assessment for the Transportation of Highly Enriched Uranium from the Russian Federation to the Y-12 National Security Complex and Finding of No Significant Impact* (DOE/EA-1471, January 2004) (DOE 2004d). DOE/NNSA prepared this EA to evaluate the environmental impacts of transporting HEU from Russia to Y-12 for safe, secure storage. The amount of HEU to be transferred under the proposed action would be, on average, approximately 366 pounds per year over a period of 10 years. The HEU would eventually be sent to a facility in Lynchburg, Virginia, where it would be fabricated into reactor fuel. The analysis in the EA shows that the proposed transfer of HEU from Russia to the United States entails little or no risk to the quality of the environment or to human health. A FONSI confirmed this conclusion.

3. *Environmental Assessment for the Transportation of Unirradiated Uranium in Research Reactor Fuel from Argentina, Belgium, Japan and the Republic of Korea to the Y-12 National Security Complex* (DOE/EA-1529, June 2005) (DOE 2005h). DOE/NNSA prepared this EA to evaluate the environmental impacts of transporting uranium from various foreign countries to Y-12 for safe, secure storage. The uranium would eventually be sent to a facility in Lynchburg, Virginia, where it would be fabricated into reactor fuel. The analysis in the EA shows that the proposed transfer of uranium from the various foreign countries to the United States entails little or no risk to the quality of the environment or to human health. A FONSI confirmed this conclusion.

In reviewing these and other relevant documents, the following general conclusions can be supported:

The potential environmental impacts associated with the transportation of nuclear materials over the global commons (i.e., oceans) can be accomplished in specific cases with the appropriate safety and security measures without causing significant adverse impacts. However, two types of impacts can occur: nonradiological and radiological. Nonradiological impacts associated with such transportation are insignificant when compared to the normal transportation of all other goods across the global commons. Radiological impacts associated with such transportation generally involve small doses to aircraft (or ship's crew for surface transport), which are well below any regulatory standards. For example, the *Project Sapphire EA*, which assessed the transportation of a relatively large amount of enriched uranium (1,245 pounds) compared to the other NEPA documents identified above, concluded that a collective dose of 0.34 person-rem would result to 30 crew. Statistically, this would result in an associated latent cancer fatality probability of 1.4×10^{-4}, which would not be significant since not a single crew member would be expected to die from a latent cancer (DOE 1995).

Potential impacts from accidents are also possible. As documented in the *Project Sapphire EA*, in-flight accidents would have a higher probability of container breach than landing/stall accidents. Further, for the global commons, only in-flight accidents probabilities are applicable because no landings would occur in the commons. The bounding accident scenario assumes the containers would breech and the enriched uranium would be released. Depending upon the specific body of water, the volume of water and the well-mixed conditions in the shallow sea would likely disperse the uranium such that effects would be localized and short-term, although there may be some fatalities to marine species in the localized area of the accident (DOE 1995).

In an accident scenario, only the crew and the global commons would be affected. There would be no exposure to the public. The *Project Sapphire EA* examines an accident scenario for a large quantity (1,245 pounds) of enriched uranium. For Project Sapphire, the probability of the accident occurring in-flight was estimated to be 6.7×10^{-10}. This is a bounding conservative probability (overestimation) based on a severe case accident where the impact forces exceed standards and fire engulfs the plane for more than 30 minutes causing 70 percent of the packages to fail. The *Project Sapphire EA* FONSI concludes there may be some loss of life to marine organisms directly exposed to the enriched uranium in this hypothetical bounding case scenario. However, as a result of the large volumes of water, the mixing mechanisms within it, the existing background concentrations of uranium, the radiation-resistance of aquatic organisms, and the radiological and toxicological impact of a very low probability accident would be localized and of short duration (DOE 1995).

5.16 DECONTAMINATION AND DECOMMISSIONING IMPACTS

Eventually, any facility used for EU operations would be subject to the process of D&D. Depending upon the decisions made as a result of this SWEIS, D&D could be required for the UPF, the Capability-sized UPF, the No Net Production/Capability-sized UPF, for EU facilities replaced by the UPF, or for existing and/or upgraded EU facilities. The primary D&D goal would be to decontaminate any facility to the extent that its residual radioactivity would be at an acceptable level. The facility decontamination would be conducted in accordance with all applicable regulations and requirements and in a manner which would minimize potential impacts to the health and safety of workers, the general public, and the environment. The facility decontamination would be executed in accordance with the decommissioning plan prepared by the facility operator (a DOE contractor) and approved by DOE.

In addition to the D&D of any facility used for EU operations, the IFDP (see Section 3.3) has specific, short term plans for the D&D of several existing buildings at Y-12. In the longer term, over 2.9 million square feet of contaminated space is expected to become surplus over the next fifteen years as a result of NNSA modernization and relocation of DOE Office of Science and DOE Office of Nuclear Energy mission-related operations from Y-12 to ORNL. Under the Y-12 modernization program, over 900,000 square feet of floor space in non-process contaminated facilities has already been demolished. Currently there are eleven excess facilities at Y-12 totaling over 1 million square feet. These facilities are being considered for D&D under the IFDP program. In addition to this, eight process-contaminated facilities, with a combined floor space of about 350,000 square feet, are projected to become excess over the next ten years and are also being considered by the IFDP (YSO 2007a).

Prior to the initiation of D&D activities, the facility operator would have to prepare a detailed D&D plan. The D&D plan would contain a detailed description of the site-specific D&D activities to be performed and would be sufficient to allow an independent reviewer to assess the appropriateness of the decommissioning activities; the potential impacts on the health and safety of workers, the public, and the environment; and the adequacy of the actions to protect health and safety and the environment. All buildings and systems would require regulatory planning, document preparation, and characterization and deactivation before any D&D activities would be allowed to commence. Facilities would be characterized to identify waste types (e.g., radiological and chemical waste), construction material types (e.g., steel, roofing, concrete, etc.), presence of equipment, levels of contamination, expected waste volumes, and other information that will be used to support safe demolition and clarify requirements for developing facility-specific plans. Active systems (e.g., electric, steam, water, gas, telecom) would be identified and deactivated, as appropriate. Adaptive reuse of such infrastructure would be considered and recyclable materials would be sorted and managed separately, to the extent practicable (YSO 2007a).

The IFDP is planning to initiate the D&D process within the next three to five years, although this schedule may be accelerated through the use of funding from the American Recovery and

Reinvestment Act of 2009. CD-1 documentation was completed in June 2008 and approved in November 2008. Because the entire ORR has already been determined to be a Superfund Site, the D&D of heavily contaminated facilities at Y-12 will be performed under the provisions of the Comprehensive Environmental Response, CERCLA and the Federal Facility Agreement (FFA) between EPA, DOE and the State of Tennessee. The CERCLA process will require extensive documentation, approvals by EPA and the TDEC and will assure NEPA values are addressed in the design process. A significant advantage of performing the D&D activities under the terms of CERCLA would be the maximum use of an onsite CERCLA disposal cell, greatly reducing transportation costs and risk. Milestones for the proposed IFDP implementation would be subject to agreement among EPA, DOE and TDEC and would then be added to the existing ORR FFA (YSO 2007a).

Although IFDP D&D activities are expected to commence within the next three to five years, the major IFDP D&D activities would not take place for many years (e.g., most likely any D&D activities associated with the action alternatives in this SWEIS would not take place prior to approximately 2018). As such, the major D&D activities are to be resolved under the provisions of CERCLA and are beyond the planning basis for this SWEIS. This SWEIS includes the following qualitative assessment of the D&D impacts that might result from each of the SWEIS alternatives.

5.16.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the UPF would not be constructed, and existing EU facilities would continue to be operated. At the end-of-life (EOL) for these facilities (assumed to be 50 years from now), the existing facilities would undergo D&D. Because the operations in those facilities involve mainly EU, potential residual contamination could include:

- Surface contamination on equipment, walls, ceilings, roof, floors, sinks, laboratory hoods, air ventilation ducts, etc;
- Solid and liquid contaminated waste from normal operations and off-normal and accident events; and
- Land contamination from normal and off-normal operations and accident events.

It is expected that most surface contamination would be easily removed and reduced to acceptable levels. Any wastes from such decontamination would be classified, in accordance with the *Low-Level Radioactive Waste Policy Act Amendments Act* of 1985 (42 U.S.C. 2021b), as LLW, since they would not be high level waste, spent nuclear fuel, or byproduct material as defined by the *Atomic Energy Act* of 1954.

The extent and amount of D&D associated with the No Action Alternative cannot be estimated without a detailed assessment of the facilities, which would not be conducted until the EOL is reached. However, this SWEIS acknowledges that the No Action Alternative could involve D&D of approximately 633,000 square feet of EU facilities once those facilities reach EOL. Additionally, approximately 50,000-80,000 square feet of facilities could become excess if the CCC were constructed. Such D&D would likely generate large quantities of low-level waste and non-radioactive waste. The LLW would be disposed at NTS, Envirocare of Utah, Environmental

Management Waste Management Facility, or other appropriate permitted disposal facility, while non-radioactive waste would likely be disposed of at landfills within ORR.

D&D activities would also cause health and safety impacts to workers (occupational and radiological), as well as potential health impacts to the public through the release of radiological materials. While D&D activities would also produce socioeconomic impacts, it would be speculative to quantify the number of jobs that would be created; however, it is noted that D&D activities at the East Tennessee Technology Park and other DOE sites have created a significant number of jobs relative to the number of operational jobs that were lost when a facility ceased operations.

5.16.2 Alternative 2 – Uranium Processing Facility Alternative

D&D actions associated with the UPF would be the same as discussed under the No Action Alternative (except such D&D would likely occur in the 2018 timeframe, after EU operations would begin in the UPF), but would also include the eventual D&D of the UPF in approximately 50 years. As such, this alternative would involve D&D of more than 1 million square feet (633,000 square feet of existing EU facilities and 388,000 square feet of the UPF). The types of impacts that would occur for this alternative would be expected to be similar to the impacts described for the No Action Alternative.

5.16.3 Alternative 3 – Upgrade in-Place Alternative

The Upgrade in-Place Alternative would involve essentially the same D&D actions as discussed under the No Action Alternative. The types and magnitudes of impacts that would occur for this alternative would be expected to be similar to the impacts described for the No Action Alternative.

5.16.4 Alternative 4 – Capability-sized UPF Alternative

The Capability-sized UPF Alternative would involve essentially the same D&D actions as discussed under Alternative 2, UPF Alternative. The types and magnitudes of impacts that would occur for this alternative would be expected to be similar to the impacts described for that alternative.

5.16.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

The No Net Production/Capability-sized UPF Alternative would involve essentially the same D&D actions as discussed under Alternative 2, UPF Alternative. The types and magnitudes of impacts that would occur for this alternative would be expected to be similar to the impacts described for that alternative.

CHAPTER 6: CUMULATIVE IMPACTS

This chapter considers past, present, and reasonably foreseeable actions that could, along with the Y-12 Site-Wide Environmental Impact Statement (SWEIS) alternatives, result in cumulative impacts to the environment.

6.0 OVERVIEW

The Council on Environmental Quality (CEQ) regulations that implement the procedural provisions of the *National Environmental Policy Act* (NEPA) defines cumulative impact as the "impact on the environment which results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 *Code of Federal Regulations* (CFR) Part 1508.7). Thus, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity is taking the actions. The cumulative impact analysis in this chapter is based on continued operations at Y-12, other actions associated with ORR, and offsite activities with the potential to contribute to the cumulative environmental impact.

6.1 METHODOLOGY AND ANALYTICAL BASELINE

Based on the analysis presented in Chapter 5, a cumulative impact analysis focuses on those resources, ecosystems and human communities with the greatest potential for cumulative impacts. These resource areas include land use, traffic and transportation, socioeconomics, waste management, health and safety and air quality. The analysis has been conducted in accordance with CEQ NEPA regulations and the CEQ handbook, "Considering Cumulative Effects Under the National Environmental Policy Act (CEQ 1997a)," on the preparation of cumulative impact assessments.

Cumulative impact assessment is based on both geographic (spatial) and time (temporal) considerations. Historical impacts at Y-12 are captured in the existing No Action Alternative as are those associated with the decisions made in the Records of Decision on the *Complex Transformation Supplemental Programmatic Environmental Impact Statement* (73 *Federal Register* [FR] 77644 and 73 FR 77656, December 19, 2008) and other U.S. Department of Energy (DOE) decisions already made, including those considered in the Y-12 Modernization Environmental Assessment and Finding of No Significant Impact (DOE/EA 1548) that will affect future impacts. Future impacts will be analyzed for the same timeframe as the alternatives analyzed in this SWEIS (2009 – 2019). Geographic boundaries vary by discipline depending on the time an effect remains in the environment, the extent to which the effect can migrate, and the magnitude of the potential impact. These geographic areas are referred to as regions of influence (ROIs) Based on these factors, DOE has determined that for impacts to waste generation and public and worker health, a 50-mile radius surrounding ORR is the potential impact area. The impact area for transportation and socioeconomics is a four-county area in Tennessee where more than 90 percent of ORR workforce resides: Anderson, Knox, Loudon, and Roane. The impact area for land use is ORR and adjoining properties.

6.2 POTENTIALLY CUMULATIVE ACTIONS

In addition to this SWEIS, actions that may contribute to cumulative impacts include on- and offsite projects conducted by Federal, state, and local governments, private sector, or individuals that are within the ROIs of the actions considered in this SWEIS. Information on present and future actions was obtained from a review of city, county, state and Federal information as well as any known plans in the private sector. *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) and NEPA documents were reviewed to determine if current or proposed projects could affect the cumulative impact analysis at Y-12. The potentially cumulative actions discussed below are those that may contribute to cumulative impacts on or in the vicinity of Y-12. For those actions that are speculative, not yet well defined, or are expected to have a negligible contribution to potential aggregated cumulative impacts, the actions are described but not included in the cumulative effects.

6.2.1 Potential Future Modernization Projects

Several new facilities have been proposed as part of the integrated modernization efforts at Y-12 and are expected to be constructed after 2015. These facilities are included in the Y-12 Master Site Plan which represents a vision of the end state that the National Nuclear Security Administration (NNSA) wants to achieve in the next 20 to 25 years (Figure 1.2-2). Table 3.3-1 lists the future modernization projects that would replace old, outdated existing facilities. Because planning for these facilities has not been initiated, no detailed quantitative impacts have been assessed. However, modernized facilities would be expected to reduce health impacts to workers and the public, incorporate pollution prevention/waste minimization measures in their operation, and reduce emissions to the environment compared to the facilities that are currently operating.

The need to deactivate and decommission NNSA current and future excess facilities is expected to increase as a result of modernization. Over the next 10 years, over 1.6 million gross square feet of space will become excess to NNSA. Some of this space is process-contaminated. An additional 1 million gross square feet of excess space would be available for decontamination and decommissioning (D&D) once DOE's Office of Science (DOE-SC) has completed its final phase of relocation from the Y-12 Site to the Oak Ridge National Laboratory (ORNL). This has left seven buildings which will undergo D&D by the DOE Office of Environmental Management (EM) under the Integrated Facilities Disposition Plan (IFDP). In addition one DOE Office of Nuclear Energy (DOE-NE) facility, four EM facilities, and seven NNSA facilities are vacant and will undergo D&D by EM under the IFDP. To the extent that some of these activities have already occurred or decisions have already been made to proceed, some impacts from these activities are reflected within data provided for the No Action Alternative. Cleanup and D&D activities conducted under CERCLA are reviewed through the CERCLA process (see sections 5.13 and 5.16). The deactivation of process-contaminated facilities has the potential to significantly reduce surveillance and maintenance.

6.2.2 Operation of the Spallation Neutron Source

In 1999, DOE issued a *Final Environmental Impact Statement for the Construction and Operation of the Spallation Neutron Source* (SNS EIS) (DOE/EIS–0247) (DOE 1999), and a Record of Decision (ROD) to construct and operate the SNS (64 FR 35140). Construction of SNS conventional facilities began in 1999 and was completed in 2004. The SNS conducted a commissioning run on April 28, 2006, and is currently operational. The SNS is an accelerator-based research facility that provides the United States scientific and industrial research communities a high-energy proton source that generates pulses of neutrons to examine the atomic properties of a variety of materials.

The potential impacts from the construction and operation of the SNS were identified for wetlands, protected species, cultural resources, transportation, infrastructure and research projects in the Walker Branch Watershed. The SNS EIS estimated that construction of the SNS would affect 0.23 acres of wetlands. A mitigation action plan was developed to address the potential environmental impacts, including cumulative effects. In 2000, a supplement analysis evaluated the potential impacts from incorporating superconducting accelerator technology at SNS (DOE 2000b). The addition of a superconducting technology was found to have no significant environmental impacts (DOE 2005a).

6.2.3 Lease of Parcel ED-6 and Land and Facilities within the ETTP

DOE issued the *Environmental Assessment U.S. Department of Energy Conveyance of Parcel ED-6 to the City of Oak Ridge, Tennessee* (DOE/EA-1514) (DOE 2007a) and a Finding of No Significant Impact on May 9, 2007. Parcel ED-6 is primarily undeveloped land located within the city of Oak Ridge, west of Wisconsin Avenue, south of Whippoorwill Drive, north of Oak Ridge Turnpike (SR 95) and east of the Horizon Center Industrial Park. The property being conveyed is part of the National Environmental Research Park (NERP) and is within the Poplar Creek Road Unit of the Oak Ridge Wildlife Management Area (WMA). The Environmental Assessment (EA) analyzes the potential impacts associated with three action alternatives–Proposed Action, Mixed Development Alternative, and Conservation Easement Alternative and the No Action alternative. All of the action alternatives involve the conveyance of approximately 362 acres under 10 CFR Part 770 to the city of Oak Ridge but differ in how and the amount of the land that will eventually be developed. Under the Proposed Action, only a portion of the land transferred (i.e., land located west of Wisconsin Avenue and north of East Quarry Road) would be used for residential development due to topography and utility right-of-way (ROW) constraints on other portions of the parcel. The Mixed Development Alternative would involve both commercial and residential development. Under the Conservation Easement Alternative, portions of the transferred land located west of Wisconsin Avenue would be included in the Black Oak Ridge Conservation Easement.

The potential impacts from development under the Proposed Action are primarily to land use, ecological resources, and socioeconomics. Development under the Proposed Action, while compatible with local zoning requirement, would result in a change to the present land use of the ED-6 parcel as well as remove area from the NERP and the Oak Ridge WMA. Development also could result in potential elimination of up to 174 acres of deep forest habitat and adversely impact neo-tropical migratory birds that use the area for breeding and migration. Potential positive impacts could be realized from additional tax revenues depending on the number of housing units built or potential negative impacts could also be realized from the loss of DOE payment-in-lieu-of-tax revenues due to the transfer.

6.2.4 Surplus Highly Enriched Uranium Disposition Activities

DOE issued the *Storage and Disposition of Weapons-Usable Fissile Materials, Final Programmatic Environmental Impact Statement* (DOE/EIS-0229) (DOE 1996b) in December 1996. In the Final Environmental Impact Statement (EIS), DOE considered the potential environmental impacts of alternatives for a program to reduce global nuclear proliferation risks by blending up to 221 tons of U.S.-origin surplus highly enriched uranium (HEU) down to low enriched uranium (LEU) to make it non-weapons usable. Because of the huge amount of recoverable energy stored in the HEU and its great economic value, DOE plans to convert approximately 165 tons of the surplus HEU to commercial or research reactor fuel. A substantial quantity of the HEU has already been converted to LEU reactor fuel. The remainder will be converted by about 2015. DOE has transferred 14 metric tons of uranium in the form of highly-enriched UF6 and 51 tons of HEU metal and oxides as required by the United States Enrichment Corporation (USEC) Privatization Act. Down blending of this material was completed in the summer of 2006. Additional off-specification material, not suitable for sale on the open market, will be transferred to the Tennessee Valley Authority (TVA) for use in reactors. In addition, there is also approximately 11 tons of surplus HEU under the International Atomic Energy Agency (IAEA) safeguards at Y-12 since 1994. The facility where it is stored is to be decommissioned around the year 2010 in order to enhance security and reduce costs at Y-12. The IAEA-safeguarded HEU must be removed from Y-12 before the facility can be decommissioned. The NNSA Office of Fissile Material Disposition will contract for down blending approximately 19 tons of surplus HEU for use in commercial power reactors. Down blending this material will enable disposition of the material subject to international safeguard monitoring. Approximately 11 tons of HEU has been reserved for use as fuel in foreign research reactors. This material will be down blended to low enriched uranium fuel and sold through NNSA contracts for use as fuel. The HEU Disposition Program will continue to develop disposition pathways for the remaining material which can be down blended and used as fuel in power or research reactors. Approximately 25 tons of the surplus HEU is not usable for commercial-grade fuel and will be disposed of as waste at a high-level geologic waste repository or a low-level waste (LLW) facility. DOE is preparing detailed plans for the disposal of the remaining surplus HEU. Only a small portion of this material is stored at Y-12.

6.2.5 Oak Ridge Integrated Facility Disposition Project

As part of the environmental cleanup strategic planning, DOE-Oak Ridge Office (ORO) and EM in coordination with the DOE-SC, DOE-NE, and the NNSA are developing an IFDP. The IFDP is a strategic plan for disposing of legacy materials and facilities at ORNL and Y-12 using an integrated approach that results in risk reduction, eliminates $70 to $90 million per year in cost of operations, provides surveillance and maintenance of excess facilities, and management of other legacy conditions. The IFDP includes facilities currently in the ORO EM life-cycle baseline and newly identified excess (or soon to be excess) facilities. Under the IFDP, the D&D

of approximately 188 facilities at ORNL, 112 facilities at Y-12, and remediation of soil and groundwater contamination would occur over the next 30 to 40 years. The IFDP will be conducted as a remedial action under CERCLA. Benefits of the IFDP include reduced risk to workers and the public from potential exposure hazardous and radioactive materials; and the reduction of surveillance and maintenance costs for obsolete, inactive facilities. On June 21, 2007 a Critical Decision (CD)-0 was approved. Approval of the CD-1 package is expected in early 2009.

6.2.6 General Area-Wide Growth and Infrastructure Upgrades and Expansion

Area-Wide Economic Growth. DOE operations in Oak Ridge continue to be a significant contributor to the State of Tennessee and the ROI economies. DOE employment and spending generate additional jobs and have fueled development in the ROI. In 2004, spending by DOE and its contractors led to an increase of approximately $3.7 billion in the state's gross state product (UTenn 2005). Continued modernization activities at Y-12 and ORNL, reindustrialization activities at East Tennessee Technology Park (ETTP) and new construction at Y-12 and ORNL will continue to fuel economic growth in the ROI and the State of Tennessee for the foreseeable future. Some of the major projects considered in this cumulative impact analysis include the Rarity Ridge development, the renovation of Oak Ridge Mall, and the development of the Horizon Center.

DOE wetland/floodplain properties at the former Boeing site across the Clinch River from the Oak Ridge K-25 plant were conveyed to develop approximately 1,200 acres. Rarity Communities Inc. is developing 1,500 homes inside the city limits of Oak Ridge at this site. The Horizon Center is a new business and industrial park located on 957 acres in Oak Ridge. The site is within the corporate city limits of Oak Ridge, and is 10 miles west of its central business district. The developers of Horizon Center plan to accommodate the development of approximately 4 million square feet of manufacturing, research and development, distribution, office, and support facilities.

Highway Improvement Projects. Several highway improvement projects have been proposed within the SWEIS ROI. In Anderson and Roane counties, a 4.1 mile section of State Route (SR)-95 from near Westover Drive to SR-62 in Anderson and Roane counties will undergo reconstruction and widening. This proposed improvement will reconstruct SR-95 from a four-lane undivided road to a four-lane divided road. In Loudon County, Tennessee Department of Transportation (TDOT) plans to improve the right-of-way of the intersection of SR-73 and SR-2.

In Knox County, three highway improvement projects are proposed along sections of Interstate (I)-40, SR-115 and SR-131. A 2.2 mile section of I-40 from I-275 to the Broadway Connector at Cherry Street will be widened. A 2.2 mile section of State Route 115 (Alcoa Highway) from north of the Bridge over the Little River to Maloney Road will be widened. Improvements to SR-115 will follow the existing alignment but the route will be improved from a four lane divided road with left turns to a six-lane divided road with no direct turns. In addition, a 3.5-mile section of SR-131 (Emory Road) from north of Bishop Road to SR-71 will be widened from a two-lane to a five-lane road. These three proposed project are expected to have a direct positive impact on the flow of traffic, especially in the downtown Knoxville area, and ensure a safer, more efficient means of travel.

6.2.7 Tennessee Valley Authority Power Plants and Projects

The TVA is the nation's largest public power company with a multi-state service area, and 33,000 megawatts of dependable generating capacity. Through 158 locally owned distributors, TVA provides power to nearly 8.5 million residents of the Tennessee Valley. TVA operates 21 hydroelectric dams, seven coal-fired power plants, two nuclear power plants, and four combustion turbine sites in Tennessee, with a combined generating capacity of more than 19,000 megawatts. There are more than 9,200 TVA employees based in Tennessee. By 2010, TVA will have spent about $6 billion on emissions controls at its fossil-fuel plants to ensure that this power supply is generated as cleanly as possible, consistent with efficiency

6.2.7.1 *TVA Power Plants*

A description of the TVA power plants within 50 miles of Oak Ridge is as follows:

1. Norris Dam

    - Norris provides 809 miles of shoreline and 33,840 acres of water surface.
    - The recreational use of Norris Reservoir exceeds that of any other tributary reservoir in the TVA river system.
    - Norris Dam is 265 feet high and stretches 1,860 feet across the Clinch River.
    - The generating capacity of Norris is 131,400 kilowatts of electricity.

2. Douglas Dam

    - Douglas provides 513 miles of shoreline and about 28,420 acres of water surface for recreation activities.
    - Douglas Dam is 202 feet high and stretches 1,705 feet across the French Broad River.
    - The generating capacity of Douglas's four units combined is 165,600 kilowatts of electricity.

3. Cherokee Dam

    - Cherokee Reservoir provides nearly 400 miles of winding shoreline and about 28,780 acres of water surface.
    - The dam is 175 feet high and stretches 6,760 feet from one end to the other.
    - The generating capacity of the four hydroelectric units at Cherokee is 135,200 kilowatts of electricity.

4. Tellico Dam

    - Tellico has 357 miles of shoreline and 15,560 acres of water surface for recreation activities.

- Tellico Dam is 129 feet high and reaches 3,238 feet across the Little Tennessee River.
- Water from Tellico helps drive the four generating units at Fort Loudoun Dam, which has a generating capacity of 145,000 kilowatts of electricity.

5. Fort Loudoun Dam

- Fort Loudoun provides 379 miles of shoreline and 14,600 acres of water surface.
- Fort Loudoun Dam is 122 feet high and stretches 4,190 feet across the Tennessee River
- The generating capacity of Fort Loudoun's four units is 155,600 kilowatts of electricity.

6. Melton Hill Dam

- The reservoir provides nearly 193 miles of shoreline and 5,470 acres of water surface for recreation.
- The dam is 103 feet high and stretches 1,020 feet across the Clinch River.
- The generating capacity of Melton Hill is 72,000 kilowatts of electricity.

7. Watts Bar Dam
   - Watts Bar provides 722 miles of shoreline and over 39,090 acres of water surface.
   - Watts Bar Dam is 112 feet high and stretches 2,960 feet across the Tennessee River
   - The generating capacity at Watts Bar is 175,000 kilowatts of electricity.

8. Great Falls Dam

- Great Falls provides 120 miles of winding shoreline and about 1,830 acres of water surface.
- The dam is 92 feet high and stretches 800 feet across the Caney Fork River.
- The generating capacity of Great Falls Dam is 33,800 kilowatts of electricity.

9. Bull Run Fossil Plant

Bull Run has a single coal-fired generating unit. The plant consumes about 6,300 tons of coal a day and generates more than 6.5 billion kilowatt-hours of electricity a year, enough to supply 460,000 homes. When the plant's generator went into operation in 1967, it was the largest in the world in the volume of steam produced. Bull Run was named the second-most-efficient coal-fired plant in the nation in 2004 by Electric Light & Power magazine. It's been ranked among the top 10 every year since 1995.

10. Kingston Fossil Plant

Kingston has nine coal-fired generating units. Construction began in 1951 and was completed in 1955. The plant consumes some 14,000 tons of coal a day and generates about 10 billion kilowatt-hours of electricity a year, enough to supply more than 700,000 homes.

11. Watts Bar Nuclear Plant

Watts Bar operates one nuclear generating unit. Construction at Watts Bar began in 1973 and was completed in 1996. The winter net dependable generating capacity is 1,167 megawatts.

6.2.7.2 *Watts Bar Reservoir Land Management Plan EIS*

In February 2009, TVA issued the *Final Watts Bar Reservoir Land Management Plan EIS* (TVA 2009a). The purpose of this EIS is to assess the potential environmental impacts of a reasonable range of alternatives for allocating 16,000 acres of TVA public land on Watts Bar Reservoir and provide a means to involve the public in the decisionmaking process. The purpose of the land planning effort is to apply a systematic method of evaluating and identifying the most suitable use of public land under TVA stewardship.

Three alternatives are proposed in the Amended Draft EIS. Under Alternative A (No Action) TVA would continue to use the 1988 Plan with minor updates to reflect the changes that have been made over the past 17 years. Alternative B (Modified Development and Recreation) would update the Plan to provide a stronger emphasis on economic development and developed recreation. Alternative C (Modified Conservation and Recreation) would update the Plan to provide a stronger emphasis on natural resource conservation and informal recreation activities.

6.2.8 The Tennessee State Recreation Plan, 2003–2008

In February 2004, the Tennessee State Recreation Plan, 2003-2008 (Tenn 2004) was prepared. This Plan assesses state-wide recreational resources and develops objectives and proposals for achieving these objectives. This Plan was reviewed to determine if there was any potential for cumulative impacts. The Plan identifies five primary objectives:

- Make the most of what we have.
- Set aside recreation resources for the future.
- Ensure consistent quality throughout the Tennessee Recreation System.
- Generate stronger support for conservation and recreation.
- Provide recreation programming to address critical needs.

To achieve these objectives, nineteen proposals were developed, ranging from organizing resources, to developing a comprehensive one-stop website for recreation information, to developing a comprehensive statewide plan for acquisition of recreation lands. There are no specific proposals in the Plan that lend themselves to a cumulative impact analysis related to the Y-12 SWEIS. None of the actions in the Y-12 SWEIS would be inconsistent with the objectives or proposals that are identified in the Tennessee State Recreation Plan, 2003-2008.

6.3 CUMULATIVE IMPACTS BY RESOURCE AREA

The following resource areas have the potential for cumulative impacts: land resources, traffic and transportation, socioeconomics, waste management, health and safety, and water. Cumulative impacts for these resources areas are presented below.

6.3.1 Land Use

Cumulative impacts on land use at Y-12 are presented in Table 6.3.1-1. Cumulative actions are expected to disturb approximately 289 acres or 5 percent of the 5,400 acres encompassed by Y-12. The addition of the UPF under Alternative 2, or the minimum Uranium Processing Facility (UPF) under the Capability-Based Alternative, would disturb approximately 35 acres but occupy an 8-acre footprint of previously disturbed land. Continued Infrastructure Reduction and D&D activities under the No Action Alternative would continue to contribute the amount of land available for future development in the developed area of Y-12. Activities under all four alternatives would be consistent with current industrial land uses at Y-12 and would not affect offsite land uses. There would be minimal cumulative impact to land use under the alternatives addressed in this SWEIS.

Table 6.3.1-1. Cumulative Land Use Impacts at Y-12.

Past, Present, and Reasonably Foreseeable Future Actions	Land Use Commitment (acres)
Existing site activities[a]	256
Production and Public Interface Facilities	20
Potable Water Supply Upgrade	1
UPF	8
Total	**289**
Total Site Capacity (developed area)	5,400 (800)

[a]DLA 2004.

Construction of the SNS on ORR required clearing a 110 acre greenfield site between Y-12 and ORNL and changing its use from Mixed Research/Future Initiatives to Institutional/Research. The transfer and development of Parcel ED-6 could result in a change in the present land use and could remove area from the NERP and Oak Ridge WMA. Use of the portions of the property for recreation purposes (i.e., deer and turkey hunts) would be lost with the transfer and development. However, the transfer of Parcel ED-6 would represent a transfer of less than 2 percent of the 20,000-acre NERP and about 1 percent of the 37,000-acre Oak Ridge WMA. The developments and projects would result in small area land use changes on ORR that would be adverse but would not affect land use or residential development outside the ORR boundary.

Depending upon the alternative selected, the *Watts Bar Reservoir Land Management Plan Draft EIS* could result in the use of 52 to 3,700 acres of public land for private Economic Development uses. The eventual use of approximately 3,400 acres of high quality terrestrial habitat to economic or recreation development would be a large loss of terrestrial habitat on Watts Bar Reservoir.

The IFDP estimates that over the next 15-25 years, 3.9 million square feet of contaminated floor space will become excess as a result of NNSA Modernization and the relocation of NE and SC facility activities to ORNL.

6.3.2 Traffic and Transportation

Cumulative traffic impacts (i.e., traffic congestion and delays) are expected primarily along Bear Creek Road during construction due to the number of construction projects occurring simultaneously at the site. These impacts are expected to be short-term, lasting the length of the construction period.

The addition of 400 permanent workers at SNS would have a minimal cumulative impact on traffic along primary roads serving ORR. The marginal increase in worker traffic due to the relocation of workers from offsite locations to the Production and Public Interface facilities is not expected to have a significant effect on traffic at Y-12. Increases to workforce traffic along primary roads serving ORR from the SNS and Production and Public Interface facilities would be offset once the UPF under Alternative 2, or the minimum UPF under the Capability-Based Alternatives are operational since employment at Y-12 is expected to decrease by approximately 750 workers, due to improvements in operational efficiency.

The IFDP estimates that over the next 15-25 years, 3.9 million square feet of contaminated floor space will become excess as a result of NNSA Modernization and the relocation of NE and SC facility activities to ORNL. This would require a substantial amount of construction vehicles and with additional workers, traffic issues could transpire.

Depending upon the actual extent of development, activities associated with Rarity Ridge and the Horizon Center would likely have the highest potential adverse environmental impact from traffic and transportation, when compared to the Y-12 SWEIS alternatives. For example, the development of Rarity Ridge could add 1,500 new homes, which could add approximately 3,000 new cars to the area, assuming two cars per household. However, this would impact less than 1 percent of the existing population of the ROI, and would not be expected to have a significant impact on traffic/transportation within the ROI.

6.3.3 Socioeconomics

The ROI for the cumulative impact analysis is the four-county area in Tennessee consisting of Anderson, Knox, Loudon, and Roane Counties and considers income, population, housing, and community services. More than 90 percent of the ORR workforce resides in this area. Table 6.3.3-1 shows the cumulative employment for Y-12 and the total ROI employment. The construction employment is likely an overestimate, since construction of the SNS has been completed, but represents a small fraction of the total ROI employment. Construction activities from these proposed development projects are anticipated to overlap with most of the construction occurring between 2008 and 2011. The number of indirect jobs created in the ROI from these proposed development projects would primarily result from the construction of the UPF.

Table 6.3.3-1. Cumulative Employment for Y-12 and ROI.

Activity	Site (Operation) Employment (FTE)	Construction/D&D Employment
Past, Present, and Reasonably Foreseeable Future Actions		
Y-12 existing site activities	6,500[a]	
Production and Public Interface Facilities	(b)	(c)
Potable Water Supply Upgrade	(b)	40
UPF	-750	2,900
ED-6 Parcel Development	NA	(c)
Integrated Facility Disposition Project	(b)	NA
Surplus Highly Enriched Uranium	(b)	NA
Spallation Neutron Source	400	400
Total Employment	**6,150**	**3,300**
ROI Employment Total	**282,500**	

a – Site employment includes both Y-12 employees and contractors.
b – Employment for this activity is included in the 6,500 existing employees.
c – Construction employment numbers not available because property would be developed by a private developer.
NA – not applicable.

The operational workforce at Y-12 is expected to decrease with the addition of the UPF due to operational efficiencies and a consolidation of the PIDAS. There would be no net increase in the Y-12 operational workforce from the Public and Production Interface facilities and the Potable Water Supply Upgrade.

The operational workforce of the SNS is estimated to be 400 workers. SNS also is expected to host 1,000 to 2,000 visiting scientists each year (DOE 1999). More than 1,600 indirect jobs would be created because of the SNS. A positive cumulative socioeconomic impact would be realized from the construction of the UPF, development of Parcel ED-6, and the operation of the SNS. Since the temporary construction workforce would likely come from the existing ROI labor force, minimal cumulative impacts on housing and community service are anticipated. Development of the Parcel ED-6 and operation of the SNS would have a minor impact on the community services (i.e., schools, police and fire protection) depending on the housing density of the final development, the age distribution of the new residents, and the number of new workers moving into the ROI.

Development of the Horizon Center, which is planned to accommodate the development of approximately 4 million square feet of manufacturing, research and development, distribution, office, and support facilities, would likely add jobs and result in an influx of workers and their families to the ROI. A recent analysis developed for the land use planning estimated that if ETTP redevelopment and other initiatives succeed during the next 20 years, the cumulative impact could result in up to 25,000 direct and indirect jobs or an increase of 6.9 percent over the 2001 ROI employment figures (ORNL 2002). This rate is about 0.3 percent per year. Given the uncertainties surrounding future success of any of these initiatives, this is expected to represent an upper bound on the cumulative employment impacts. This increase falls well within historical growth rates for the ROI and is not expected to create an undue strain on local socioeconomic resources (DOE 2007a).

The IFDP estimates that over the next 15-25 years, 3.9 million square feet of contaminated floor space will become excess as a result of NNSA Modernization and the relocation of NE and SC facility activities to ORNL. The precise number of workers will not be known until the CD-1 budget and planning is prepared (see textbox in Section 3.2.2.1 for definitions of CD levels), but would probably be in the range of from 100 to 400. It is not expected that increased jobs of this magnitude would pose any disruptions to the region of influence.

6.3.4 Waste Management

The addition of the UPF is not likely to result in major impacts on the waste management infrastructure at Y-12 and ORR because the additional waste generated by the UPF mission would be a small percentage of the total wastes that would be generated at ORR.

The waste generated by other actions (e.g., 2.7 million cubic yards of CERCLA solid waste and 1.4 billion gallons of CERCLA liquid waste for ORR facilities in the next 10 years [DOE 2001a]) when combined with waste generated from other actions would not exceed existing ORR and offsite waste management facilities capacities and capabilities for treatment, disposal, and/or storage. Therefore, no cumulative impacts on waste management facilities are expected.

The IFDP estimates that over the next 15-25 years, 3.9 million square feet of contaminated floor space will become excess as a result of NNSA Modernization and the relocation of NE and SC facility activities to ORNL. This clean up would be done under CERCLA and wastes disposed of in onsite, CERCLA created waste management facilities.

6.3.5 Health and Safety

The cumulative radiological health impacts on public and worker health from routine ORR operations and DOE actions are shown in Table 6.3.5-1. The values listed in this table describe the impacts from proposed DOE actions. In addition to the estimated radiological doses to the hypothetical MEI and the offsite population within a 50 mile radius of the ORR, Table 6.3.5-1 lists the potential LCFs for the public and workers due to exposure to radiation. The worker effects are not additive, but site-specific.

Table 6.3.5-1. Estimated Annual Radiological Impacts to Offsite Population and Facility Workers.

Activity	MEI Dose (mrem/yr)	Population Dose (person-rem/yr)	Population Latent Cancer Fatalities[b]	Collective Worker Dose (person-rem/yr)	Worker Latent Cancer Fatalities
Existing site activities	0.15	25.8	0.015	68.4	0.04
Surplus HEU Disposition[a]	0.039	0.16	9.6×10^{-5}	11.3	0.005
Watts Bar Nuclear Plant[a]	0.26	1.2	7.2×10^{-4}	NA	NA
Spallation Neutron Source[a]	1.5	1.3	7.8×10^{-4}	370	0.2
Cumulative Impact	**NA**	**28.5**	**0.017**	**NA**	**NA**

a - Source: DOE 2001a.
b – This represents the number of LCFs for each year of exposure.

The IFDP estimates that over the next 15-25 years, 3.9 million square feet of contaminated floor space will become excess as a result of NNSA Modernization and the relocation of NE and SC facility activities to ORNL. The D&D of these facilities would increase the dose to both the public and workers. Estimates are not possible until more precise plans are finalized by the CD-1 process.

6.3.6 Air Quality

ORR's contribution to air pollution in the ROI is negligible compared to other sources. The major sources of criteria pollutants are the TVA fossil plants, which emit thousands of tons of sulfur dioxide, nitrogen oxides, and carbon dioxide annually. Table 6.3.6-1 shows the amount of sulfur dioxide, nitrogen oxides, and carbon dioxide that are emitted annually by the TVA fossil plants within the ROI and the Y-12 steam plant, which is responsible for 90 percent of the Y-12 pollutant emissions to the atmosphere. As can be seen from that table, the Y-12 steam plant emissions account for less than 10 percent of emissions compared to the TVA fossil plants. When the new Y-12 Steam Plant becomes operational in late 2010, the levels of emissions will be significantly less than those shown in Table 6.3.6-1.

Table 6.3.6-1. Air Emissions from TVA Fossil Plants in the ROI and the Y-12 Steam Plant Complex, 2004.

	Emissions (tons/year)		
	Sulfur dioxide	**Nitrogen oxides**	**Carbon Dioxide**
Bull Run Fossil Plant[a]	28,600	8,000	4,602,000
Kingston Fossil Plant[a]	75,000	14,900	10,384,000
Y-12 Steam Plant	2,286[b]	654[b]	89,921[c]

a Source: TVA 2006.
b Source: YSO 2007
c Calculated estimate based on 100 million Btu thermal input with bituminous coal fuel operating 24 hours per day 365 days per year.

TVA has made significant progress in reducing criteria pollutants from its fossil plants such as Bull Run and Kingston. For example, in 2004, sulfur dioxide emissions from Bull Run and Kingston were reduced by approximately 33 percent and 17 percent respectively compared to 2001 emissions. In 2004, nitrogen oxide emissions from Bull Run and Kingston were reduced by approximately 53 percent and 43 percent respectively compared to 2001 emissions. By 2010 TVA will have spent about $6 billion on emissions controls at its fossil-fuel plants to ensure that this power supply is generated as cleanly as possible, consistent with efficiency. To further reduce sulfur dioxide emissions, Bull Run burns a blend of low-sulfur coal, and construction on a scrubber to further reduce sulfur dioxide began in 2005. To reduce nitrogen oxides, it uses a selective catalytic reduction system as well as combustion and boiler optimization controls.

TVA has taken a number of steps to make the efficient generation of power at Bull Run as clean as possible:

- The use of low-sulfur coal from eastern Kentucky reduces emissions of sulfur dioxide.
- Construction of a scrubber began in the spring of 2005 to further reduce SO2. The scrubber should be operational in 2009.
- The plant is equipped with electrostatic precipitators that capture ash from the burning coal.

- Boiler optimization controls limit the production of nitrogen oxides which contribute to the formation of ozone and acid rain. A selective catalytic reduction system further reduces nitrogen oxide emissions by transforming them into harmless nitrogen and water vapor.

To reduce sulfur dioxide emissions at Kingston, all nine units use a blend of low-sulfur coal. Scrubbers will be added to the plant beginning in 2006 to further reduce sulfur dioxide. To reduce nitrogen oxides, Units 1 through 4 and Unit 9 use combustion controls and boiler optimization. Units 5 through 8 use low-nitrogen oxide burners. In addition, eight selective catalytic reduction systems have been installed to control nitrogen oxide emissions (TVA 2006).

The IFDP estimates that over the next 15-25 years, 3.9 million square feet of contaminated floor space will become excess as a result of NNSA Modernization and the relocation of NE and SC facility activities to ORNL. This clean up would result in temporary increases in pollutant emissions due to the use of machinery, the demolition process, and the disturbance of waste by the moving of debris.

A major source of manmade emissions of mercury to the environment in the United States is coal-fired power plants. The Y-12 Steam Plant, a coal-fired power plant, is a source of mercury emissions. As noted above, there are two TVA coal-fired power plants within the Y-12 ROI that are also sources of mercury emissions. Table 6.3.6-2 shows the amount of mercury emitted by the Y-12 Steam Plant and TVA's Bull Run and Kingston coal-fired power plants during 2007. As can be seen from the table, the Y-12 Steam Plant accounts for less than 3 percent of the total mercury emissions from coal-fired power plants in the ROI.

Table 6.3.6-2. Mercury Emissions from TVA Fossil Plants in the ROI and the Y-12 Steam Plant Complex, 2007.

	Mercury Emissions (lbs.)
Bull Run[a]	444
Kingston[a]	716
Y-12 Steam Plant[b]	32
Total	1,192

[a] TVA 2008
[b] DOE 2008

6.3.7 Water Resources

Because the quality and availability of water are critical to sustaining both the human and natural environment, potential cumulative impacts to water resources are addressed in this section. As noted in Section 4.3.5, raw water for ORR is obtained from the Clinch River and pumped into the water treatment plant, which is owned and operated by the city of Oak Ridge and supplies treated water to customers in the city, including ORNL, as well as Y-12. The water treatment plant has a capacity to deliver up to 24 million gallons per day (8.76 billion gallons per year). Treated water usage at Y-12 averages about 4.2 million gallons per day or about 1.54 billion gallons per year. This represents about 17.5 percent of the total amount of treated water capacity of the system. The remainder of the treated water is consumed by the residential and commercial customers of the Oak Ridge water treatment system.

Y-12 generates about 750,000 gallons of wastewater each day, as noted in Section 4.3.6. The wastewater flows to the city of Oak Ridge sewage treatment facility. The sewage treatment facility treats an average of 5.8 million gallons of wastewater per day. Wastewater generated at Y-12 represents about 13 percent of the total sewage treated.

6.3.8 Ecological Resources

Because none of the alternatives addressed for Y-12 would result in the disturbance of previously undisturbed land, it is unlikely that the proposed actions would adversely affect wildlife habitat or species beyond the impacts that have occurred in the past. Certainly, the presence of Y-12 affects wildlife by having displaced about 800 acres of former habitat, and the activities at Y-12 would create sufficient disturbance as to discourage most wildlife from reinhabiting the highly industrialized site. The wildlife habitat disturbed by Y-12 is only part of the overall direct impact on wildlife resulting from DOE development of the ORR. Approximately 12,250 acres of the 35,000-acre ORR are disturbed by development. Y-12 accounts for about 6.5 percent of the disturbed land on the ORR and 2.3 percent of the total area.

In addition to wildlife habitat directly affected by DOE and NNSA facilities and activities, the region around ORR has been and continues to be impacted by human development. Development in the region around ORR has resulted in wildlife habitat being directly displaced and the remainder being broken up into small isolated pockets with decreased value for supporting populations of larger species and those that require large unbroken areas of habitat.

Ongoing disturbance of existing wildlife habitat may occur in the region. As noted in Section 6.3.1, depending upon the alternative selected by TVA in the *Watts Bar Reservoir Land Management Plan Draft EIS, from* 52 to 3,700 acres of public land could be set aside for private economic development uses. The eventual use of up to 3,700 acres of high quality terrestrial habitat to economic or recreation development would be a large loss of terrestrial habitat on Watts Bar Reservoir.

CHAPTER 7: REGULATORY REQUIREMENTS

This chapter provides information concerning environmental, safety, and health standards with shich the proposed plans for the Y-12 National Security Complex (Y-12) are required to comply. These requirements are formally stated in Federal and state statutes, regulations, orders and directives, as indicated, and in agreements, such as the Federal Facility Agreement, between the responsible executive agencies. In addition, implementation of plans for Y-12 must satisfy requirements to obtain permits, approvals, and consultations with appropriate governmental authorities, as directed by law. The regulatory framework also provides a substantive basis for evaluating the proposed action and alternatives based on the ability of the alternatives to comply with these Federal and state regulatory requirements and qualify for the necessary permits and licenses.

7.0 INTRODUCTION

During the 1940s and 1950s, when Y-12 was constructed, national security requirements were the dominant consideration for facilities design and operation. Since then, emphasis has shifted to operational safety, worker health and safety, and public and environmental health and safety, resulting in the need for the U.S. Department of Energy (DOE) to comply with new requirements as it continues to carry out its national security mission. Today, both Federal and state environmental, health, and safety agencies exercise regulatory authority over Y-12 operations, and agreements between DOE and the agencies ensure DOE compliance with applicable environmental, health, and safety laws.

Because facilities at Y-12 are more than 40 years old, achieving compliance with evolving environmental, health and safety requirements represents an expensive challenge. However, all facilities at Y-12, whether newly constructed or existing, must comply with an increasing number of complex regulations. Ongoing operations at Y-12, and any changes in operations at Y-12, are also governed by the same requirement to meet current environmental, health and safety standards, as the laws require.

An overview of Federal and state regulatory framework that applies to Y-12 facilities and operations is provided in the following sections. Section 7.1 presents Federal and state environmental, safety, and health agencies with authority to regulate DOE facilities and operations at Y-12. Section 7.2 presents the legal authorities, including statutes, regulations, directives, and orders which govern Y-12 facilities and operations, with which Y-12 facilities and operations are required to comply, and with which the Site-Wide Environmental Impact Statement (SWEIS) proposed action and alternatives must also comply. Section 7.3 identifies and discusses additional coordination between DOE and other agencies that may also be required, along with this SWEIS, to satisfy the requirements of the *National Environmental Policy Act* (NEPA), under which this SWEIS has been prepared. Section 7.4 provides information about Y-12 current compliance with environmental requirements and indicates the results of regulatory reviews for 2007.

7.1 REGULATORY AGENCIES

Environmental, safety, and health requirements applicable to facilities and operations at Y-12 are based on Federal and state law. Federal law incorporates legislation enacted by Congress, signed by the President or not vetoed by the President, and codified in the United States Code. State law governing operations at Y-12 is the law of the State of Tennessee.

Implementation of Federal environmental, safety and health statutes is delegated to specific Federal agencies, including the Environmental Protection Agency (EPA), the Department of Transportation, and the Department of Labor. This delegation of responsibility to an agency may be statutory or by Executive Order (EO). In some cases, particularly as regards programs under the jurisdiction of the EPA, such as permitting and enforcement, responsibility is further delegated by the agency to state agencies with the Federal agency retaining program oversight.

Like Federal agencies, state agencies also operate under legal authority to implement and enforce environmental, health, and safety laws, as embodied in state statutes as provided for by federal statutes and delegated by federal agencies. Regulations issued by state agencies support this process. The Tennessee Department of Environment and Conservation (TDEC) is responsible for protecting and improving Tennessee land, air, water and recreation resources; most Tennessee environmental regulations are published by the Tennessee Department of State as Chapter 1200 - Health, Environment and Conservation of the Rules and Regulations of the State of Tennessee (TDEC 1999a).

7.2 FEDERAL AND STATE ENVIRONMENTAL STATUTES AND REGULATIONS

The NEPA (Public Law [Pub. Law] 91-190, 42 *United States Code* [U.S.C.] 4321 et seq.) and its implementing regulations (40 *Code of Federal Regulations* [CFR] Parts 1500-1508) require that Federal agencies, including DOE, analyze and consider the potential environmental impacts of proposed major actions and alternatives before decisions are made and actions taken, such as the proposed action and alternative actions under consideration for Y-12. The analysis identifies possible means of avoiding or mitigating potential environmental, safety and health impacts. Identification of applicable environmental protection statutes, regulations, and orders thus provides a legal framework for examination of the proposed action and the alternative actions to ensure that at least a threshold level environmental, health and protection is provided. In addition a comparison can be made among the alternatives with regard to compliance with regulatory requirements as a means of identifying the alternative most likely to have the least environmental impact.

Regulatory authority over the production, possession, use and disposal of source, special nuclear, and byproduct material was addressed in the *Atomic Energy Act* of 1954 (42 U.S.C. §2011 *et seq.*), which established the Atomic Energy Commission. As one of two successor agencies to the Atomic Energy Commission, the DOE is responsible for establishing standards to protect health and minimize danger to life or property from activities under its jurisdiction, except cases where the Nuclear Regulatory Commission (NRC), the other successor agency, has been granted statutory regulatory control. Regulatory activity within NRC's jurisdiction, which covers commercial nuclear materials, facilities, and activities, including waste management, is exercised directly by NRC or indirectly through approved state regulatory programs. Some DOE activities, such as the disposal of civilian reactor fuel and the disposal of transuranic wastes are subject to NRC regulation.

Federal agencies, including DOE, are required under EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, to comply with applicable administrative and procedural pollution control standards established by, but not limited to, the *Clean Air Act* (CAA), *Noise Control Act, Clean Water Act* (CWA), *Safe Drinking Water Act, Toxic Substances Control Act* (TSCA), and *Resource Conservation and Recovery Act* (RCRA). DOE Order 450.1A, *Environmental Protection Program*, addresses DOE compliance with applicable laws, regulations, and executive orders, recognizes extensive regulation of DOE activities by outside agencies, and requires that each DOE facility prepare an Environmental Monitoring Plan. Except for certain specific activities involving radioactive materials, all environmental protection and compliance activities at DOE facilities, including Y-12, are subject to regulation by external Federal, state and local entities.

DOE regulations, which are contained in 10 CFR, address such areas as energy conservation, administrative requirements and procedures, nuclear safety, and classified information. For the purpose of this SWEIS, relevant regulations include: “Procedural Rules for DOE Nuclear Activities” (10 CFR Part 820), “Nuclear Safety Management” (10 CFR Part 830), “Occupational Radiation Protection” (10 CFR Part 835), “Compliance with the National Environmental Policy Act” (10 CFR Part 1021), and “Compliance with Floodplains/Wetlands Environmental Review Requirements” (10 CFR Part 1022).

Applicable regulatory environmental laws and regulations can be categorized by environmental pathways: air, water, land (which includes waste management and pollution prevention), and the subsequent impact to worker safety and health, the public, and the natural environment. Table 7.2.1-1 lists Federal statutes, regulations, and EO that pertain to control, remediation, and/or regulation of the environment and worker safety, grouped by the resources to which each requirement pertains. Table 7.2.1-2 lists state statutes, regulations, and EOs that pertain to control, remediation, and/or regulation of the environment and worker safety, similarly grouped by the resources to which each requirement pertains. For most requirements identified, the statute and corresponding regulatory citations are listed. A description providing the basic environmental actions resulting from each of the Federal and state statutes and EO is also provided. Details regarding specific compliance with the relevant statutes, regulations, and permits are included in Chapter 4 of this SWEIS, as appropriate for each relevant resource. DOE is committed to fully comply with all applicable environmental statutes, regulatory requirements, EOs and internal orders. Table 7.2.1-3 lists the most pertinent DOE directives (orders, manuals, and notices) for implementation of environmental safety and health regulations.

Table 7.2.1-1. Major Federal Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic.

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Air and Noise	*Clean Air Act* of 1970, as amended	42 U.S.C. 7401 *et seq.*	EPA	Requires sources to meet standards and obtain permits to satisfy; National Ambient Air Quality Standards, State Implementation Plans, Standards of Performance for New Stationary Sources, National Emission Standards for Hazardous Air Pollutants, and Prevention of Significant Deterioration.
	National Ambient Air Quality Standards/State Implementation Plans	42 U.S.C. 7409 *et seq.*	EPA	Requires compliance with primary and secondary ambient air quality standards governing sulfur dioxide, nitrogen oxide, carbon monoxide, ozone, lead, and particulate matter and emission limits/reduction measures as designated in each State's implementation plan.
	Standards of Performance for New Stationary Sources	42 U.S.C. 7411	EPA	Establishes emission standards and recordkeeping requirements for new or modified sources specifically addressed by a standard.
	National Emissions Standards for Hazardous Air Pollutants	42 U.S.C. 7412	EPA	Requires sources to comply with emission levels of carcinogenic or mutagenic pollutants; may require a preconstruction approval depending on the process being considered and the level of emissions that will result from the new or modified source.
	Prevention of Significant Deterioration	42 U.S.C. 7470 *et seq.*	EPA	Applies to areas that are in compliance with National Ambient Air Quality Standards. Requires comprehensive preconstruction review and the application of Best Available Control Technology to major stationary sources (emissions of 100 tons/yr) and major modifications; requires a preconstruction review of air quality impacts and the issuance of a construction permit from the responsible State agency setting forth emission limitations to protect the Prevention of Significant Deterioration increment.
	Noise Control Act of 1972, as amended	42 U.S.C. 4901 *et seq.*	EPA	Requires facilities to maintain noise levels that do not jeopardize public health and safety.
	Greening the Government through Efficient Energy Management	EO 13123	EPA	Calls for Federal agencies to reduce greenhouse gas emissions by 30 percent and establish energy improvement goals.
	Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances	EO 12843	EPA	Requires Federal agencies to minimize procurement of ozone depleting substances and comply with Title VI of CAA Amendments with respect to stratospheric ozone protection and to recognize the limited availability of Class I substances until final phase-out.

Table 7.2.1-1. Major Federal Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic (*continued*).

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Water	*Clean Water Act*, as amended	33 U.S.C. 1251 *et seq.*	EPA	Requires EPA or state-issued permits and compliance with provisions of permits regarding discharge of effluents (pollutants) to surface waters or other activities affecting water quality.
	National Pollutant Discharge Elimination System (section 402 of the CWA)	33 U.S.C. 1342	EPA	Requires permit to discharge effluents and storm waters to surface waters; permit modifications are required if discharge effluents are altered.
	Dredged or Fill Material (Section 404 of CWA) *Rivers and Harbors Appropriations Act* of 1899	33 U.S.C. 1344, 33 U.S.C. 401 *et seq.*	U.S. Army Corps of Engineers (USACE)	Requires permits to authorize the discharge of dredged or fill material in wetlands and to authorize certain work in or structures affecting wetlands.
	Wild and Scenic Rivers Act of 1968	16 U.S.C. 1271 *et seq.*	U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management, U.S. Forest Service, National Park Service	Requires consultation prior to construction of any new Federal project associated with a river designated as wild and scenic or under study in order to minimize and mitigate any adverse effects on the physical and biological properties of the river.
	Safe Drinking Water Act of 1974, as amended	42 U.S.C. 300f *et seq.*	EPA	Requires permits for construction/operation of underground injection wells and subsequent discharging of effluents to ground aquifers and establishes minimum standards for drinking water at the tap of public water supplies.
	Floodplain Management	EO 11988	CEQ, Water Resources Council	Requires consultation for project impacting a floodplain.

Table 7.2.1-1. Major Federal Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic (*continued*).

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Hazardous and Solid Wastes	*Resource Conservation and Recovery Act*/Hazardous and Solid Waste Amendments of 1984	42 U.S.C. 6901 *et seq.*	EPA	Requires notification and permits for operations involving hazardous waste treatment, storage, or disposal facilities; changes to site hazardous waste operations could require amendments to RCRA hazardous waste permits.
	Comprehensive Environmental Response, Compensation, and Liability Act of 1980;*Superfund Amendments and Reauthorization Act* of 1986	42 U.S.C. 9601 *et seq.*	EPA	Requires cleanup and notification if there is a release or threatened release of a hazardous substance; requires DOE to enter into Interagency Agreements with the EPA and State to control the cleanup of each DOE site on the National Priorities List.
	Superfund Implementation	EO 12580	EPA	Establishes DOE responsibilities related to the National Contingency Plan.
	Community Environmental Response Facilitation Act of 1992	PL 102-426	EPA	Amends the *Comprehensive Environmental Response, Compensation, and Liability Act* to establish a process for identifying, prior to the termination of Federal activities, property that does not contain contamination. Requires prompt identification of parcels that will not require remediation to facilitate the transfer of such property for economic redevelopment purposes.
	Farmland Protection Policy Act of 1981	7 U.S.C. 4201 *et seq.*	Soil Conservation Service	DOE shall avoid any adverse effects to prime and unique farmlands.
	Toxic Substances Control Act of 1976	15 U.S.C. 2601 *et seq.*	EPA	Requires inventory reporting and chemical control provisions to protect the public from the risks of exposures to chemicals; strict limitations on use and disposal imposed on polychlorinated biphenyls, lead-based paint, and asbestos-contaminated equipment and material.
	Federal Facility Compliance Act of 1992	42 U.S.C. 6961	EPA	Waives sovereign immunity for Federal facilities under the *Resource Conservation and Recovery Act* and requires DOE to develop plans and enter into agreements with states as to specific management actions for specific mixed waste streams.

Table 7.2.1-1. Major Federal Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic (*continued*).

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Biotic	*Fish and Wildlife Coordination Act* of 1934	16 U.S.C. 661 *et seq.*	USFWS	Requires consultation on the possible effects on wildlife if there is construction, modification, or control of bodies of water in excess of 10 acres (4 hectares) surface area.
	Bald and Golden Eagle Protection Act of 1973, as amended	16 U.S.C. 668 *et seq.*	USFWS	Consultations should be conducted to determine if any protected birds are found to inhabit the area. If so, DOE must obtain a permit prior to moving any nests due to construction or operation of project facilities.
	Migratory Bird Treaty Act of 1918, as amended	16 U.S.C. 703 *et seq.*	USFWS	Requires consultation to determine if there are any impacts on migrating bird populations due to construction or operation of project facilities. If so, DOE will develop mitigation measures to avoid adverse effects.
	Responsibilities of Federal Agencies to Protect Migratory Birds	EO 13186	USFWS	DOE shall take measures to develop and implement a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service that shall promote the conservation of migratory bird populations.
	Wilderness Act of 1964	16 U.S.C. 1131 *et seq.*	Department of Commerce (DOC), Department of Interior (DOI)	DOE shall consult with the Department of Commerce and Department of the Interior (DOI) and minimize impacts.
	Wild Free-Roaming Horses and Burros Act of 1971	16 U.S.C. 1331 *et seq.*	DOI	DOE shall consult with the DOI and minimize impacts.
	Executive Order 11990 Protection of Wetlands	EO 11990	USACE, USFWS	Requires Federal agencies to avoid the long- and short-term adverse impacts associated with the destruction or modification of wetlands.
	Compliance with Floodplain/Wetlands Environmental Review Requirements	10 CFR 1022	DOE	Requires DOE to comply with all applicable floodplain/wetlands environmental review requirements.
	Endangered Species Act of 1973	16 U.S.C. 1531 *et seq.*	USFWS, National Marine Fisheries Service (NMFS)	Requires consultation to identify endangered or threatened species and their habitats, assess DOE impacts thereon, obtain necessary biological opinions, and, if necessary, develop mitigation measures to reduce or eliminate adverse effects of construction or operations.

Table 7.2.1-1. Major Federal Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic (*continued*).

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Cultural	*National Historic Preservation Act* of 1966, as amended	16 U.S.C. 470 *et seq.*	President's Advisory Council on Historic Preservation (ACHP)	Requires consultation with State Historic Preservation Office and interested parties prior to construction to ensure that no historical properties will be affected. The ACHP may choose to participate in the consultation and any subsequent agreements.
	Curation of Federally Owned and Administered Archaeological Collections	16 U.S.C. § 470 *et seq.*	DOI	Requires agencies to take responsibility for the curation of archaeological collections that are recovered from lands under their control. Agencies must assure through funding agreements and inspections that archaeological collections are properly curated in a facility that meets the standards outlined in the regulations.
	Indian Sacred Sites	Executive Order 13007, 61 FR 26771	DOE	Requires agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.
	Consultation and Coordination With Indian Tribal Governments	Executive Order 13175, 65 FR 67249	DOE	DOE shall establish regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies with tribal implications, strengthen U.S. government-to-government relations with Indian tribes, and reduce imposition of unfunded mandates upon Indian tribes.
	Archaeological and Historical Preservation Act of 1974	16 U.S.C. 469 *et seq.*	DOI	DOE shall obtain authorization for any disturbance of archeological resources.
	Archaeological Resources Protection Act of 1979, as amended	16 U.S.C. 470aa *et seq.*	DOI	Requires a permit for the removal of archaeological resources from public land. If archaeological resources are discovered during construction, provides penalties for unauthorized removal or destruction.
	Antiquities Act of 1906	16 U.S.C. 431-33	DOI	DOE shall comply with all applicable sections of the act.

Table 7.2.1-1. Major Federal Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic (*continued*).

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
	American Indian Religious Freedom Act of 1978	42 U.S.C. 1996	DOI	Affirms the right of Native Americans to have access to their sacred places. Promotes consultation with Indian religious practitioners to identify, maintain access, and avoid impacts to places of religious importance to Native Americans.
	Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. 3001	DOI	Describes the procedures to be followed if Native American cultural items and human remains are discovered during construction and the conditions under which these items can be removed or excavated.
	Protection and Enhancement of the Cultural Environment	EO 11593	DOI	DOE shall aid in the preservation of historic and archeological data that may be lost during construction activities.
Worker Safety and Health	*Occupational Safety and Health Act* of 1970	5 U.S.C. 651	Occupational Safety and Health Administration (OSHA)	DOE shall comply with all applicable worker safety and health legislation (including guidelines of 29 CFR Part 1960) and prepare, or have available in the workplace, Material Safety Data Sheets.
	Hazard Communication Standard	29 CFR 1910.1200	OSHA	Requires DOE to ensure that workers are informed of, and trained to handle, all chemical hazards in the DOE workplace.
	Atomic Energy Act of 1954, as amended	42 U.S.C. 2011	EPA, DOE	DOE shall follow its own standards and procedures, particularly with respect to radioactive substances, to ensure the safe operation of its facilities.
	Nuclear Waste Policy Act of 1982	42 U.S.C. 108 10101 *et seq.*	NRC, EPA, DOE	Requires DOE to obtain all required permits and dispose of spent nuclear fuel, high level, and transuranic radioactive waste; requires certification and compliance of Waste Isolation Pilot Plan.
	Low-Level Radioactive Waste Policy Act of 1954	42 U.S.C. 2021b-2021d	DOE	Requires DOE to dispose of low-level radioactive wastes in accordance with the requirements of the States in which it operates.
	Worker Safety and Health Program	10 CFR Part 851	DOE	Establishes requirements for a worker safety and health program.

Table 7.2.1-1. Major Federal Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic (*continued*).

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
	Occupational Radiation Protection	10 CFR Part 835	DOE	Establishes limits for worker exposure to radioactivity.
Other	*National Environmental Policy Act* of 1969, as amended	42 U.S.C. 4321 *et seq.*	CEQ, DOE	DOE shall comply with NEPA and its implementing procedures.
	Uranium Mill Tailings Radiation Control Act of 1978	42 U.S.C. 7901 *et seq.*	DOE, EPA and NRC	EPA and NRC regulate remediation of abandoned uranium mill tailings sites. DOE is responsible for the remediation at those sites. DOE implements health and environmental standards and acquires licenses when required.
	Hazardous Materials Transportation Act of 1975, as amended	49 U.S.C. 5101 *et seq.*	DOT	DOE shall comply with the requirements governing hazardous materials and waste transportation.
	Hazardous Materials Transportation Uniform Safety Act of 1990	49 U.S.C. 5105 *et seq.*	DOT	Restricts shippers of highway route-controlled quantities of radioactive materials to use-only permitted carriers.
	Emergency Planning and Community Right-To-Know Act of 1986	42 U.S.C. 11001 *et seq.*	EPA	Requires the development of emergency response plans and reporting requirements for chemical spills and other emergency releases, and imposes right-to-know reporting requirements covering storage and use of chemicals which are reported in toxic chemical release forms.
	Pollution Prevention Act of 1990, under the provision of the *Superfund Amendments and Reauthorization Act* (SARA).	42 U.S.C. 13101 and section 313 of SARA	EPA	Establishes a national policy that pollution should be reduced at the source and requires a toxic chemical source reduction and recycling report for an owner or operator of a facility required to file an annual toxic chemical release form under section 313 of SARA.
	Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	EO 12898	DOE	Requires Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Amended by Executive Order 12948.

Table 7.2.1-1. Major Federal Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic (*continued*).

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
	Strengthening Federal Environmental, Energy, and Transportation Management	EO 13423	DOE, CEQ, OMB, Federal Environmental Executive	Requires Federal agencies to employ a range of actions to reduce energy and water consumption, use of efficient vehicles and energy conservation in new buildings
	Protection and Enhancement of Environmental Quality	EO 11514	CEQ	Requires Federal agencies to demonstrate leadership in achieving the environmental quality goals of NEPA; provides for DOE consultation with appropriate Federal, State, and local agencies in carrying out their activities as they affect the environment.
	Federal Workforce Transportation	EO 13150	EPA, DOT, DOE	Directs DOT, EPA and DOE to implement a “transit pass” transportation fringe benefit program as part of a three-year Nationwide Pilot Program no later than October 1, 2000.

Table 7.2.1-2. Major State Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic.

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Air	Air Pollution Control	TCA, 68-201-105, 4-5-202	TN Air Pollution Control Board	Permit required to construct, modify, or operate an air contaminant source; sets fugitive dust requirements.
	Hazardous Air Contaminants	TCA, 68-201-105, 4-5-202 et *seq.*	TDEC, Division of Air Pollution Control	Adopts the primary NESHAP of Federal regulations for state enforcement.
	Tennessee Air Quality Act	TCA, 53-3408 *et seq.*	TDEC, Division of Air Pollution Control	Requires permits to construct, modify, or operate an air containment source; sets fugitive dust requirements.

Table 7.2.1-2. Major State Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic (*continued*).

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Water	*Tennessee Water Quality Control Act*	TCA, 69-3-101 *et seq.*, 70-324-70	TDEC, Water Quality Control Board	Authority to issue new or modify existing NPDES permits required for a water discharge source and mandates protection of water quality.
	Tennessee National Pollutant Discharge Elimination System	TCA, 69-3-108	TDEC, Division of Water Quality	In accordance with 33 U.S.C. 1342, Tennessee enforces an EPA-authorized state program that administers both Federal and state requirements for point and nonpoint source discharges to surface water.
	Safe Drinking Water Act	TCA, 68-221-701	TDEC, Division of Water Supply	Adopts Federal standards for drinking water.
	Aquatic Resource Alteration	TDEC Rules, 1200-4-7 *et seq.*	TDEC, Division of Water Quality	Any activity which involves the alteration of waters of the state typically requires a state aquatic resource alteration permit, including activities in, but not limited to, wetlands, culverts, and road crossings over surface water.
Hazardous and Solid Wastes	Tennessee Underground Storage Tank Program Regulations	TDEC Rules, 1200-1-15	TDEC Division of UST Programs	Permit required prior to construction or modification of an underground storage tank.
	Tennessee Hazardous Waste Management Act	TCA 68-212	TDEC Division of Solid Waste Management	Permit required to construct, modify, or operate a hazardous waste treatment, storage, or disposal facility.
	Tennessee Solid Waste Processing and Disposal Regulations	TDEC Rules, 1200-1-7	TN Division of Solid Waste Management	Permit required to construct or operate a solid waste processing or disposal facility.
Biotic	Tennessee State Executive Order on Wetlands	Tennessee Executive Order 8-65	TN Division of Water Quality Control	Requires consultation with responsible agency.
	Tennessee Threatened Wildlife Species Conservation Act of 1974	TCA 70 -8	TN Wildlife Resources Agency	Requires consultation with responsible agency.

Table 7.2.1-2. Major State Authorities for Regulation of Environmental Control Remediation and Worker Safety, Arranged by Topic (*continued*).

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
	Tennessee Rare Plant Protection and Conservation Act of 1985	TCA 70-8-301 *et seq.*	TN Wildlife Resources Agency	Requires consultation with responsible agency.
	Tennessee Water Quality Control Act	TCA 69-3	TN Division of Water Quality Control	Permit required prior to alteration of a wetland.
Cultural	Desecration of Venerated Objects	TCA 39-17-311	Law enforcement, coroner	Forbids a person to offend or intentionally desecrate venerated objects including a place of worship or burial.
	Abuse of Corpse	TCA 39-17-312	Law enforcement, coroner	Forbids a person from disinterring a corpse that has been buried or otherwise interred.
	Excavation of areas containing Native American Indian human remains	TCA 11-6-116	TDEC	Requires notification prior to excavation in areas containing human remains of Native American Indian.
	Tennessee Protective Easements	TCA 11-15-101	TN State Government	Grants power to the state to restrict construction on land deemed as a “protective” easement.

Table 7.2.1-3. Selected Department of Energy Directives.

DOE Directive	Directive Title
5400.5 Chg 2	Radiation Protection of the Public and the Environment
5480.19 Chg 2	Conduct of Operations
5530.1A	Accident Response Group
5530.4	Aerial Measuring System
470.2A	Security and Emergency Management Independent Oversight and Performance Assurance Program
5632.1C	Protection and Control of Safeguards and Security Interests
M 231.1A Chg 2	Environment, Safety, and Health Reporting Manual
N 441.1	Radiological Protection for DOE Activities
O 151.1C	Comprehensive Energy Management System
O 153.1	Departmental Radiological Emergency Response Assets
O 225.1A	Accident Investigations
O 231.1A Chg 1	Environment, Safety and Health Reporting
O 414.1C	Quality Assurance
O 420.1B	Facility Safety
O 430.1B Chg 1	Real Property Asset Management
O 435.1 Chg 1	Radioactive Waste Management
O 440.1B	Worker Protection Management for DOE (including the NNSA) Federal Employees
O 450.1A	Environmental Protection Program
O 451.1B Chg 1	*National Environmental Policy Act* Compliance Program
O 460.1B	Packaging and Transportation Safety
O 460.2A	Departmental Materials Transportation and Packaging Management
O 470.4A	Safeguards and Security Program

7.3 CONSULTATION

DOE procedures for compliance with NEPA are specified in 10 CFR Part 1021, which supplements Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of NEPA (40 CFR parts 1500-1508). Among other things, these procedures require consultations with Federal and state agencies having jurisdiction or special expertise, including those responsible for protecting significant resources, such as, endangered species, critical habitats, or historic resources. Federal and state agencies with jurisdiction or expertise in these areas were consulted during the development of the Y-12 SWEIS. Representatives of Federal and state agencies were involved in scoping activities for this SWEIS and were consulted in the preparation of the Final Y-12 SWEIS. Copies of letters from DOE inviting the participation of consulting agencies and response letters received by DOE are included in Appendix C.

Table 7.3-1 provides laws and EOs that involve consultation for this SWEIS and that are applicable to the Y-12 proposed action and alternatives. Accompanying each law or EO is a brief description of the purpose of the cited statutes and the consultation occurring for the current Y-12 proposed actions and alternatives.

Table 7.3-1. Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives.

Statute/Executive Order	Statute Citation	Regulatory Citation	Consulting Agency	SWEIS—Applicability; Consultations, and DOE involvement
Endangered Species Act; The Rare Plant Protection and Conservation Act of 1985; *Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act* of 1974	16 U.S.C. § 1531 *et seq.*	19 CFR Parts 10, 12; 30 CFR Part 773; 32 CFR Part 190; 43 CFR Part 8340; 50 CFR Parts 17, 23, 81, 225, 230, 402, 424, 450-453 TAC Sections 70-8-301 to 314 TAC Sections 70-8-101 to 110	USFWS TDEC TDEC	Ensures that actions authorized, funded, or carried out by DOE are not likely to jeopardize the continued existence of any Federally listed threatened or endangered species or destroy or adversely modify their critical habitat. A biological assessment and a Section 7 Endangered Species Consultation for proposed activities included in the SWEIS shall be conducted by DOE in consultation with the U.S. Fish and Wildlife Service.
Endangered and Threatened Wildlife and Plant/Interagency Cooperation		50 CFR Part 17; 50 CFR Part 402	USFWS	Describes interagency implementation regulations for the *Endangered Species Act.*
Migratory Bird Treaty Act, as amended	16 U.S.C. § 703 *et seq.*	30 CFR Part 773; 50 CFR Parts 14, 20	Department of the Interior, USFWS	Federal statute mandates protection of sensitive or otherwise regulated wildlife species making it unlawful to pursue, hunt, take, capture, or kill (or attempt any of the preceding) any migratory bird, nest, or eggs of such birds.
Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants/Migratory Bird Hunting		50 CFR Part 10; 50 CFR Part 20	USFWS	Implementation regulations for the *Migratory Bird Treaty Act.*

Table 7.3-1. Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives (*continued*).

Statute/Executive Order	Statute Citation	Regulatory Citation	Consulting Agency	SWEIS—Applicability; Consultations, and DOE involvement
National Historic Preservation Act, as amended	16 U.S.C. § 470	7 CFR Part 656; 36 CFR Parts 61, 63, 65, 68, 78, 79, 800-811	SHPO	Protects sites with significant national historic value, placing them on the National Register of Historic Places (NRHP). DOE, as a governmental agency, must locate and inventory historic properties and cultural resources under the jurisdiction prior to undertaking an activity that might move or alter their appearance. As required by Section 106 of the NHPA and per DOE's Memorandum of Agreement with the TSHPO, proposed Y-12 activities shall be evaluated in consultation with the SHPO.
National Historic Preservation	Executive Order 11593	NA	DOE	DOE, in consultation with the ACHP (16 U.S.C. § 470i), is to institute procedures to assure Federal plans and programs that contribute to historic preservation and to proactively interact with the SHPO to identify structures, buildings, and properties to nominate for listing in the NRHP.
Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. § 3001	43 CFR Part 10	CIN	Tribal descendants shall own American Indian human remains and cultural items discovered on Federal lands after November 16, 1990. Notification of tribal governments by DOE is required if and when items are discovered during an activity at Y-12 or elsewhere on the DOE ORR.
Protection of Wetlands	Executive Order 11990	NA	USACE	Federal activities are required to avoid short- and long-term adverse impacts to wetlands whenever a practicable alternative exists.
Floodplains Management	Executive Order 11988	NA	USACE	DOE is directed to establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for any action undertaken. Impacts to floodplains are to be avoided to the extent practicable.
Wetland Protection and Floodplain Management		10 CFR Part 1022	DOE	Regulations establish requirements for compliance with Executive Orders 11990 and 11988. No floodplain impacts are identified for the SWEIS; wetland impacts are under consultation. The ORR implements protection of wetlands through each site's NEPA program in accordance with 10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements." Each of the sites has also conducted surveys for the presence of wetlands and conducts surveys on a project- or program-as needed basis. Two surveys of wetlands resources were conducted on the Y-12 Complex. *Identification and Characterization of Wetlands in the Bear Creek Watershed* surveys the Y-12 Complex and surrounding areas. *Wetland Survey of Selected Areas in the Oak Ridge Y-12 Plant Area of Responsibility, Oak Ridge, Tennessee* surveys selected areas in the Y-12 Complex area of responsibility.

Table 7.3-1. Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives (*continued*).

Statute/Executive Order	Statute Citation	Regulatory Citation	Consulting Agency	SWEIS—Applicability; Consultations, and DOE involvement
Environmental Justice	Executive Order 12898	NA	DOE	Federal entities are directed to identify and address disproportionately high adverse human health or environmental impacts on minority and low-income populations resulting from an agency's program, policies, or activities. Data must be collected, analyzed, and made publicly available on race, national origin, and income level of populations in areas surrounding the Federal facility expected to have a substantial environmental, human health, or economic effect. Environmental justice issues for Y-12 have been identified and addressed prior to preparation of this SWEIS, and are further addressed through this SWEIS; the policy requirements of this EO remains applicable to future actions at Y-12.
Protection of Children from Environmental Health Risks and Safety Risks	Executive Order 13045	NA		Directs Federal agencies, to the extent permitted by law and appropriate, and consistent with the agency's mission, to: (a) make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and (b) ensure that their policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.
Federal Workforce Transportation	Executive Order 13150	NA	EPA/DOT/ Treasury Dept./OMB/ GSA	Directs DOT, EPA and DOE to implement a "transit pass" transportation fringe benefit program as part of a three-year Nationwide Pilot Program no later than October 1, 2000. Before extending the program to other Federal agencies and their employees nationwide, results from the pilot program will be analyzed by an entity to be determined by the consulting agencies to determine whether it is effective in reducing single occupancy vehicle travel and local area traffic congestions. Federal agencies are encouraged to use any non-monetary incentive that the agencies may otherwise offer under any other provision of law or other authority to encourage mass transportation and vanpool use. Under this EO, DOE is required to implement a carpool program for all Federal employees working at ORR facilities, including Y-12.

Table 7.3-1. Applicable Laws and Executive Orders Y-12 Proposed Action and Alternatives (*continued*).

Statute/Executive Order	Statute Citation	Regulatory Citation	Consulting Agency	SWEIS—Applicability; Consultations, and DOE involvement
Federal Environmental, Energy, and Transportation Management	Executive Order 13423	NA		Requires that Federal agencies: ensure that (i) at least half of the statutorily required renewable energy consumed by the agency in a fiscal year comes from new renewable sources, and (ii) to the extent feasible, the agency implements renewable energy generation projects on agency property for agency use.

Notes: EO—Executive Order.

7.4 ENVIRONMENTAL COMPLIANCE

As described above, DOE activities, including operations at Y-12, are required to comply with environmental standards established by a number of federal and state legal authorities. Principal among the regulating agencies that verify this compliance are the EPA and TDEC These agencies issue permits, review compliance reporting, participate in joint monitoring programs, inspect facilities and operations, and oversee adherence to the requirements of applicable law.

See Chapter 4, Section 4.6.2 for a description of air quality, permit limitations and emissions at ORR and Section 4.7.2 for a description of surface water quality, permit limitations and discharges on the ORR. It also describes the current status of compliance issues associated with the current NPDES permit.

There were no penalties or consent orders issued to Y-12 in 2007. One Notice of Violation was issued, which resulted from two minor violations noted during the annual RCRA audit conducted by the TDEC in 2007. Both violations were corrected to the satisfaction of TDEC (DOE 2008).

CHAPTER 8: SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

In accordance with the *National Environmental Policy Act* (NEPA) (42 *United States Code* §4321 et seq.) requirements, this section discusses the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. It also examines long-term adverse cumulative impacts, with a focus on impacts that may narrow the range of options for future use. Impacts of the alternatives at the Y-12 National Security Complex (Y-12) are discussed in Chapter 5, and cumulative impacts are identified in Chapter 6.

Based on the general plans of the city of Oak Ridge and the surrounding counties, Y-12 and much of the surrounding area have been designated for industrial uses. The long-term productivity of Y-12 would be optimized by its continued use for U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) missions. The long-term benefits of continuing to operate Y-12 include fulfilling national defense missions, together with other research and development, and also including technology transfer to academia and industry. If Y-12 were shut down and the property were to return to other uses, such as agriculture or urban development, any short-term benefits of such a transfer would be minimal compared to the long-term loss to the Nation of a major production facility which supports our Nation's nuclear weapons stockpile and contributes significantly to nuclear nonproliferation initiatives.

Environmental remediation activities currently occurring and scheduled to continue under any alternative will, in the long term, improve the options for alternative uses of Y-12. Cleanup of the site increases the options for future use of the property rather than narrowing them.

CHAPTER 9: IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource. For example, as a landfill receives waste, the primary impact is a limit on waste capacity. The secondary impact is a limit on future land use options. An irretrievable commitment refers to the use of consumption of a resource that is neither renewable nor recoverable for use by future generations.

9.0 INTRODUCTION

Operations at Y-12 National Security Complex (Y-12) under all alternatives would require an irreversible and irretrievable commitment of resources. This section discusses four major resources: land, energy, material, and water that have the potential to be committed irreversibly or irretrievably under the Y-12 Site-Wide Environmental Impact Statement (SWEIS) alternatives.

9.1 LAND

Past activities at Y-12 have led to soil contamination. Soil contaminants include volatile organic compounds, metals, polychlorinated biphenyls, dioxins, and uranium. Although some areas of legacy contamination are in the process of investigation or remediation, testing activities could lead to discovering further contamination in these areas. Contaminated areas are essentially unavailable for other purposes due to a variety of factors. These include construction-related criteria involving soil compacting, regulatory restrictions, and compatibility issues related to U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) missions. The total acreage removed from future or unrestricted use is yet-to-be-determined because some sites could require continued monitoring, limited access, limited use, and potentially require other future corrective actions for an extended period of time. Nonhazardous waste from Y-12 would occupy landfill space, thus limiting future land use options at those locations.

9.1.1 Alternative 1 – No Action Alternative

While specific land usage within Y-12 may change, the overall industrial use classification would remain the same through the period addressed in the SWEIS. Because Y-12 would continue to require security and emergency response buffers, real estate associated with eliminating excess facilities would not be released for public use and there would be no local land use changes.

Infrastructure reduction activities would continue to consolidate the industrialized footprint at Y-12, resulting in less runoff and potential for soil erosion.

9.1.2 Alternative 2 – Uranium Processing Facility Alternative

Construction of the Uranium Processing Facility (UPF) would require approximately 35 acres of land, which includes land for a construction laydown area (4 acres) and temporary parking. While specific usage of this land may change, the overall industrial use classification would remain the same. Once operational, the UPF would take up approximately eight acres.
No added impact on land would occur during operation because of site design and engineered control measures.

9.1.3 Alternative 3 – Upgrade in-Place Alternative

Overall, there would be no appreciable land use impacts or changes beyond those described for the No Action Alternative. Operation of the upgraded facilities would have no impact on the current land use at Y-12 and would not change the current industrial use classification that exists at Y-12. Upgrading the existing facilities would not allow the Protected Area at Y-12 to be reduced from approximately 150 acres to 15 acres.

9.1.4 Alternative 4 – Capability-sized UPF Alternative

Under this alternative NNSA would construct a minimum UPF. The minimum UPF would likely be slightly smaller than the full UPF in Alternative 2 but for purposes of this SWEIS the land use impacts of the full and minimal UPFs are considered to be similar. Operations under the Capability-sized UPF Alternative would have no impact on the current land use and would not change the current industrial use classification that exists at Y-12. Consequently, the Capability-sized UPF Alternative would not entail any significant change to land use.

9.1.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Similar to Alternative 4, however, under this alternative NNSA would not add new types or increased numbers of secondaries to the stockpile. Operations under the No Net Production/Capability-sized UPF Alternative would have no impact on the current land use and would not change the current industrial use classification that exists at Y-12. Consequently, the No Net Production/Capability-sized UPF Alternative would not entail any significant change to land use.

9.2 ENERGY

The irretrievable commitment of resources during construction and operation of Y-12 facilities would include nonrenewable fuels to generate heat and power, and fuels used to operate motor vehicles and heavy equipment. Energy resources consumed at Y-12 would include electricity, natural gas, diesel fuel, fuel oil, and unleaded gasoline. Estimates of usage requirements (i.e., materials and resources) are discussed in Chapter 3 of this SWEIS.

At Y-12, the average monthly power usage is less than approximately 40 megawatts (MW); the average peak monthly usage is less than approximately 50 MW. Compared to the available capacity, which is approximately 430 MW, the available electrical capacity far exceeds current demands. Almost all of the electricity used would be generated using nonrenewable resources.

9.2.1 Alternative 1 – No Action Alternative

Activities under the No Action Alternative would cause minimal changes to the energy use and other infrastructure requirements at the site. As Y-12 continues to downsize and become more efficient, trends indicate that energy usage and most other infrastructure requirements have been reducing by approximately 2 to 5 percent per year. This is expected to continue for the foreseeable future.

9.2.2 Alternative 2 – Uranium Processing Facility Alternative

Construction of the UPF would require approximately 2.2 MW per month of electric power for the approximately 6-year construction period. During operations, the UPF would require less than 1.8 MW per month of electric power. Demand for electricity at Y-12 due to operation of the UPF would not increase because enriched uranium (EU) operations would be phased out in existing facilities once the UPF becomes operational.

9.2.3 Alternative 3 – Upgrade in-Place Alternative

There would be no change of infrastructure demands beyond the demands of the No Action alternative.

9.2.4 Alternative 4 – Capability-sized UPF Alternative

Construction of the minimum UPF would likely have the same demand for electricity as the full UPF (i.e., 2.2 MW per month) for the duration of the construction period. Because operations under the Capability-sized UPF Alternative would be a fraction of those under the other alternatives, operational energy demand under this alternative would be from about 40 to 45 percent lower than for the No Action Alternative.

9.2.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

The electricity demand under the No Net Production/Capability-sized UPF Alternative would be similar to those described above for Alternative 4.

9.3 MATERIAL

Resources irreversibly and irretrievably committed for the operation of Y-12 include construction, maintenance, and operational support materials. Consumption of these widely available materials would not be expected to result in critical shortages. The amount of materials required for construction maintenance, and operational support under all alternatives is small compared to the materials used in the local economy.

In addition to materials available in the local economy, Y-12 operations require materials that are not available on the open market, such as highly enriched uranium (HEU). NNSA maintains a stockpile of such materials that is adequate to support ongoing and reasonably foreseeable operations.

9.3.1 Alternative 1 – No Action Alternative

Consumption of materials under the No Action Alternative would be minimal and is expected to decrease as Y-12 continues to downsize and become more efficient.

9.3.2 Alternative 2 – Uranium Processing Facility Alternative

Construction, maintenance, and operational support materials would be consumed for the construction and operation of the new UPF, however, the amount of materials required would be small compared to the materials used in the local economy.

9.3.3 Alternative 3 – Upgrade in-Place Alternative

Maintenance and operational support materials would be consumed for the upgrade and operation of existing EU and other processing facilities; however, the amount of materials required would be small compared to the materials used in the local economy.

9.3.4 Alternative 4 – Capability-sized UPF Alternative

Construction, maintenance, and operational support materials would be consumed for the construction and operation of the minimum UPF, however, the amount of materials required would be small compared to the materials used in the local economy.

9.3.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Construction, maintenance, and operational support materials would be consumed for the construction and operation of the minimum UPF, however, the amount of materials required would be small compared to the materials used in the local economy.

9.4 WATER

Raw water for Oak Ridge Reservation is obtained from the Clinch River south of the eastern end of Y-12 and pumped to the water treatment plant located on the ridge northeast of Y-12. Treated water usage at Y-12 averages 4.2 million gallons per day or 2,000 million gallons per year. Regional demand on the water supply is increasing, but well below supply capabilities. Because water from the Clinch River is naturally replenished at a rate equal to or greater than usage, Y-12's water use is not considered to be an irreversible and irretrievable commitment of resources.

9.4.1 Alternative 1 – No Action Alternative

Under the No Action Alternative there would be no change in current plans; therefore there would be no irreversible and irretrievable commitment of water resources.

9.4.2 Alternative 2 – Uranium Processing Facility Alternative

Some groundwater may be extracted during construction activities and used during operation of the UPF; however would be below supply capabilities.

9.4.3 Alternative 3 – Upgrade in-Place Alternative

Water requirements under this alternative would not raise the average annual water use for Y-12 (approximately 2,000 million gallons per year); any additional impacts would not be beyond impacts described for the No Action Alternative.

9.4.4 Alternative 4 – Capability-sized UPF Alternative

It is expected that usage requirements would decrease by 40 percent due to reduction in production in the minimum UPF relative to the No Action Alternative.

9.4.5 Alternative 5 – No Net Production/Capability-sized UPF Alternative

Water usage requirements under the No Net Production/Capability-sized UPF Alternative would be similar to those described above for Alternative 4.

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CHAPTER 11: GLOSSARY

Absorbed dose: The energy imparted to matter by ionizing radiation per unit mass of irradiated material at the place of interest in that material. Expressed in units of radiation absorbed dose or grays, where one radiation absorbed dose equals 0.01 gray. Also, see "radiation absorbed dose."

Acute exposure: The exposure incurred during and shortly after a radiological release. Generally, the period of acute exposure ends when long-term interdiction is established, as necessary. For convenience, the period of acute exposure is normally assumed to end 1 week after the inception of a radiological release.

Air pollutant: Any substance in air which could, if in high enough concentration, harm people, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of matter capable of being airborne.

Air Quality Control Region (AQCR): Geographic subdivisions of the United States, designed to deal with pollution on a regional or local level. Some regions span more than one state.

Air quality standards: The level of pollutants in the air prescribed by regulations that may not be exceeded during a specified time in a defined area.

Alpha activity: The emission of alpha particles by fissionable materials (uranium or plutonium).

Alpha particle: A positively charged particle, consisting of two protons and two neutrons, that is emitted during radioactive decay from the nucleus of certain nuclides. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

Ambient air: The surrounding atmosphere as it exists around people, plants, and structures. Air quality standards are used to provide a measure of the health-related and visual characteristics of the air.

Aquifer: A saturated geologic unit through which significant quantities of water can migrate under natural hydraulic gradients.

Aquitard: A water-saturated sediment or rock whose permeability is so low it cannot transmit any useful amount of water.

Archaeological sites (resources): Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.

Artifact: An object produced or shaped by human workmanship of archaeological or historic interest.

As low as reasonably achievable (ALARA): A concept applied to the quantity of radioactivity released in routine operation of a nuclear system or facility, including "anticipated operational occurrences." It takes into account the state of technology, economics of improvements in relation to benefits to public health and safety, and other societal and economic considerations in relation to the use of nuclear energy in the public interest.

Atmospheric dispersion: The process of air pollutants being dispersed in the atmosphere. This occurs by the wind that carries the pollutants away from their source and by turbulent air motion that results from solar heating of the Earth's surface and air movement over rough terrain and surfaces.

***Atomic Energy Act* of 1954:** This act was originally enacted in 1946 and amended in 1954. For the purpose of this Programmatic Environmental Impact Statement "...a program for Government control of the possession, use, and production of atomic energy and special nuclear material whether owned by the Government or others, so directed as to make the maximum contribution to the common defense and security and the national welfare, and to provide continued assurance of the Government's ability to enter into and enforce agreements with nations or groups of nations for the control of special nuclear materials and atomic weapons..." (Section 3(c)).

Atomic Energy Commission: A five-member commission, established by the *Atomic Energy Act* of 1946, to supervise nuclear weapons design, development, manufacturing, maintenance, modification, and dismantlement. In 1974, the Atomic Energy Commission was abolished and all functions were transferred to the Nuclear Regulatory Commission and the Administrator of the Energy Research and Development Administration. The Energy Research and Development Administration was later terminated and its functions vested by law in the Administrator were transferred to the Secretary of Energy.

Background radiation: Ionizing radiation present in the environment from cosmic rays and natural sources in the Earth; background radiation varies considerably with location.

Badged worker: A worker equipped with an individual dosimeter who has the potential to be exposed to radiation.

Baseline: A quantitative expression of conditions, costs, schedule, or technical progress to serve as a base or standard for measurement during the performance of an effort; the established plan against which the status of resources and the progress of a project can be measured.

BEIR V: Biological Effects of Ionizing Radiation; referring to the fifth in a series of committee reports from the National Research Council.

Beryllium: An extremely lightweight, strong metal used in weapons systems.

Benthic: Plants and animals dwelling at the bottom of oceans, lakes, rivers, and other surface waters.

Best Available Control Technology: A term used in the Federal *Clean Air Act* that means the most stringent level of air pollutant control considering economics for a specific type of source based on demonstrated technology.

Beta particle: A charged particle emitted from the nucleus of an atom during radioactive decay. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron.

Beyond Evaluation Basis Accident: An accident, generally with more severe impacts to onsite personnel and the public than an Evaluation Basis Accident or Design Basis Accident (DBA), initiated by operational or external causes with an estimated probability of occurrence less than 10^{-6} per year and used for estimating the impacts of a planned new or modified facility and/or process. For those cases where a DBA is defined, these accidents are often referred to as Beyond Design Basis Accidents or Severe Accidents.

Case: A "case" is a container that confines the secondary and other components.

Cask (radioactive materials): A container that meets all applicable regulatory requirements for shipping.

Categorical Exclusion: A category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency in implementation of the Code of Federal Regulations and for which, therefore, neither an environmental assessment nor an environmental impact statement is required (40 CFR 1508.4).

Chemical oxygen demand: A measure of the quantity of chemically oxidizable components present in water.

Chronic exposure: Low-level radiation exposure incurred over a long period of time.

***Clean Air Act*:** This Act mandates and enforces air pollutant emissions standards for stationary sources and motor vehicles.

***Clean Air Act* Amendments of 1990:** Expands the Environmental Protection Agency's enforcement powers and adds restrictions on air toxics, ozone depleting chemicals, stationary and mobile emissions sources, and emissions implicated in rain and global warming.

***Clean Water Act* of 1972, 1987:** This Act regulates the discharge of pollutants from a point source into navigable waters of the United States in compliance with a National Pollution Discharge Elimination System permit as well as regulates discharges to or dredging of wetlands.

Climatology: The science that deals with climates and investigates their phenomena and causes.

***Code of Federal Regulations* (CFR):** All Federal regulations in force are published in codified form in the *Code of Federal Regulations*.

Collective committed effective dose equivalent (CEDE): The CEDE of radiation for a population.

Committed dose equivalent: The predicted total dose equivalent to a tissue or organ over a 50-year period after an intake of radionuclide into the body. It does not include external dose contributions. Committed dose equivalent is expressed in units of rem or Sievert. The "committed effective dose equivalent", or CEDE, is the sum of the committed dose equivalents to various tissues of the body, each multiplied by the appropriate weighting factor.

***Comprehensive Environmental Response, Compensation, and Liability Act* of 1980 (CERCLA or Superfund):** This act provides regulatory framework for remediation of past contamination from hazardous waste. If a site meets the act's requirements for designation, it is ranked along with other "Superfund" sites and is listed on the National Priorities List. This ranking is the Environmental Protection Agency's way of determining which sites have the highest priority for cleanup.

Comprehensive Test Ban Treaty (CTBT): A proposed treaty prohibiting nuclear tests of all magnitudes.

Conceptual design: Efforts to develop a project scope that will satisfy program needs; ensure project feasibility and attainable performance levels of the project for congressional consideration; develop project criteria and design parameters for all engineering disciplines; and identify applicable codes and standards, quality assurance requirements, environmental studies, construction materials, space allowances, energy conservation features, health, safety, safeguards, and security requirements and any other features or requirements necessary to describe the project.

Credible accident: An accident that has a probability of occurrence greater than or equal to one in a million years.

Criteria pollutants: Six air pollutants for which national ambient air quality standards are established by the Environmental Protection Agency under Title I of the Federal *Clean Air Act*: sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, particulate matter (smaller than 10 microns in diameter), and lead.

Critical habitat: Defined in the *Endangered Species Act* of 1973 as "specific areas within the geographical area occupied by [an endangered or threatened] species..., essential to the conservation of the species and which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species... that are essential for the conservation of the species."

Criticality: The condition in which nuclear fuel sustains a chain reaction. It occurs when the number of neutrons present in one generation cycle equals the number generated in the previous cycle.

Cultural resources: Archaeological sites, architectural features, traditional use areas, and Native American sacred sites or special use areas.

Cumulative impacts: In an EIS, the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal), private industry, or individuals undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR Part 1508).

Decommissioning: The process of withdrawing a building, equipment, or a facility from active service.

Decontamination: The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive or chemical contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

Design-basis accident (DBA): An accident postulated for the purpose of establishing functional and performance requirements for safety structures, systems, and components.

Designed-denial: Utilization of security technologies in the facility design process to achieve a security posture that will meet security requirements.

Depleted uranium: Uranium whose content of the isotope uranium-235 is less than 0.7 percent, which is the uranium-235 content of naturally occurring uranium.

Direct economic effects: The initial increases in output from different sectors of the economy resulting from some new activity within a predefined geographic region.

Direct Effect Multiplier: The total change in regional earnings and employment in all related industries as a result of a one-dollar change in earnings and a one-job change in a given industry.

Direct jobs: The number of workers required at a site to implement an alternative.

Disposition: The ultimate "fate" or end use of a surplus Department of Energy facility following the transfer of the facility to the Office of the Assistant Secretary for Environmental Waste Management.

Dose: The energy imparted to matter by ionizing radiation. The unit of absorbed dose is the rad.

Dose commitment: The dose an organ or tissue would receive during a specified period of time (e.g., 50 to 100 years) as a result of intake (as by ingestion or inhalation) of one or more radionuclides from a defined release, frequently over a year's time.

Dose equivalent: The product of absorbed dose in rad (or gray) and the effect of this type of radiation in tissue, and a quality factor. Dose equivalent is expressed in units of rem or Sievert, where 1 rem equals 0.01 Sievert. The dose equivalent to an organ, tissue, or the whole body will be that received from the direct exposure plus the 50-year committed dose equivalent received from the radionuclides taken into the body during the year.

Dosimeter: A small device (instrument) carried by a radiation worker that measures cumulative radiation dose (e.g., TLD - thermoluminescent badge or ionization chamber).

Drinking-water standards: The prescribed level of constituents or characteristics in a drinking water supply that cannot be exceeded legally.

Dual use/dual benefit: Projects that have uses in or benefits for the defense sector and the private industry or civilian sector.

Effective dose equivalent (EDE): The summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue. The EDE includes the CEDE from internal deposition of radionuclides, and the effective dose equivalent due to penetrating radiation from sources external to the body. EDE is expressed in units of rem (or Sievert).

Effluent: A gas or fluid discharged into the environment.

Emission standards: Legally enforceable limits on the quantities and/or kinds of air contaminants that can be emitted into the atmosphere.

Endangered species: Defined in the *Endangered Species Act* of 1973 as "any species which is in danger of extinction throughout all or a significant portion of its range."

***Endangered Species Act* of 1973:** This act requires Federal agencies, with the consultation and assistance of the Secretaries of the Interior and Commerce, to ensure that their actions will not likely jeopardize the continued existence of any endangered or threatened species or adversely affect the habitat of such species.

Enduring stockpile: Weapons types expected to be retained in the smaller stockpile for the foreseeable future.

Environment, safety and health (ES&H) program: In the context of the Department of Energy, encompasses those Department of Energy requirements, activities, and functions in the conduct of all Department of Energy and Department of Energy-controlled operations that are concerned with: impacts to the biosphere; compliance with environmental laws, regulations, and standards controlling air, water, and soil pollution; limiting the risks to the well-being of both operating personnel and the general public to acceptably low levels; and protecting property adequately against accidental loss and damage. Typical activities and functions related to this program include, but are not limited to, environmental protection, occupational safety, fire protection, industrial hygiene, health physics, occupational medicine, and process and facilities safety, nuclear safety, emergency preparedness, quality assurance, and radioactive and hazardous waste management.

Environmental Assessment (EA): A written environmental analysis that is prepared pursuant to the *National Environmental Policy Act* to determine whether a Federal action would significantly affect the environment and thus require preparation of a more detailed environmental impact statement. If the action would not significantly affect the environment, then a finding of no significant impact is prepared.

Environmental Impact Statement (EIS): A document required of Federal agencies by the *National Environmental Policy Act* for major proposals significantly affecting the environment. A tool for decision-making, it describes the positive and negative effects of the undertaking and alternative actions.

Environmental justice: The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards due to a lack of political or economic strength.

Environmental survey: A documented, multidisciplined assessment (with sampling and analysis) of a facility to determine environmental conditions and to identify environmental problems requiring corrective action.

Epicenter: The point on the Earth's surface directly above the focus of an earthquake.

Epidemiology: The science concerned with the study of events that determine and influence the frequency and distribution of disease, injury, and other health-related events and their causes in a defined human population.

ES&H vulnerabilities: Conditions or weaknesses at facilities that could lead to unnecessary or increased exposure of workers or the public to radiation or to highly enriched uranium (HEU) associated chemical hazards, or to the release of radioactive materials to the environment.

Evaluation Basis Accident: An accident, generally with small impacts to the public, initiated by operational or external causes with an estimated probability of occurrence greater than 10^{-6} per year and used for estimating the impacts of a planned new or modified facility and/or process when a Safety Analysis Report, that would define a DBA, has not been prepared. A DBA is used to establish the performance requirements of structures, systems, and components that are necessary to maintain them in a safe shutdown condition indefinitely or to prevent or mitigate the consequences of the DBA so that the public and onsite personnel are not exposed to radiation in excess of appropriate guideline values.

Exposure limit: The level of exposure to a hazardous chemical (set by law or a standard) at which or below which adverse human health effects are not expected to occur:

- Reference dose is the chronic exposure dose (mg or kg per day) for a given hazardous chemical at which or below which adverse human non-cancer health effects are not expected to occur.

- Reference concentration is the chronic exposure concentration (mg/m3) for a given hazardous chemical at which or below which adverse human non-cancer health effects are not expected to occur.

Fault: A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred. A normal fault occurs when the hanging wall has been depressed in relation to the footwall. A reverse fault occurs when the hanging wall has been raised in relation to the footwall.

Finding of No Significant Impact (FONSI): A document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded, will not have a significant effect on the human environment and will not require an environmental impact statement.

Fissile material: Any material capable of supporting a self-sustaining neutron chain reaction to include uranium-233, enriched uranium, plutonium-239, plutonium-241, americium-242, curium-243, curium-245,-247, californium-249,-251.

Floodplain: The lowlands adjoining inland and coastal waters and relatively flat areas including at a minimum that area inundated by a 1-percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical action floodplain is defined as the 500-year (0.2 percent) floodplain.

Foreign Research Reactors: Nuclear reactors, in different countries, that make neutrons used in applications such as analysis and testing of materials, production of radioisotopes, and research including medical research. Low enriched uranium (LEU) is often times an element used in powering research reactors.

Formation: In geology, the primary unit of formal stratigraphic mapping or description. Most formations possess certain distinctive features.

Fugitive emissions: Emissions to the atmosphere from pumps, valves, flanges, seals, and other process points not vented through a stack. Also includes emissions from area sources such as ponds, lagoons, landfills, and piles of stored material.

Gamma rays: High-energy, short-wavelength, electromagnetic radiation accompanying fission and emitted from the nucleus of an atom. Gamma rays are very penetrating and can be stopped only by dense materials (such as lead) or a thick layer of shielding materials.

Gaussian plume: The distribution of material (a plume) in the atmosphere resulting from the release of pollutants from a stack or other source. The distribution of concentrations about the centerline of the plume, which is assumed to decrease as a function of its distance from the source and centerline (Gaussian distribution), depends on the mean wind speed and atmospheric stability.

Genetic effects: The outcome resulting from exposure to mutagenic chemicals or radiation which results in genetic changes in germ line or somatic cells.

- Effects on genetic material in germ line (sex cells) cause trait modifications that can be passed from parents to offspring.
- Effects on genetic material in somatic cells result in tissue or organ modifications (e.g. liver tumors) that do not pass from parents to offspring.

Global Threat Reduction Initiative (GTRI): NNSA operations based at Y-12 that are uniquely qualified to assist in removing, securing, and dispositioning special nuclear threats from the U.S. and around the globe.

Glove box: An airtight box used to work with hazardous material, vented to a closed filtering system, having gloves attached inside of the box to protect the worker.

Hazard chemical: Under 29 CFR 1910, Subpart Z, "hazardous chemicals" are defined as "any chemical which is a physical hazard or a health hazard." Physical hazards include combustible liquids, compressed gases, explosives, flammables, organic peroxides, oxidizers, pyrophorics, and reactives. A health hazard is any chemical for which there is good evidence that acute or chronic health effects occur in exposed employees. Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes or mucous membranes.

Hazard Index (HI): A summation of the hazard quotient for all chemicals now being used at a site and those proposed to be added to yield cumulative levels for a site. A HI value of 1.0 or less means that no adverse human health effects (non-cancer) are expected to occur.

Hazard quotient (HQ): The ratio of the estimated exposure (e.g., daily intake rate) to be expected to have no adverse effects. It is independent of a cancer risk, which is calculated only for those chemicals identified as carcinogens.

Hazardous material: A material, including a hazardous substance, as defined by 49 CFR 171.8 which poses a risk to health, safety, and property when transported or handled.

Hazardous/toxic waste: Any solid waste (can also be semisolid or liquid, or contain gaseous material) having the characteristics of ignitability, corrosivity, toxicity, or reactivity, defined by the *Resource Conservation and Recovery Act* and identified or listed in 40 CFR 261 or by the *Toxic Substances Control Act*.

Heavy metals: Metallic or semimetallic elements of high molecular weight, such as mercury, chromium, cadmium, lead, and arsenic, that are toxic to plants and animals at known concentrations.

High-efficiency particulate air (HEPA) filter: A filter used to remove particulates from dry gaseous effluent streams.

High-level waste: The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid. High-level waste contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

Highly enriched uranium (HEU): Uranium enriched to 20 percent or more of the uranium-235 isotope.

Historic resources: Archaeological sites, architectural structures, and objects produced after the advent of written history dating to the time of the first Euro-American contact in an area.

Hydrology: The science dealing with the properties, distribution, and circulation of natural water systems.

Incident-free risk: The radiological or chemical impacts resulting from packages aboard vehicles in normal transport. This includes the radiation or hazardous chemical exposure of specific population groups such as crew, passengers, and bystanders.

Indirect economic effects: Indirect effects result from the need to supply industries experiencing direct economic effects with additional outputs to allow them to increase their production. The additional output from each directly affected industry requires inputs from other industries within a region (i.e., purchases of goods and services). This results in a multiplier effect to show the change in total economic activity resulting from a new activity in a region.

Induced economic effects: The spending of households resulting from direct and indirect economic effects. Increases in output from a new economic activity lead to an increase in household spending throughout the economy as firms increase their labor inputs.

Indirect jobs: Within a regional economic area, jobs generated or lost in related industries as a result of a change in direct employment.

Interim (permit) status: Period during which treatment, storage, and disposal facilities coming under the *Resource Conservation and Recovery Act* of 1980 are temporarily permitted to operate while awaiting denial or issuance of a permanent permit.

Ionizing radiation: Alpha particles, beta particles, gamma rays, X-rays, neutrons, high speed electrons, high speed protons, and other particles or electromagnetic radiation that can displace electrons from atoms or molecules, thereby producing ions.

Isotope: An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of protons but different numbers of neutrons and different atomic masses.

Lacustrine wetland: Lakes, ponds, and other enclosed open waters at least 20 acres in extent and not dominated by trees, shrubs, and emergent vegetation.

Laser: A device that produces a beam of monochromatic (single-color) "light" in which the waves of light are all in phase. This condition creates a beam that has relatively little scattering and has a high concentration of energy per unit area.

Latent fatalities: Fatalities associated with acute and chronic environmental exposures to chemicals or radiation.

Low Enriched Uranium (LEU): Uranium with a lower than 20 percent concentration of the isotope U^{235}. Depending on the percentage LEU can be used in commercial light water reactors for power purposes, research reactors for non power purposes or to replace highly enriched uranium.

Low-level waste: Waste that contains radioactivity but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or "11e(2) by-product material" as defined by DOE Order 5820.2A, *Radioactive Waste Management*. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic waste is less than 100 nanocuries per gram. Some low-level waste is considered classified because (1) the nature of the generating process and/or constituents, and (2) the waste would reveal too much about the generating process.

Manufacturing: see "production."

Material Access Areas (MAA's): Areas that house Categories I, II, and sometimes III enriched uranium materials and require the highest level of security. see "Special nuclear materials" for a definition of Categories I, II, and III.

Maximum contaminant level: The maximum permissible level of a contaminant in water delivered to any user of a public water system. Maximum contaminant levels are enforceable standards.

Maximally exposed individual (MEI): A hypothetical person who could potentially receive the maximum dose of radiation or hazardous chemicals.

Meteorology: The science dealing with the atmosphere and its phenomena, especially as relating to weather.

Migration: The natural movement of a material through the air, soil, or groundwater; also, seasonal movement of animals from one area to another.

Mixed waste: Waste that contains both "hazardous waste" and "radioactive waste" as defined in this glossary.

Modified Mercalli intensity: A level on the modified Mercalli scale. A measure of the perceived intensity of earthquake ground shaking with 12 divisions, from I (not felt by people) to XII (damage nearly total).

National Ambient Air Quality Standards (NAAQS): Air quality standards established by the *Clean Air Act*, as amended. The primary NAAQS are intended to protect the public health with an adequate margin of safety, and the secondary NAAQS are intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.

National Emission Standards for Hazardous Air Pollutants (NESHAP): Standards set by the U.S. Environmental Protection Agency for air pollutants which are not covered by National Ambient Air Quality Standards and which may, at sufficiently high levels, cause increased fatalities, irreversible health effects, or incapacitating illness. These standards are given in 40 CFR Part 61 and 63. National Emission Standards for Hazardous Air Pollutants are given for many specific categories of sources (e.g., equipment leaks, industrial process cooling towers, dry-cleaning facilities, petroleum refineries).

***National Environmental Policy Act* of 1969 (NEPA):** This Act is the basic national charter for the protection of the environment. It requires the preparation of an environmental impact statement for every major Federal action that may significantly affect the quality of the human or natural environment. Its main purpose is to provide environmental information to decision makers and the public so that actions are based on an understanding of the potential environmental consequences of a proposed action and its reasonable alternatives.

National Environmental Research Park (NERP): An outdoor laboratory set aside for ecological research to study the environmental impacts of energy developments. NERPs were established by the Department of Energy to provide protected land areas for research and education in the environmental sciences and to demonstrate the environmental compatibility of energy technology development and use.

***National Historic Preservation Act* of 1966, as amended (NHPA):** This Act provides that property resources with significant national historic value be placed on the National Register of Historic Places. It does not require any permits but, pursuant to Federal code, if a proposed action might impact an historic property resource, it mandates consultation with the proper agencies.

National Pollutant Discharge Elimination System (NPDES): Federal permitting system required for hazardous effluents regulated through the *Clean Water Act*, as amended.

National Register of Historic Places (NRHP): A list maintained by the Secretary of the Interior of districts, sites, buildings, structures, and objects of prehistoric or historic local, state, or national significance. The list is expanded as authorized by Section 2(b) of the *Historic Sites Act* of 1935 (16 U.S.C. 462) and Section 101(a)(1)(A) of the NHPA of 1966, as amended.

Nitrogen oxides (NO_X): Refers to the oxides of nitrogen, primarily NO (nitrogen oxide) and NO_2 (nitrogen dioxide). These are produced in the combustion of fossil fuels and can constitute an air pollution problem. When nitrogen dioxide combines with volatile organic compounds, such as ammonia or carbon monoxide, ozone is produced.

Nonattainment area: An air quality control region (or portion thereof) in which the Environmental Protection Agency has determined that ambient air concentrations exceed NAAQS for one or more criteria pollutants.

Nonproliferation Treaty: A treaty with the aim of controlling the spread of nuclear weapons technologies, limiting the number of nuclear weapons states and pursuing, in good faith, effective measures relating to the cessation of the nuclear arms race. The treaty does not invoke stockpile reductions by nuclear states, and it does not address actions of nuclear states in maintaining their stockpiles.

Nuclear facility: A facility whose operation involves radioactive materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public. Included are facilities that produce, process, or store radioactive liquid or solid waste, fissionable materials, or tritium; conduct separations operations; conduct irradiated materials inspection, fuel fabrication, decontamination, or recovery operations. Incidental use of radioactive materials in a facility operation (e.g., check sources, radioactive sources, and X-ray machines) does not necessarily require a facility to be included in this definition.

Nuclear grade: Material of a quality adequate for use in a nuclear application.

Nuclear production: Production operations for components of nuclear weapons that are fabricated from nuclear materials, including plutonium and uranium.

Nuclear (or national) security enterprise: A relatively new term that refers to the NNSA complex in its entirety. In the past, NNSA used the term "nuclear weapons complex". NNSA believes that "nuclear security enterprise" more accurately describes its basic mission as a "nuclear security" organization that addresses a broad range of nuclear security items (the stockpile, nuclear nonproliferation, nuclear counter-terrorism, incident response, emergency management, etc.). NNSA's national security enterprise consists of the eight major facilities across the country that work together to keep the nation's nuclear weapons safe and reliable without underground nuclear testing. The facilities are: Los Alamos National Laboratory (NM), Lawrence Livermore National Laboratory (CA), Sandia National Laboratories (NM and CA), Pantex Plant (TX), Y-12 National Security Complex (TN), Kansas City Plant (MO), Savannah River Site (SC), and Nevada Test Site (NV).

Nuclear weapon: The general name given to any weapon in which the explosion results from the energy released by reactions involving atomic nuclei, either fission, fusion, or both.

Nuclear Weapons Complex: See "nuclear security enterprise."

Occupational Safety and Health Administration (OSHA): Oversees and regulates workplace health and safety, created by the *Occupational Safety and Health Act* of 1970.

Offsite: As used in this EIS, the term denotes a location, facility, or activity occurring outside the boundary of the entire Oak Ridge Reservation site.

Onsite: As used in this EIS, the term denotes a location or activity occurring somewhere within the boundary of the Oak Ridge Reservation.

Onsite population: Department of Energy and contractor employees who are on duty, and badged onsite visitors.

Operable unit: A discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration or eliminates or mitigates a release, threat of release, or pathway of exposure. The cleanup of a site can be divided into a number of operable units.

Outfall: The discharge point of a drain, sewer, or pipe as it empties into a body of water.

Ozone: The triatomic form of oxygen; in the stratosphere, ozone protects the Earth from the sun's ultraviolet rays, but in lower levels of the atmosphere ozone is considered an air pollutant.

Packaging: The assembly of components necessary to ensure compliance with Federal regulations. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle tie-down system and auxiliary equipment may be designated as part of the packaging.

Palustrine wetland: Nontidal wetlands dominated by trees, shrubs, and emergent vegetation.

Perched groundwater: A body of groundwater of small lateral dimensions lying above a more extensive aquifer.

Performance Categories (PC): Defined in DOE O 420.1, performance categories classify the performance goals of a facility in terms of a facility's structural ability to withstand natural phenomena hazards (i.e., earthquakes, winds, and floods). Ranging from 0 to 4, each PC has a qualitative and quantitative description of the performance goal for its category. Both the qualitative description of acceptable performance and the quantitative probability for each PC are equally significant in establishing the design and evaluation criteria. In general, facilities that are classified as (1) PC 0 do not consider safety, mission, or cost considerations, (2) PC 1 must maintain occupant safety, (3) PC 2 must maintain occupant safety and continued operations with minimum interruption, (4) PC 3 must maintain occupant safety, continued operations, and hazard materials confinement, and (5) PC 4 must meet occupant safety, continued operations, and confidence of hazard confinement.

Person-rem: The unit of collective radiation dose commitment to a given population; the sum of the individual doses received by a population segment.

Physical setting: The land and water form, vegetation, and structures that compose the landscape.

Plume: The elongated pattern of contaminated air or water originating at a point source, such as a smokestack or a hazardous waste disposal site.

Plutonium: A heavy, radioactive, metallic element with the atomic number 94. It is produced artificially in a reactor by bombardment of uranium with neutrons and is used in the production of nuclear weapons.

Prehistoric: Predating written history, in North America, also predating contact with Europeans.

Prevention of Significant Deterioration: Regulations established by the 1977 *Clean Air Act* Amendments to limit increases in criteria air pollutant concentrations above baseline.

Prime farmland: Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor without intolerable soil erosion, as determined by the Secretary of Agriculture (*Farmland Protection Policy Act* of 1981, 7 CFR Part 658).

Probable maximum flood: Flood levels predicted for a scenario having hydrological conditions that maximize the flow of surface waters.

Production: Encompasses the fabrication, processing, assembly, and acceptance testing of nuclear weapons and nuclear weapon components, and is interchangeable with the term manufacturing.

Programmatic Environmental Impact Statement (PEIS): Programmatic EISs are broadly scoped analyses that assess the environmental impacts of federal actions across a span of conditions, such as facilities, geographic regions, or multi-project programs.

Project-specific EIS: A legal document prepared in accordance with the requirements of 102(2)(C) of NEPA which evaluates the environmental impacts of a single action at a single site.

Proliferation: The spread of nuclear weapons and the materials and technologies used to produce them.

Protected area: An area encompassed by physical barriers, subject to access controls, surrounding material access areas, and meeting the standards of DOE Order 5632.1C, *Protection and Control of Safeguards and Security Interests.*

Quality factor: The principal modifying factor that is employed to derive dose equivalent from absorbed dose.

Rad: See “radiation absorbed dose.”

Radiation: The particles or electromagnetic energy emitted from the nuclei of radioactive atoms. Some elements are naturally radioactive; others are induced to become radioactive by bombardment in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.

Radiation absorbed dose: The basic unit of absorbed dose equal to the absorption of 0.01 joule per kilogram of absorbing material.

Radioactive waste: Materials from nuclear operations that are radioactive or are contaminated with radioactive materials, and for which use, reuse, or recovery are impractical.

Radioactivity: The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

Radioisotopes: Radioactive nuclides of the same element (same number of protons in their nuclei) that differ in the number of neutrons.

Radionuclide: A radioactive element characterized according to its atomic mass and atomic number which can be man-made or naturally occurring. Radionuclides can have a long life as soil or water pollutants, and are believed to have potentially mutagenic or carcinogenic effects on the human body.

RADTRAN: A computer code combining user-determined meteorological, demographic, transportation, packaging, and material factors with health physics data to calculate the expected radiological consequences and accident risk of transporting radioactive material.

Reasonably Available Control Technology: The lowest emissions limit that a particular source is capable of meeting by the application of control technology that is reasonably available as well as technologically and economically feasible.

Receiving waters: Rivers, lakes, oceans, or other bodies of water into which wastewaters are discharged.

Recharge: Replenishment of water to an aquifer.

Record of Decision (ROD): A document prepared in accordance with the requirements of 40 CFR 1505.2 that provides a concise public record of the Department of Energy's decision on a proposed action for which an EIS was prepared. A ROD identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), factors balanced by the Department of Energy in making the decision, whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why they were not.

Regional economic area: A geographic area consisting of an economic node and the surrounding counties that are economically related and include the places of work and residences of the labor force. Each regional economic area is defined by the U.S. Bureau of Economic Analysis.

Region of influence (ROI): A site-specific geographic area that includes the counties where approximately 90 percent of the current Department of Energy and/or contractor employees reside.

Rem: See "roentgen equivalent man."

Remediation: The process, or a phase in the process, of rendering radioactive, hazardous, or mixed waste environmentally safe, whether through processing, entombment, or other methods.

Replacement Secondary Fabrication: This function includes the fabrication, surveillance, and storage of the secondary uranium and lithium portion of a nuclear weapon.

***Resource Conservation and Recovery Act* (RCRA), as amended:** A law that gives the Environmental Protection Agency the authority to control hazardous waste from "cradle to grave" (i.e., from the point of generation to the point of ultimate disposal), including its minimization, generation, transportation, treatment, storage, and disposal. RCRA also sets forth a framework for the management on non-hazardous solid wastes.

Riparian wetlands: Wetlands on or around rivers and streams.

Risk: A quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

Risk assessment (chemical or radiological): The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or radiological materials.

Roentgen: A unit of exposure to ionizing X- or gamma radiation equal to or producing 1 electrostatic unit of charge per cubic centimeter of air. It is approximately equal to 1 rad.

Roentgen equivalent man (REM): The unit of radiation dose for biological absorption equal to the product of the absorbed dose, in rads, a quality factor which accounts for the variation in biological effectiveness of different types of radiation. Also known as "rem."

Runoff: The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually enters streams.

***Safe Drinking Water Act*, as amended:** This Act protects the quality of public water supplies, water supply and distribution systems, and all sources of drinking water.

Safe secure trailer (SST): A specially designed semitrailer, pulled by an armored tractor, which is used for the safe, secure transportation of cargo containing nuclear weapons or special nuclear material.

Safety Analysis Report: A safety document providing a concise but complete description and safety evaluation of a site, design, normal and emergency operation, potential accidents, predicted consequences of such accidents, and the means proposed to prevent such accidents or mitigate their consequences. A safety analysis report is designated as final when it is based on final design information. Otherwise, it is designated as preliminary.

Sanitary wastes: Wastes generated by normal housekeeping activities, liquid or solid (includes sludge), which are not hazardous or radioactive.

Scope: In a document prepared pursuant to the NEPA of 1969, the range of actions, alternatives, and impacts to be considered.

Scoping: Involves the solicitation of comments from interested persons, groups, and agencies at public meetings, public workshops, in writing, electronically, or via fax to assist Department of Energy in defining the proposed action, identifying alternatives, and developing preliminary issues to be addressed in an EIS.

Secondary: See "weapon secondary."

Security: Minimizing the likelihood of unauthorized access to or loss of custody of a nuclear weapon or weapon system, and ensuring that the weapon can be recovered should unauthorized access or loss of custody occur.

Seismic: Pertaining to any earth vibration, especially an earthquake.

Seismic zone: An area defined by the Uniform Building Code (1991), designating the amount of damage to be expected as the result of earthquakes. The United States is divided into six zones: (1) Zone 0 - no damage; (2) Zone 1 - minor damage; corresponds to intensities V and VI of the modified Mercalli intensity scale; (3) Zone 2A - moderate damage; corresponds to intensity VII of the modified Mercalli intensity scale (eastern U.S.); (4) Zone 2B - slightly more damage than 2A (western U.S.); (5) Zone 3 - major damage; corresponds to intensity VII and higher of the modified Mercalli intensity scale; and (6) Zone 4 - areas within Zone 3 determined by proximity to certain major fault systems.

Seismicity: The tendency for the occurrence of earthquakes.

Severe accident: An accident with a frequency rate of less than 10^{-6} per year that would have more severe consequences than a design-basis accident, in terms of damage to the facility, offsite consequences, or both.

Shielding: Any material of obstruction (bulkheads, walls, or other constructions) that absorbs radiation in order to protect personnel or equipment.

Short-lived nuclides: Radioactive isotopes with half-lives no greater than about 30 years (e.g., cesium^{137} and SR^{90}).

Shrink-swell potential: Refers to the potential for soils to contract while drying and expand after wetting.

Silt: A sedimentary material consisting of fine mineral particles intermediate in size between sand and clay.

Siltstone: A sedimentary rock composed of fine textured minerals.

Site-Wide EIS (SWEIS): A document prepared in accordance with the requirements of 102(2)(C) of NEPA which evaluates the environmental impacts of many actions at one large, multiple-facility Department of Energy site. Site-wide EISs are used to support programmatic and specific decisions.

Source term: The estimated quantities of radionuclides or chemical pollutants released to the environment.

Special nuclear materials (SNM): As defined in Section 11 of the *Atomic Energy Act* of 1954, special nuclear material means (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Nuclear Regulatory Commission determines to be special nuclear material, or (2) any material artificially enriched by any of the foregoing (it does not include source material). Special nuclear material is categorized into Security Categories I, II, III, and IV based on the type, attractiveness level, and quantity of material. Categories I and II require the highest level of security.

Standardization (Epidemiology): Techniques used to control the effects of differences (e.g., age) between populations when comparing disease experience. The two main methods are:

- Direct method, in which specific disease rates in the study population are averaged, using as weights the distribution of the comparison population.
- Indirect method, in which the specific disease rates in the comparison population are averaged, using as weights the distribution of the study population.

Strategic Arms Reduction Treaty (START) I and II: Terms which refer to negotiations between the U.S. and Russia (the former Soviet Union during START I negotiations) aimed at limiting and reducing nuclear arms. START I discussions began in 1982 and eventually led to a ratified treaty in 1988. The START II protocol, which in December 2000, will attempt to further reduce the acceptable levels of nuclear weapons ratified in START I.

Strategic reserve: That quantity of plutonium and highly enriched uranium reserved for future weapons use. For the purposes of this SWEIS, strategic reserves of plutonium will be in the form of pits, and strategic reserves of highly enriched uranium will be in the form of canned secondary assemblies. Strategic reserves also include limited quantities of plutonium and highly enriched uranium metal maintained as working inventory at Department of Energy laboratories.

***Superfund Amendments and Reauthorization Act* (SARA) of 1986:** Public Law 99-499 passed in 1986 which amends the CERCLA of 1980. SARA more stringently defines hazardous waste cleanup standards and emphasizes remedies that permanently and significantly reduce the mobility, toxicity, or volume of wastes. Title III of SARA, the Emergency Planning and

Community Right-to-Know Act, mandates establishment of community emergency planning programs, emergency notification, reporting of chemicals, and emission inventories.

Surface water: Water on the Earth's surface, as distinguished from water in the ground (groundwater).

Threatened species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Threshold limit values: The recommended concentrations of contaminants workers may be exposed to according to the American Council of Governmental Industrial Hygienists.

***Toxic Substances Control Act* of 1976 (TSCA):** This act authorizes the Environmental Protection Agency to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the Environmental Protection Agency before they are manufactured for commercial purposes.

Transuranic waste: Waste contaminated with alpha-emitting radionuclides with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram at time of assay.

Unclassified Controlled Nuclear Information (UCNI): Certain unclassified but sensitive Government information concerning nuclear material, weapons, and components whose dissemination is controlled under section 148 of the *Atomic Energy Act*.

Unusual occurrence: Any unusual or unplanned event that adversely affects or potentially affects the performance, reliability, or safety of a facility.

Uranium: A naturally occurring heavy, silvery-white metallic element (atomic number 92) with many radioactive isotopes. Uranium-235 is most commonly used as a fuel for nuclear fission. Another isotope, uranium-238, can be transformed into fissionable plutonium-239 following its capture of a neutron in a nuclear reactor.

Volatile organic compound: A broad range of organic compounds, often halogenated, that vaporize at ambient or relatively low temperatures, such as benzene, chloroform, and methyl alcohol.

Visual Resource Management (VRM) Class: Port of BLM's visual resource inventory process that provides a means for determining visual values, consisting of scenic quality evaluation, sensitivity level analysis, and delineation of distance zones. Classes are established through a resource management planning (RMP) process and are ultimately based on management decisions made in the RMPs. Classes range from VRM Class I (highly scenic) to VRM Class IV (industrialized, low scenic quality). Management objectives for these classes are: Class I, preserve existing character of landscape; Class II, retain existing character of landscape with little change that respects basic elements of landscape; Class III, partially retain existing character of landscape with moderate changes that do not dominate view of casual observer; and Class IV, major modifications of existing character of landscape that dominate viewer's attention.

War Reserve: Operational weapons and materials designated as essential for national security needs.

Waste Isolation Pilot Plant (WIPP): A facility in southeastern New Mexico developed as the disposal site for transuranic waste.

Waste minimization and pollution prevention: An action that economically avoids or reduces the generation of waste and pollution by source reduction, reducing the toxicity of hazardous waste and pollution, improving energy use, or recycling. These actions will be consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

Weapon secondary: A "secondary" is a component of a nuclear weapon that contains elements needed to initiate the fusion reaction in a thermonuclear explosion.

Weapons-grade: Fissionable material in which the abundance of fissionable isotopes is high enough that the material is suitable for use in nuclear weapons.

Weighting factor: Represents the fraction of the total health risk resulting from uniform whole-body irradiation that could be attributed to that particular tissue.

Wetland: Land or areas exhibiting hydric soil conditions, saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions.

Whole-body dose: Dose resulting from the uniform exposure of all organs and tissues in a human body. (See also "effective dose equivalent.")

Wind rose: A depiction of wind speed and direction frequency for a given period of time.

Worker year: Measurement of labor requirement equal to 1 full-time worker employed for 1 year.

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CHAPTER 14: DISTRIBUTION LIST

Chapter 14 provides a list of the parties to whom the U.S. Department of Energy (DOE) distributed this Draft Y-12 Site-Wide Environmental Impact Statement (SWEIS).

The U.S. Department of Energy (DOE) provided copies of the Draft Y-12 Site-Wide Environmental Impact Statement (SWEIS), or the Summary of the Draft Y-12 SWEIS, to Federal, state, and local elected and appointed government officials and agencies; Native American representatives; national, state, and local environmental and public interest groups; and other organizations and individuals listed in this chapter. Approximately 35 printed copies of the complete Draft Y-12 SWEIS were sent to interested parties. Additionally, approximately 100 copies of the Summary, accompanied by an electronic copy (CD-ROM) of the complete Draft Y-12 SWEIS, were sent to interested parties. Printed copies of the complete Draft Y-12 SWEIS will be provided to others upon request. The Draft Y-12 SWEIS can be found on the worldwide web at: http://www.y12sweis.com.

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APPENDIX A: Y-12 PLANNING PROCESS AND FACILITY INFORMATION

APPENDIX A: Y-12 PLANNING PROCESS AND FACILITY INFORMATION

This appendix to the Y-12 Site-Wide Environmental Impact Statement (SWEIS) presents information on both the planning processes and facilities associated with the Y-12 National Security Complex (Y-12). This includes a summary of major Y-12 configurations and infrastructure; a description of the Y-12 production processes; a description of Defense Programs (DP) major facilities; a summary of principal Waste Management activities; information about traffic and transportation; and a description of the facility planning and transition process. Tables and figures related to these discussions are included to conveniently summarize selected facility information.

A.1 Y-12 SITE CONFIGURATION AND INFRASTRUCTURE

This section summarizes information dealing with the Y-12 Site configuration and infrastructure.

A.1.1 Site Configuration

The Y-12 Area of Responsibility in the Oak Ridge Reservation (ORR) covers about 5,400 acres. The main area of Y-12 is largely developed and encompasses about 800 acres, with nearly 600 acres enclosed by a security fence. The National Nuclear Security Administration (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. The structures include laboratory, machining, dismantlement, storage, and research and development (R&D) areas. Because of the Site's defense programs manufacturing and storage facilities, the land in the Y-12 area is classified in the U.S. Department of Energy's (DOE's) industrial category. The *Y-12 Ten-Year Site Plan FY 2009–2018* (NNSA 2008a) identifies 13 mission critical facilities on Y-12.

More than 70 percent of the floor space at Y-12 was built prior to 1950 as part of the Manhattan Project. Many of the old buildings supported the Plant's original mission to electromagnetically separate isotopes of uranium. These buildings have been modified over the years to accommodate changing missions. The separation of lithium isotopes with column exchange technology was performed in some of the buildings, but that process was discontinued in the 1960s.

The Enriched Uranium (EU) Complex was built in the early 1940s with several buildings added in the 1950s. The most recent production facility additions at Y-12 were made in the late 1960s and early 1970s as part of the Production Facilities Modifications Program. Major facilities added at that time included the depleted uranium (DU) Metalworking Building, Assembly and Special Materials Process Buildings, and the Special Materials Machining Building.

[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).

Generally speaking, Y-12 can be divided into three areas: (1) the East End mission support area; (2) the West End manufacturing areas; and (3) the West End environmental area. East End facilities are generally technical, administrative, and Y-12 support functions. The West End manufacturing area is generally considered an area inside the Perimeter Intrusion Detection and Assessment System (PIDAS) fence. The area inside the PIDAS boundaries contains manufacturing and nuclear material storage facilities as well as technical and Y-12 support operations and program management, product certification, quality control, product engineering and scheduling, maintenance, and utilities. The West End environmental area formerly managed by the Office of Environmental Management (EM) and now managed by NNSA, contains tank farms, waste management treatment facilities, and storage areas; included are such facilities or areas as the Bear Creek Road Debris Burial Area, Rust Spoil Area, Liquid Organic Waste Storage Facility, Hazardous Chemical Disposal Area, Oil Landfarm, Oil Landfarm Contaminant Area, and Sanitary Landfill 1.

A.2 MAJOR Y-12 PRODUCTION PROCESSES

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 includes:

- manufacture and assessment of nuclear weapon secondaries, cases, and other weapons components;
- dismantlement of weapons secondaries, cases, and other weapons components returned from the stockpile;
- safe and secure storage and management of special nuclear materials (SNM);
- supply of SNM for use in naval reactors;
- promotion of international nuclear safety and nonproliferation; and
- reduction of global dangers.

Functional capabilities required to perform these activities include operations to physically and chemically process, machine, inspect, assemble, certify, disassemble, and store materials. Management of wastes generated from these operations is also required. The fabrication of secondaries and cases can be subdivided into the following major material production processes: uranium, lithium, and nonnuclear/special materials. The following typical process descriptions are provided to illustrate the functional activities and operations associated with each of the major production processes. These processes are based on traditional secondary and case fabrication methods and represent upper bounds to the types and number of processes that would be continued in the downsized and modernized Y-12.

A.2.1 Process Descriptions

Processes described in this section deal with uranium, lithium, special materials, and nonnuclear materials.

A.2.1.1 *Uranium*

The uranium process provides finished enriched and depleted uranium parts and products. The operations are capable of all uranium handling and processing functions, from raw materials handling to finished parts manufacturing. In addition, dedicated areas are provided for storage of in-process uranium materials and for the highly enriched uranium (HEU) strategic reserve.

The production of uranium parts and products involves casting or wrought processing; metal-working; machining, inspection, and certification; chemical recovery; assembly, disassembly, and quality evaluation; and in-process storage. The products from casting or wrought processing are billets and cast parts that feed directly to machining and metal-working. Billets are cropped and cast parts are delugged before they are sent to the next operation. The input to casting consists of retired weapons parts, metal buttons from storage, and recycled scrap metal from metal-working and machining. A casting charge is prepared and processed in a criticality-safe configuration in a vacuum induction furnace. Scrap metal and machine turnings are degreased, cleaned, and briquetted before direct recycle.

Metal-working operations prepare a wrought product as feed for machining operations. Cropped billets from casting are preheated in a salt bath, rolled into a sheet, annealed in a salt bath, blanked, and pressed. The blanking operations are a major source of recycled metal for casting. Formed parts are cleaned, debrimmed, and machined.

Both formed and cast blanks are machined to finished dimensions and inspected. Scrap metal and machine turnings are returned to casting for cleanup and reuse. Miscellaneous solids are sent to the chemical recovery systems for treatment to recycle the material back to metal buttons. Product inspections and certification are accomplished with coordinate measurement machines, optical gauges, high-energy x-ray radiography, ultrasonic and dye penetrant flaw-inspection methodology, plating thickness gauges, and mechanical properties tests.

Enriched uranium chemical recovery receives feed from virtually all areas in the process. The major feeds are residuals from casting, impure metal chips from machining operations, and a miscellaneous array of combustibles from all areas. The feeds are incinerated and processed in a head-end treatment that consists of acid dissolution, leaching, and feed preparation for solvent extraction. The feed solution is processed through primary extraction by which it is purified, concentrated by evaporation, and purified further by secondary extraction. The solution is then converted to oxide, then to UF_4, and then to uranium metal buttons. Secondary residues are returned to the head-end treatment. Finished metal is returned to casting for reuse.

Assembly operations assemble parts into subassemblies using joining techniques such as welding, adhesive bonding, and mechanical joining. Disassembly takes retired weapons apart and recycles all materials of value. The quality evaluation function receives weapons from the stockpile for disassembly, evaluation, and life cycle tests. Shipping containers for weapons parts and subassemblies are certified and refurbished as part of the assembly and disassembly process.

Uranium storage includes storage vaults for in-process uranium materials, which include buttons and other scrap materials directly recycled, as well as semi-finished and finished components.

The vaults at Y-12 are also used for the strategic reserve, which includes assembled secondaries and HEU metal castings and surplus HEU awaiting final disposition.

A.2.1.2 *Lithium*

The lithium process provides finished lithium hydride and lithium deuteride parts. Primary functional elements of this process include powder production and forming, finishing and inspection, and deuterium production. These systems are briefly described below.

The lithium hydride and lithium deuteride from storage, recycled weapons parts, and manufacturing scrap are broken, crushed, and ground to produce powder. The powder is loaded into molds and cold-pressed isostatically to form solid blanks.

The blanks are unloaded from the molds and placed into vacuum furnaces to be outgassed. After the outgassed blanks cool, they are loaded into form-fitting bags, heated, and warm-pressed. The blanks are then cooled to room temperature and removed from the bags. The fully dense machining blanks that result from forming operations are radiographed to detect any high-density inclusions. Powder production, mold loading, and radiography are all performed in dry gloveboxes to minimize reaction of the lithium hydride and lithium deuteride with moisture in the atmosphere. Mold unloading, furnace loading and unloading, and bag loading and unloading are all conducted in an inert glovebox. The lithium hydride or lithium deuteride is handled outside inert-atmosphere gloveboxes only when it is sealed in a mold or bag.

The blanks from forming operations are machined to final shapes and dimensions on lathes through single-point machining methods and finishing operations. Most machine dust is collected for direct recycle salvage operations. The finished part weight and dimensions are inspected with certified balances and contour measurement machines. All machining and inspection activities are conducted in dry gloveboxes to minimize any reaction with moisture in the atmosphere. Certified parts receive a final vacuum outgas treatment before final assembly.

Deuterium is required for many of the products and is stored for future use. Deuterium oxide, or heavy water, is electrolytically reduced. The resulting deuterium is compressed and stored for use. If necessary, the compressed deuterium gas is used to reconvert the lithium metal to deuteride in the final step of wet chemistry.

Lithium wet chemistry can be used to pre-produce lithium hydride and lithium deuteride to meet production requirements for many decades. The principal function of wet chemistry is to purify lithium hydride and lithium deuteride by removing oxygen and other trace elements. The principal feeds to this system are retired weapons components from the disassembly operation, machine dust, powder, and killed parts from other operations. Purification is accomplished by transforming the lithium hydride and lithium deuteride through a chemical dissolution process, then the solution is evaporated and crystallized. The crystals are then reduced to lithium metal and impurities are removed. The lithium metal is reconverted to lithium hydride and lithium deuteride by combining it with hydrogen or deuterium gas. The resulting lithium hydride and lithium deuteride billet, sealed in a thin stainless-steel can, is transferred to lithium storage.

The production of lithium hydride and lithium deuteride components creates a considerable amount of scrap that must be recycled to recover the lithium and deuterium. Much of the machine dust, unacceptable formed parts, machined parts that fail inspection, and stockpile returned parts are directly recycled. Salvage operations typically process material that is too impure to be recycled. Salvage operations primarily involve washing and chemical recovery. Items that require washing include machining tools and fixtures, filters used throughout the processes, and sample bottles. Oil-soaked lithium hydride and lithium deuteride blanks from the powder-forming operations are also prepared for storage. Solutions from the purification and wash operations, including mop and dike water streams, are neutralized, filtered, crystallized, and sent to storage or waste disposal.

Long-term storage is required for chemicals and pre-produced lithium hydride and lithium deuteride billets. Interim storage is provided for lithium hydride and deuteride components from disassembly or retired weapons and rejected components from forming and finishing operations.

A.2.1.3 *Special Materials*

Special materials such as diallyl-phthalate are required to support DP. Diallyl-phthalate based molding compound is formed into near-net-shape blanks that are later machined to finished parts. The primary forming operation is compression or transfer molding, which is followed by a drying and final curing step. Worker protection for potential exposure to hazardous materials is provided through the use of vent hoods, personal protective equipment, and administrative controls.

A.2.1.4 *Nonnuclear*

The nonnuclear process is responsible to produce certain weapons components composed of nonnuclear materials and to provide the uranium and lithium processes with specialized material and support services. Many types of materials are processed to provide a diverse product line that consists of both nonnuclear metal components and tooling and a variety of polymer-based items. The principal manufacturing technologies employed are hydroforming, hydrostatic forming, rolling, forging, heat treating, welding, machining, cold/hot isostatic pressing, grinding, winding, casting, plating, molding, and coating. The nonnuclear process handles several product streams, which are described briefly in the following paragraphs.

Several types of urethane foams are required to be produced. The urethane components and blowing agents are pumped into molds and allowed to expand to fill the mold. When cured, the foam moldings are ejected and trimmed to final shape.

Steel and aluminum are construction materials for both components and support tooling, making this a relatively high throughput product line. The usual fabrication route for both materials is rough machining, heat treatment, and finish machining.

Operations to produce stainless-steel cans consist of blanking, followed by hydroforming and hydrostatic forming with subsequent machining and heat treatment. Ultrasonic cleaning is required before heat treatment to ensure cleanliness for welding, which completes the assembly.

Ceramic finished parts are finished from blanks or procured. Procured parts are inspected and certified prior to final assembly.

Polyvinyl chloride is formed into bags and castings and is also applied as a coating. Items to be coated are dipped into a tank of curable, plasticized polyvinyl chloride formulation, whereas castings are produced by transferring the polyvinyl chloride liquid into a mold. All items are heat cured.

Figures A.2.1.4–1 through A.2.1.4–3 illustrates the waste management system associated with the Y-12 production missions. Waste management facilities for treatment and storage are described in Section A.4.

A.3 Y-12 DEFENSE PROGRAMS MAJOR FACILITIES DESCRIPTION

NNSA, DOE's Offices of Science (DOE-SC), Nuclear Energy (DOE-NE), and Environmental Management (DOE-EM) are the major tenants on Y-12 and have programmatic responsibility for various facilities. Real property includes over 400 buildings with a floor area of about 7.1 million square feet. NNSA is the Y-12 site landlord and is responsible for approximately 74 percent of the floorspace and approximately 390 facilities; DOE-SC and DOE-NE have programmatic responsibility for about 1.2 million square feet, and DOE-EM is responsible for about 0.6 million square feet. UT- Battelle, the Management and Operating contractor for Oak Ridge National Laboratory (ORNL), is in the process of relocating all operations (except those located in the EU Laboratory) to ORNL site. The vast majority of their facilities will be shut down and placed under long-term S&M.

All Y-12 facilities that process or store HEU are located in the protected area of Y-12 surrounded by the PIDAS (except for the two buildings which house only calibration sources managed by Radiological Control and the Protective Services Organization). The following information, which was derived from information contained in the *Final Site-Wide Environmental Impact Statement for the Y-12 National Security Complex*, DOE/EIS-0309 (DOE 2001a) and the Ten Year Comprehensive Site Plans (NNSA 2005c, NNSA 2007, and NNSA 2008a), provides information on the major DP facilities located at Y-12.

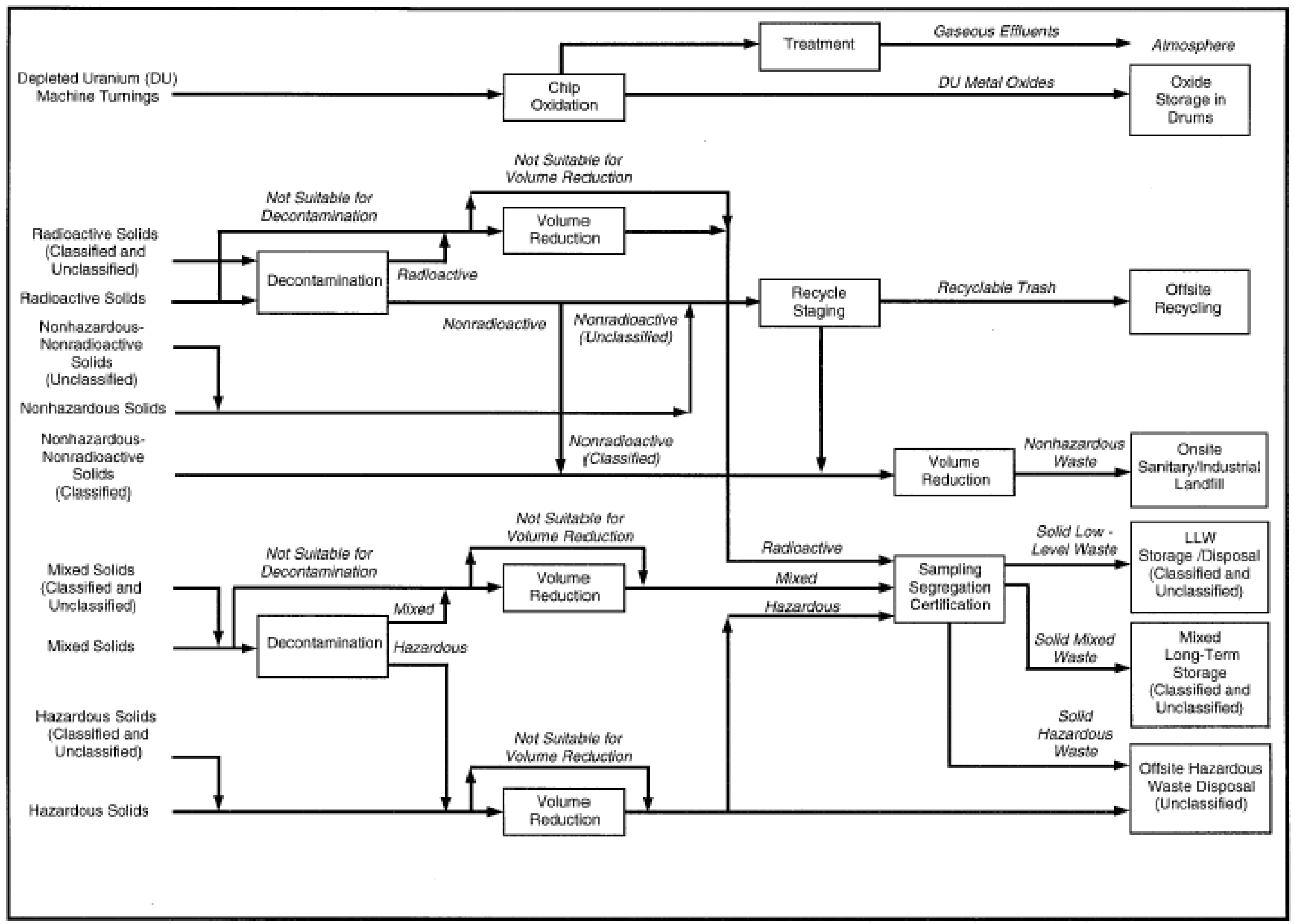

Figure A.2.1.4-1. Waste Management Process – Solid Waste Treatment.

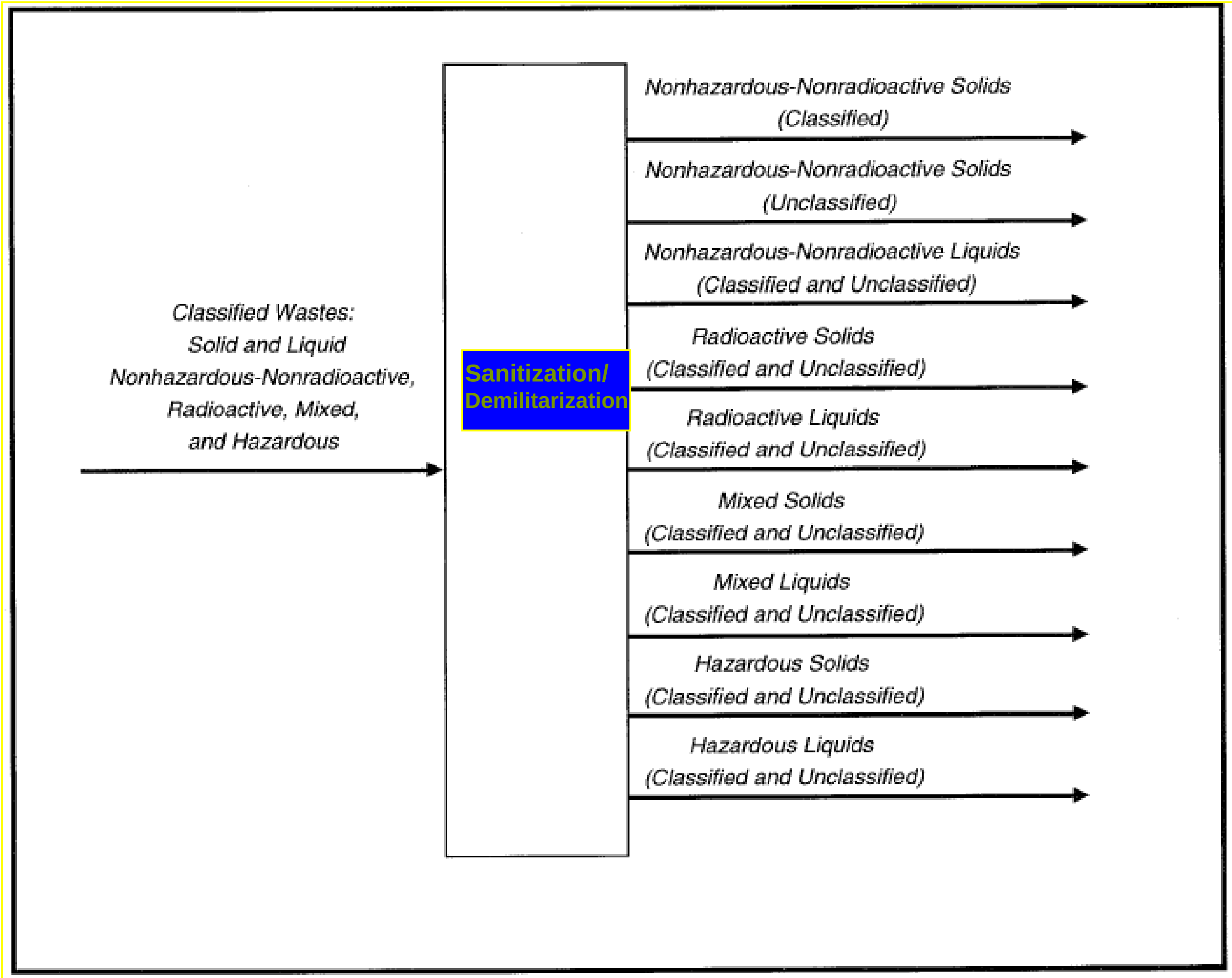

Figure A.2.1.4-2. Waste Management Process – Clearance for Release.

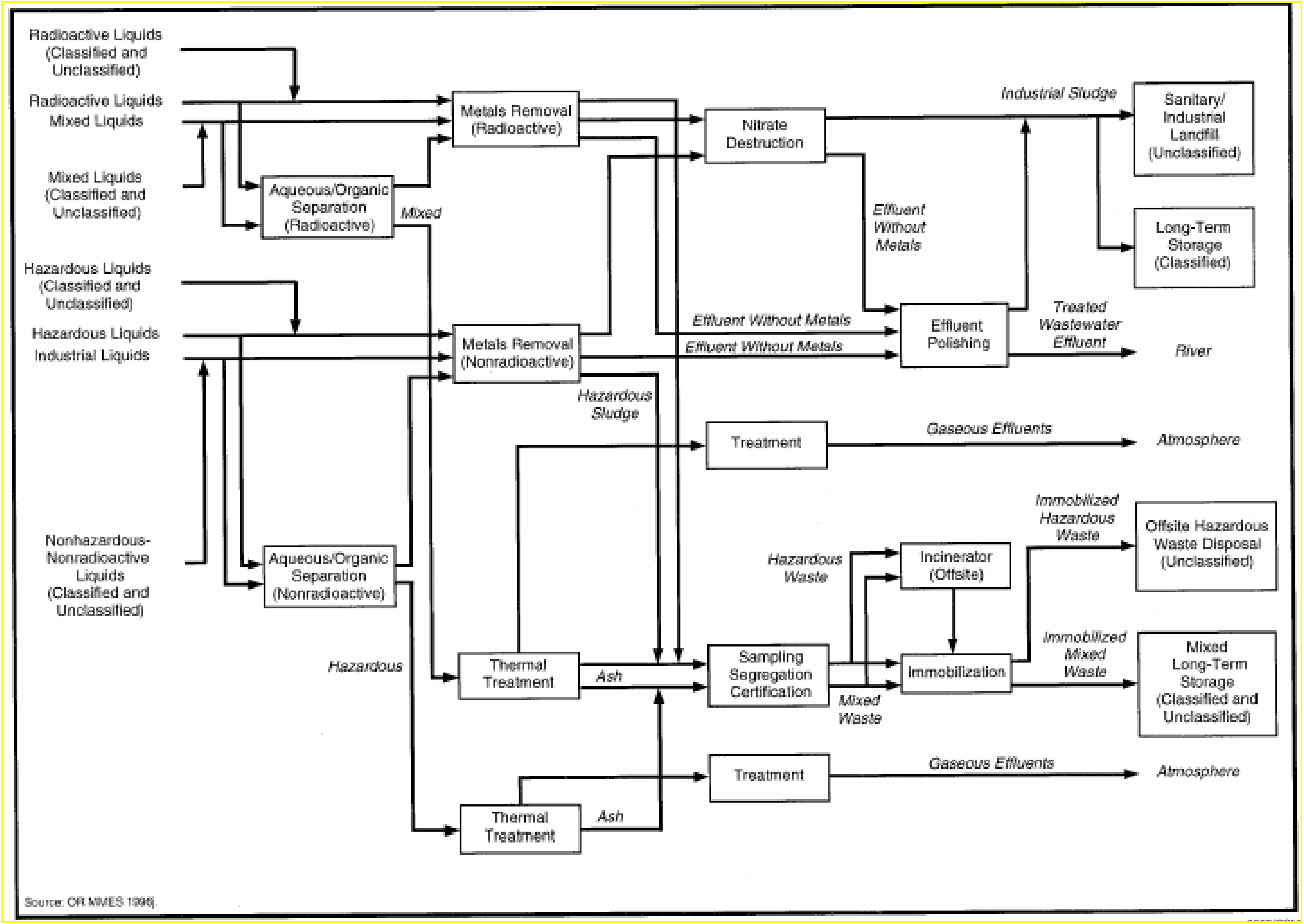

Figure A.2.1.4-3. Waste Management Process – Process Wastewater Treatment and Waste Thermal Treatment.

A.3.1 Enriched Uranium Facilities Complex

Over 100 operations or processes have been or can now be performed within the Enriched Uranium Facilities Complex. The primary missions performed in this Complex include the following:

- Casting of EU metal
- Accountability of EU from Y-12 activities
- Recovery and processing of EU to a form suitable for storage and/or future designation (from Y-12 activities and commercial scrap)
- Packaging EU for off-site transport
- Preparation of special uranium compounds and metal for research reactor fuel

The largest building is a multistory facility constructed in the early 1940s. It was built in stages over a period of years. In 1948, new structures were added. Finally, a single-story structure was added in 1951. Other less extensive modifications or additions have since been added.

The Complex houses two major process areas: (1) the Uranium Recovery Operations (also called Chemical Recovery Operations); and (2) the Metallurgical Operations.

The EU materials located in the Complex are in various chemical forms, both liquids and solids, and are in more than 6,000 separate containers. All this material is considered "in process." Material awaiting processing, including solid process residues, fluorides, low-equity residues, and aqueous and organic solutions of many kinds, is stored throughout the building. Solids are typically stored in cans made from ordinary carbon steel or stainless steel. Liquids are stored in plastic criticality-safe bottles.

There are no floor areas where solutions may collect to greater than 4 inches in depth. Nearly all vessels in the solvent extractions operation are of safe geometry. Solid oxides and residues are stored in cans of limited volume and controlled mass. The casting operation, which involves the use of large amounts of uranium metal, is closely controlled, and each operation is subjected to criticality safety analysis and control.

Large quantities of combustible organics can be in-process in the complex. In the past, there have been some minor explosions in the chemical recovery operations that involve Nitric Acid Dissolvers, Muffle Furnaces, and Destructive Distillation Unit Operations.

The Complex is currently in operation. Table A.3.1-1 summarizes the Uranium Recovery Operations and Metallurgical Operations.

Table A.3.1-1. Y-12 Defense Program Major Facility Overview.

Facility	Function	Mission	Current Status
EU Building	• 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	Operating
Intermediate Assay Building	• Chemical recovery of intermediate enrichments of EU (20% to 85% ^{235}U) • In-Process Storage	• Recovery of EU to a form suitable for storage	Not Operating-EU materials will be transferred 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 A.3.1-1. 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 and assemblies • Quality operations for certification • Disassembly of retired weapons components and assemblies and part recovery • Storage of retired weapon assemblies, subassemblies, and components • LiH/LiD production • Shelf Life Program – Medium and Long Term Evaluations	Operating
Quality Evaluation Building	• Quality Evaluation/Disassembly • DU Metalworking • Testing	• Quality Evaluation/Disassembly is 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 (currently not operating) • X-ray density	• Depleted uranium and stainless-steel machining • Dimensional inspection of parts • Electroplating of parts • Nondestructive evaluation of parts	Operating

Table A.3.1-1. 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	Active
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	Construction completed. Operational in 2010.
Purification Facility	• Chemical Processing	• Special Material production	Operating

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

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A.3.1.1 *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's 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 can be divided into the following general groupings:

- Head End 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 UFB4B
  - Calcium reduction of UF_4 powder to uranium metal

- Special Processing
  - Special materials production
  - Accountability of scrap
  - Scrap dissolution
  - Packaging of materials for transport

- Waste Streams and Materials Recovery
  - Nitrate recycling
  - Materials storage and handling
  - Chemical makeup

Liquid mixed low-level waste (MLLW), such as nitrate solutions from enriched uranium recovery, is transported from the complex for disposition or disposal.

A.3.1.2 *Metallurgical Operations*

Casting of enriched uranium metal and alloys occurs in vacuum induction furnaces. Cast components are transported via the intra-site SNM Vehicle to be machined. Machine turnings are washed in water and a solvent to remove machine coolant and boron, 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 can be described in the following general groupings of activities:

- Casting
  - Preparation of metal feed
  - Casting metal into parts or cylinders
  - Packaging of materials for shipment
  - Machine turning recycling

A.3.2 Intermediate Assay Complex

The Intermediate Assay Complex is a multi-story facility constructed in the early 1940s. The building contains an incinerator which is not currently operational.

The building has generally been reserved for intermediate enrichments (20 to 85 percent) of EU. Its original design mission was to recover EU from the electromagnetic separation process. After World War II, the building received intermediate enrichments of uranium from the gaseous diffusion plants as uranium hexafluoride. An ammonia gas reduction and hydrofluorination was used to convert the uranium hexafluoride (UF_6) to uranium tetrafluoride (UF_4). In the mid-1950s, a UF_6 to UF_4 conversion facility using fluorine and hydrogen gas was installed to perform the same function. In either case, the UF_4 was reduced with calcium metal to purified uranium metal. To support the conversion processes, recovery processes were installed to recover and purify uranium contained in the increasing waste processes. Many of these processes were patterned after the recovery process equipment that was installed in the EU Building.

In the late 1960s, the building underwent modifications to install denitration and fluid bed systems for the conversion of uranyl nitrate to UF_4. The mission to convert recovered uranyl nitrate from the Savannah River back into metal was transferred to the building in 1973. The machining-turning-cleaning process was installed in the mid-1980s to recycle intermediate enrichments of uranium turnings. In 1988, shipments of uranyl nitrate from the Savannah River were discontinued. A year later the weapon production rate was severely decreased. In 1993, decommissioning of the Building began. Since that time, most of the processes have been shut down and some processes have been removed from the facility.

The *Building Complex Phaseout/Deactivation Program Management Plan* describes the activities to transition the existing chemical recovery capabilities from this Building to the EU Building and the deactivation of this Complex. The project is expected to last about 5 years. The phaseout and deactivation will reduce the risk of existing hazards and place the building in a positive, safe, and environmentally secure configuration. Some in-process material still remains in the facility tanks and process lines.

There are no plans to resume operations in this Building, except as necessary to support decontamination and decommissioning (D&D) activities. The Building has five permitted *Resource Conservation and Recovery Act* (RCRA) waste storage locations. The locations are used for storage of both hazardous waste, as defined by RCRA, and non-hazardous waste mixed with EU awaiting recovery or disposal. The hazardous wastes include characteristic and listed wastes. Hazardous materials include several strong and weak acids and various organic materials.

Material transfers that occur within the Building Complex are performed through several methods. Dollies designed to provide safe spacing of fissile material containers are used to perform the majority of the container transfers. Personnel are also permitted to carry transfer single fissile material containers. Process material transfers are accomplished with pumps and airlifts.

A.3.3 Enriched Uranium By-Products Storage Building

The EU By-Products Storage Building is a warehouse facility. The mission of the building is to provide storage for items and materials that have been removed from the Material Access Areas. A portion of the facility is used for storage of combustibles that contain uranium. The storage area is also used for other hazardous materials including RCRA storage, polychlorinated biphenyls (PCBs), and beryllium. Combustible material storage containers include cans, plastic bags, and carbon-steel 55-gal drums. Drums that contain combustible materials are stored on wooden pallets and are collocated with other combustible materials that are also in drums on wooden pallets.

A.3.4 Depleted Uranium Processing Building

The DU Processing Building is a multi-story structure that was constructed in the early 1940s. The building is a large production and processing facility that was previously used for depleted uranium and non-uranium processing. The building includes storage areas for enriched uranium combustibles and lithium hydride. Sprinkler systems are provided in storage areas; a manual fire suppression capability is provided on-site 24 hours a day; and materials are stored in sealed drums.

A.3.5 Metalworking Complex

The Metalworking Building Complex consists of two buildings. Both are multi-story buildings. One building was constructed in the early 1940s, and the other building was added shortly thereafter. Both buildings have been expanded and modified over the years. Included is an area where EU parts and scraps are packaged and shipped. The area was constructed in the 1970s.

The mission of the Complex is to provide for storage of EU inventories, to provide fabricated metal shapes as needed for the nuclear weapons stockpile maintenance, and to support nuclear programs at other U.S. and foreign facilities. Materials stored in the Complex are considered to be part of the backlog waiting for processing.

EU parts are rolled, formed, and machined in the Metalworking Complex. The complex also includes an EU storage vault. Operations include salt-bath heat treating, rolling, shearing, and plate cutting of depleted uranium, depleted uranium alloys, and non-radiological materials. Other operations include sawing, casting, and vacuum arc re-melting of depleted uranium and depleted uranium alloys. Other operations include forming, heat treating, and rolling of depleted uranium, depleted uranium alloys, and non-radiological materials.

Part of the complex contains inspection, machining, and storage areas; a foundry (casting of depleted uranium, depleted uranium alloys, and non-radiological materials using induced melting and arc melting processes); and a R&D area. Operations in both areas include the handling, packaging, and transporting of EU materials and parts. The Area allows collection, packaging, receipt, and shipment of outgoing EU metal parts, chips, metal scrap, and contaminated combustibles. Additional operations include metal forming, heat treating, and arc melting of depleted uranium, depleted uranium alloys, and non-radiological materials. For safety, machine turnings are packed in a coolant to prevent dry-out and spontaneous combustion, and vented transport dollies are used to prevent pressurization due to hydrogen generation. The complex is currently in operation.

A.3.6 Enriched Uranium Storage Building

The EU Storage Building historically has been used as a warehouse for weapons-related materials and reactor fuel. The facility was built in 1944 and has since been renovated. The current mission is to serve as a warehouse for short-term and long-term storage of materials, including high-equity uranium, weapons assemblies, reactor fuel, and low-equity materials that are waiting for recycle.

The facility is a single-story building; air is exhausted unfiltered through roof-mounted fans. Dock areas serve the transfer of SNM and non-SNM materials to and from approved transport vehicles.

To address safety concerns, the partitioned area is covered by wet-pipe sprinkler systems, portable fire extinguishers, and fire alarms; forklift trucks are required to be electrically operated; surfaces are periodically painted with fire retardant paint; and all hot work operations (i.e., cutting, welding, etc.) are controlled by special permit. Use of combustible and flammable liquids in the facility is very limited.

A.3.7 Assembly and Special Materials Buildings

The Special Materials Building was constructed in 1943 and has been used to support nuclear weapons production since that time. As a result of a major upgrade program, some of the major processes and equipment were upgraded in the early 1990s. In addition, a portion of building was modified for storage of EU materials.

The Assembly Building is a multi-story facility built in 1971 to house weapon assemblies. Major assembly and disassembly facilities are located in the building. Current EU activities at the Assembly Building include:

- Assembly of new or replacement weapon assemblies
- Quality certification of components and assemblies
- Disassembly of retired weapon assemblies and part recovery
- Storage of assemblies, subassemblies, and components
- Quality Evaluation Shelf Life Program for Medium and Long Term Evaluations

Assembly and disassembly operations areas, vault-type rooms, and vaults are located in the building. Most of the EU is composed of metal pieces or weapons components. Significant quantities of various hazardous materials are collocated with EU in the operations areas.

Barriers to exposure of workers or the public to radiation or chemical hazards or to releases of radioactive materials to the environment include packages and containers, and vault and room walls; and some operations employ gloveboxes, hoods, and ventilation systems with high-efficiency particulate air (HEPA) filters. Both the Special Materials Building and the Assembly Building are protected by smoke and heat detectors, sprinklers, and alarm systems. Operations and storage activities are conducted by procedure in accordance with criticality safety approvals that incorporate double contingency. At least two independent criticality alarm systems cover each EU area to annunciate a criticality accident.

A.3.8 Quality Evaluation Building

The Quality Evaluation Building was built in 1943. The building has complete fire detection and fire suppression coverage.

Areas within the building can be functionally classified as follows: (1) quality evaluation of current weapons production programs and disassembly of obsolete weapons (these operations are being re-located to another facility); (2) metal-working operations (forging, forming, heat treating) and grit blast cleaning of depleted uranium, depleted uranium alloys, and metals such as steel and aluminum; (3) a Storage Area and vault-type room for storage of SNM; (4) radiography, ultrasonic, and other nondestructive testing (NDT); and (5) a plating area. The only active operational areas that involve EU within the building are quality evaluation, assembly, and storage in the vault-type room and the Storage Area. The plating area, while shut down, contains residual materials. The Storage Area and the vault-type room are set aside for storage of EU in drums.

Key safety features of the building include a criticality alarm system and detectors. Two criticality detectors are located in the building: one in the quality evaluation area (on the second floor) and the other adjacent to the Storage Area. The building is equipped with a fire detection and fire suppression system that consists of wet-pipe sprinklers. The ventilation exhaust system is HEPA-filtered. Additionally, the quality evaluation and disassembly areas are equipped with a HEPA-filtered glovebox to perform a several operations.

EU is normally stored within specially designed packages and containers except when quality evaluations or disassembly operations are performed. A variety of package configurations for EU-bearing materials is used. Polyethylene bags contain paper, plastic, mop heads, and other miscellaneous combustible materials used in the process areas. Storage of EU in the process areas is minimal due to criticality safety approval limitations.

Storage configurations range from drum arrays in vaults to cans and dollies within vault-type cages. Polyethylene bags are stored within the process areas or consolidated into 55-gallon drums prior to transport from the facility.

Building press operations include the forming of depleted uranium, depleted uranium alloys, and non-radiological materials using 7,500-ton, 1,500-ton, and 1,000-ton presses.

A.3.9 Plant Laboratory Building

The Plant Laboratory Building, which is part of the Analytical Chemistry Organization (ACO), is a multistory facility that was constructed in 1952. The building has had two major expansions since it was originally constructed. The south addition was added in 1969. Another area was added in 1981. In 2004, a new roof was installed for the Plant Laboratory Building. The primary operations area is divided between first-floor and basement levels. Two service elevators connect the various floors of the building, although one of the elevators is not currently operational.

The building is equipped with about 150 chemical fume hoods with heating, ventilation, and air conditioning (HVAC) support systems that form the primary engineered safety feature. Most chemical fume hoods in the building are original equipment. Limited hood upgrades have been performed and about 20 hoods were replaced in the mid-1980s with additional units added or replaced at various times during laboratory alteration projects. There are about 52 separate supply and exhaust systems; however, most air is supplied by seven major air handling units that provide conditioned, filtered air to the various rooms in the building. Nineteen exhaust fans support hoods, and each hood is fitted with a continuous flow monitor indicator to allow convenient confirmation of hood flow before use. The majority of the ventilation system in the building is a zoned, once-through system that provides more than six air exchanges per hour.

The facility was designed for, and is currently used as, an analytical chemistry laboratory to provide support for DP, Work-for-Others, the operation and maintenance (O&M) contractor, and regulatory compliance programs. Analyses associated with EU include impurities by inductively coupled plasma (ICP), inductively coupled plasma mass spectrometry (ICP-MS), emission spectroscopy, x-ray fluorescence spectrometry, carbon analysis by LECO carbon analyzer, and isotopic analysis by thermal ionization mass spectrometry. Weight limitations of enriched uranium are controlled by administrative procedures. EU samples are bar-coded to track and control the mass of material within the facility. Most work is completed in hoods. The area is provided with sprinklers in the event of a fire.

Special facilities located in the building include the Lithium Preparation Room, argon-purged gloveboxes, and a gas-mixing laboratory. The Lithium Preparation Room has an independent roof-mounted HVAC system that can maintain 10 percent relative humidity in the winter and 15 percent in the summer to limit hydrolysis of reactive lithium or lithium compounds. Argon-purged gloveboxes are provided in several laboratories to handle materials that require dry inert atmospheres. These are self-contained systems, and mostly include filters and desiccant systems to maintain and dry the re-circulated argon while others are once-through argon-purge types. A gas-mixing laboratory is located in the building; ACO personnel mix gases in cylinders for use by various Y-12 operations.

Fire protection for the building is provided by the Y-12 Fire Department. The building is also protected by a sprinkler system, an alarm system and by departmental procedures. An alarm system responds to the sprinkler trip alarm, pull box, and other heat and smoke detectors located in the building. In the event of a fire, it is expected to be restricted to a limited area and, because of the small amount of enriched uranium present, is not expected to have large radiological consequences. Chemical reactions that result from the mixing of incompatible chemicals are expected to be minimal because the sample sizes are limited and operations are performed according to procedures. Safety showers and eyewash fountains are readily available throughout the laboratory.

A.3.10 Enriched Uranium Calibration Standards and Test Facilities

The EU Calibration Standards and Test Facilities are located in three buildings. One building is an office building built of noncombustible materials. The office building supports a variety of DP-related organizations. EU sources are stored in this building in a Nuclear Materials Control and Accountability Vault. The sources are used for the calibration of nondestructive assay (NDA) equipment. Another building is a small wooden frame storage building. Radiological control instrument calibrations are performed in this building, and sources that await disposal are stored here. The third building is an office building constructed of noncombustible materials used to store sources used to test other systems at Y-12.

EU sources in the first building are stored in fireproof safes with combination locks. The Y-12 personnel store the sources in a cabinet in the second building. Both buildings are protected with automatic sprinkler systems. Personnel lock the sources in the third building in a file cabinet; that building is also protected by an automatic sprinkler.

A.3.11 Special Materials Machining Building

The Special Materials Machining Building is a single-story structure built in 1967. The major portion of the building is a large machine shop area containing machining equipment and controls with nominal storage for in-process parts and materials. Offices for shop supervision are provided. The building is used as a machine shop and performs machining, plating, and support operations (including NDT and dimensional inspections) of depleted uranium, depleted uranium alloys, and non-radiological materials. Currently, the facility is not in operation.

A.3.12 Depleted Uranium Machining Building

The DU Machining Building is a one-story building that was built in 1972. The building is protected by smoke and heat detectors, sprinklers, and an alarm system. Activities conducted in the Building include:

- Electroplating of parts
- Machining of depleted uranium and stainless steel parts
- Dimensional inspection of parts
- Nondestructive evaluation (x-ray and density) of parts

Barriers to exposure of workers or the public to radiation or chemical hazards or to releases of radioactive or toxic materials to the environment include gloveboxes, hoods, and ventilation systems with HEPA filters. Ventilation exhaust stacks are monitored for radiological materials as appropriate.

A.3.13 Development Buildings

The three Technology Development Buildings were built in the 1940's with additions in the 1950's and 1970's. The facilities are categorized as chemically hazardous. A foundry and a weld laboratory along with development of material and metallurgical synthesis, forming, and evaluation techniques and processes represent some of the activities. A second building conducts research and development in the areas of material characterization as well as measurements, instrumentation and control. The third building houses activities associated with material purification processes.

A.3.14 Tooling Storage Building

The Tooling Storage Building was built in 1955. The building is used as a tooling and material storage facility to support operations in the EU and DU Buildings.

A.3.15 General Manufacturing Building

The General Manufacturing Building was built in 1944. The building is a large, general machine shop with several areas that contain machining equipment and controls. Nominal storage for in-process parts and materials and offices for supervision are also provided. The building is used as a general machine shop for non-uranium metal and graphite parts.

A.3.16 Purification Facility

The new Purification Facility was approved for production operations in 2005. The Facility is rated as a chemically hazardous facility. It will produce Special Materials using a highly controlled and monitored process that has undergone multiple rigorous start-up safety reviews.

A.3.17 Highly Enriched Uranium Materials Facility Storage Building

The Highly Enriched Uranium Materials Facility (HEUMF) has completed construction. The new facility, once operational in 2010 will provide:

- Assurance of a viable EU storage capability to support the enduring nuclear weapons stockpile and strategic reserve for the foreseeable future.

- Modernized security concepts to enhance the protection of stored material and ensure the implementation of special safeguards and security requirements.
- Improved operational efficiency and reliability.
- Provision to consolidate strategic EU inventories into a state-of-the-art facility. This will address nuclear material control and accountability inventory validation issues, as well as eliminate further costly conversion of excess production areas into the long-term storage space required for increasing EU inventory levels.
- Compliance with modern codes, standards, and environmental safety and health (ES&H) regulations.

A.4 WASTE MANAGEMENT ACTIVITIES

This section summarizes information for facilities used to manage the various waste streams generated at Y-12; including low-level waste (LLW), MLLW, RCRA-hazardous waste, *Toxic Substances and Control Act* (TSCA) regulated waste, and non-hazardous waste. Other waste includes sanitary and industrial wastewater, PCB's, asbestos, construction debris, general refuse and medical waste. There are many waste management facilities at Y-12. The disposal facilities and landfills are operated by the EM Program. The majority of the waste management, treatment and storage facilities are operated by NNSA. Waste management facilities are located in buildings or on the sites where they are needed, or are collocated with other waste management facilities or operations.

DOE is authorized to manage radioactive waste that it generates under the *Atomic Energy Act* of 1954. LLW is generated during many plant operations, including machining operations that use stock materials such as steel, stainless steel, aluminum, depleted uranium, and other materials. DOE stores, treats, and repackages, but does not dispose of LLW at Y-12. The majority of the LLW generated at Y-12 is otherwise uncontaminated scrap metal and machine turnings and fines. Waste treatment provides controlled conversion of waste streams generated from operations to an environmentally acceptable (or more efficiently handled or stored) form. This activity includes continued O&M of facilities that treat wastewater and solid waste generated from production and production support activities. LLW at Y-12 is managed in accordance with DOE Orders, policy, and guidance related to management of radioactive waste. Management of this waste is not directly regulated by EPA or the Tennessee Department of Environmental Compliance (TDEC). Waste minimization and planned treatment facilities are expected to continue to reduce the volume of wastes.

The TDEC Division of Solid Waste Management (DSWM) regulates the management of waste streams under the *Tennessee Solid Waste Management Act* (TSWMA). Onsite waste disposal facilities in operation at Y-12 include industrial, construction/demolition landfills, and a *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) waste landfill. The major sources of hazardous waste are plating rinsewaters, waste oil, and solvents from machining and cleaning operations; contaminated soil, soil solutions, and soil materials from RCRA closure activities; and waste contaminated with hazardous constituents from construction/demolition activities. Facilities used to store or treat RCRA-hazardous waste at Y-12 are regulated by the DSWM as authorized by the EPA. These facilities may also be used to manage mixed waste (waste that is RCRA-hazardous and radioactive). Mixed waste is generated from site development, sample collection, metal preparation, fabrication, enriched and depleted uranium operations, assembly, and industrial engineering functions at Y-12. Mixed waste is either placed in storage to await treatment or disposal, treated at Y-12, or sent to another ORR facility for treatment and disposal. There are no facilities for the disposal of RCRA-hazardous or mixed waste currently in operation at Y-12. Some disposal of RCRA-hazardous and mixed wastes is done at a permitted off-site commercial facility.

Major activities that generate non-hazardous waste include construction and demolition activities that produce large volumes of non-contaminated wastes, including lumber, concrete, metal objects, and soil and roofing materials. Industrial trash is generated by daily operations throughout the Plant. These operations include janitorial services, floor sweepings from production areas, and production activities. Storage and physical treatment (e.g., shredding, compaction) of non-hazardous waste does not generally require a permit under RCRA. There are three landfills in operation for disposal of non-hazardous waste at Y-12. These disposal facilities are regulated by the TDEC DSWM.

PCB-contaminated waste is generated at Y-12 during spill cleanup and stabilization activities as part of ongoing O&M actions. TSCA-regulated waste that contains PCBs is managed at Y-12 in accordance with EPA regulations and with a Federal Facilities Compliance Agreement (FFCA) for management of PCBs on ORR (EPA 1997). Per the FFCA between the U.S. Environmental Protection Agency (EPA) and DOE, ORR waste that contains PCBs may be stored in TSCA-compliant facilities. Provisions in 40 CFR 761.65 allow storage of PCB-contaminated materials in RCRA-compliant storage facilities under certain circumstances. Therefore, TSCA-regulated waste is often collocated with RCRA-hazardous waste at Y-12.

A.5 TRAFFIC AND TRANSPORTATION

This section supports the results of the transportation analyses presented in Section 5.4 of this SWEIS. For this SWEIS, DOE evaluated the transportation impacts associated with two material types (radioactive wastes/radioactive materials and non-radiological materials) transported to and from multiple off-site locations. The assumptions and methodology used in the transportation analysis are described in the following section.

Since the 1940s, NNSA and its predecessor agencies have moved nuclear weapons, nuclear weapons components, and SNM by a variety of commercial and Government transportation modes. In the late 1960s, worldwide terrorism and acts of violence prompted a review of procedures for safeguarding these materials. As a result, a comprehensive new series of regulations and equipment was developed to enhance the safety and security of these materials in transit.

The Transportation Safeguards Division (TSD) subsequently was established in 1975 at the Albuquerque Operations Office. That office is now referred to as the Office of Secure Transportation (OST), which will be the name used here. OST modified and redesigned transport equipment to incorporate features that more effectively enhance protection and deny unauthorized access to the materials. During that time, OST curtailed the use of commercial transportation systems and moved to a total federal operation.

A.5.1 OST Management

Management, control, and direction of OST is centralized at Albuquerque, New Mexico. The federal agents who drive the transportation vehicles, as well as the escorts, are Nuclear Materials Couriers or Couriers for short. There are three federal agent operations centers located at Amarillo, Texas; Oak Ridge, Tennessee; and Albuquerque. Approximately 100 shippers and receivers of SNM and other sensitive materials are served at approximately 33 locations throughout the continental United States.

A.5.2 Transportation Safety

Since its establishment in 1975, OST has accumulated over 100 million miles of experience transporting DOE cargo with no accidents causing a fatality or release of radioactive material. This is due largely to the OST philosophy that safety and security are of equal and paramount importance in the accomplishment of DOE's transportation safeguards mission.

A.5.3 Transportation and Emergency Control Center

Transportation and Emergency Control Center (TECC) is a nationwide communications system operated by the OST and located in Albuquerque. This system provides a capability to monitor the status, location and maintain real-time communications 24 hours a day, 365 days a year, with every convoy. The control center maintains an emergency contact directory of federal, state, and local response organizations located throughout the contiguous U.S. This capability is available to OST 24 hours a day, 365 days a year.

A.5.4 Transportation Vehicles

The Safeguards Transporter (SGT) is a specially designed trailer for an 18-wheel rig that incorporates various deterrents to prevent unauthorized removal of cargo. The trailer has been designed to afford the cargo protection against damage in the event of an accident. This is accomplished through superior structural characteristics and a highly reliable cargo tie-down system similar to that used aboard aircraft. The tractors are standard production units which have been modified to provide protection against attack. The thermal characteristics of the SGT would allow the trailer to be totally engulfed in a fire without incurring damage to the cargo. These vehicles are equipped with communications, electronic, radiological monitoring, and other equipment that further enhance safety and security.

The vehicles used by OST must meet maintenance standards significantly more stringent than those for similar commercial transport equipment. All vehicles undergo an extensive maintenance check prior to every trip, as well as periodic preventative maintenance inspections. In addition, these vehicles are replaced more frequently than commercial shippers. As a result, OST experiences few en route breakdowns and has had no accidents due to equipment malfunction.

A.5.6 Travel Precautions

OST convoys do not travel during periods of inclement weather (ice, fog, etc.). Should the convoys encounter adverse weather, provisions exist for the convoys to seek secure shelter at previously identified facilities. Although OST provides sleeper berths in all vehicles, couriers accompanying OST shipments do not exceed 32 hours of continuous travel without being afforded the opportunity for eight hours of uninterrupted, stationary bed rest. OST has also imposed a maximum 65 miles per hour speed limit on its convoys, even if the posted limit is greater.

A.5.7 Law Enforcement Liaison

OST has a liaison program through which it communicates with law enforcement and public safety agencies throughout the country, making them aware of these shipments. OST has established procedures should a Safeguards Transporter be stopped by an officer. The liaison program provides law enforcement officers information to assist them in recognizing one of these vehicles should it be involved in an accident, and what actions to take in conjunction with the actions of the couriers in the rig and escort vehicles. Through the liaison program OST offers in-depth briefings at the state level.

A.5.8 Armed Couriers

Armed nuclear materials couriers accompany each shipment containing special nuclear material. They also drive the highway tractors and escort vehicles while operating the communications and other convoy equipment. Couriers are non-uniformed federal agents and are authorized by the *Atomic Energy Act* to make arrests and carry firearms in the performance of their duties. They carry both a photo identification card and a shield that certify their federal status. Couriers are required to obey all traffic laws and to cooperate with law enforcement officers.

After careful screening and selection, courier trainees undergo a 16-week basic training course, during which they receive instruction in tractor-trailer driving, electronic and communications systems operation, and firearms. Tests in operating procedures, physical fitness, driving, firearms, and other job-related subjects must be passed in order to pass the training and be certified as a courier. Following basic training, the courier spends the balance of the first year in on-the-job training. The first year of employment is probationary, which the courier must successfully complete to be retained. Couriers are given in-service training throughout their careers. These classes are designed to refresh and update the training taught during basic training, in addition to preparing couriers for demonstrations or armed attacks. Subjects such as team tactics, terrorist tactics, and new adversary technology are taught. Additionally, physical and firearm proficiencies are tested.

Couriers must continue to meet periodic qualification requirements relative to firearms, physical fitness and driving proficiency. They must also undergo and pass an annual medical examination for continued certification under the DOE Human Reliability Program. In addition, couriers are subject to the DOE's randomized drug and alcohol testing program. If a courier fails to meet any of the minimum requirements necessary for courier certification, the individual is temporarily removed from active status and provided additional training until demonstrated performance reaches an acceptable level.

OST operations are in compliance with the requirements of 49 CFR Part 177 for selecting, notifying drivers of, and adhering to preferred routes. The majority of OST travel, is over interstate highway; the remaining is over routes that meet the conditions for deviating from the preferred route. Regulations permit deviation from the preferred route when safety or security requirements dictate such deviation. Regulations permit OST deviation from the requirements regarding notification of the routes used. Routes used are classified, compartmented information that may not be disseminated except to persons with appropriate security clearance and a need to know.

All SGT couriers wear radiation dosimeters. Because of the nature of the material and the design of the containers, the transport of both nuclear explosives and plutonium/uranium weapons components has led to ionizing radiation doses to SGT couriers. SGT couriers are required to inspect the cargo within the trailer prior to shipment. This action is the primary contributor to dose for the crew.

A.5.9 Results

The major radiological transportation actions involving Category I SNM would be as follows:

- Canned subassemblies (CSAs) (assume approximately 200 units per year for the No Action Alternative, UPF Alternative, and Upgrade in-Place Alternative; and 10 to 50 units per year for the Capability-Based Alternatives) would continue to be shipped between Pantex and Y-12.

CSAs that may contain HEU and DU are shipped between Pantex and Y-12. CSAs are transported intersite by SGTs in DOT-criteria Type B packages. The actual number of CSAs shipped to and from Pantex is classified. When a shipment of CSAs is made from Pantex, the containers, staged in an approved storage facility, are loaded onto a pallet and driven by electric forklift to a loading dock. These containers are loaded and secured into an SGT that is then driven to Y-12. Arriving containers are unloaded and brought into a facility where a transfer check is performed. The transfer check confirms the identity and quantity of the shipment and verifies the integrity of the tamper-indicating devices on the containers.

Table A.5-1 presents the estimated radiological impacts of the annual transportation activities associated with the assembly/disassembly and high explosives (AD/HE) mission at Pantex and a 200 unit capacity for CSAs at Y-12. The radiological incident-free impacts provided in the following sections are an estimate of latent cancer fatalities due to exposure of radiation from the radioactive materials payloads proposed in the SPEIS alternatives. The RADTRAN 5.6 computer analyzes the exposure within a half-mile zone surrounding the transportation routes.

Table A.5-1. Annual Radiological Transportation Impacts – No Action Alternative, UPF Alternative, Upgrade in-Place Alternative.

Movement Description	Transportation Segment	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
CSAs	Handling	Note 1	0.0224	0.0224
	Intersite Transportation	1.51×10^{-19}	0.00145	0.00145
	Stops		2.73×10^{-9}	2.73×10^{-9}
	MEI		1.51×10^{-9}	1.51×10^{-9}

Source: NNSA 2008.
Note 1: accident impacts associated with handling accidents are included in the accident analyses for the Y-12 No Action Alternative.
Assumptions: All materials in metal form
ES-3100 or similar container used
Release and aerosol fractions based on West Valley Demonstration Project (WVDP) Waste Management EIS (DOE 2003c) values, which were determined to bound release fractions for pits and secondaries.

With respect to accident impacts, RADTRAN calculates risks and consequences of potential accidents based a number of input parameters including:

- Probability and severity fraction of accident types;
- Deposition velocity of the material;
- Release fraction from the container;
- Aerosol and respirable factors for the material; and
- Weather conditions.

The inputs for the materials, containers, and vehicles were adopted from industry standards. The probability and severity fractions were taken from the West Valley Demonstration Project Waste Management EIS (DOE 2003c). The weather conditions were based on Pasquill weather stability classes. Analyses were conducted in Stability Class D (most frequently occurring weather conditions) and Class F (stable weather conditions). All results presented in this chapter are for the stability class, which yields the more conservative case.

The maximally-exposed individual (MEI) results represent health impacts to a theoretical person who would receive the maximum exposure due to the proposed transportation. Often the MEI represents personnel associated with the material transport, such as a vehicle escort.

Handling impacts reflect the sum total exposure impacts to crews involved in the storage, packaging, and loading/unloading of the material to be transported. The number of personnel, time spent handling the material, and distance to the material are dependant on the individual transportation campaigns.

The impact results at stops are presented for two theoretical receptor groups: the worker at the truck stop and residents that live within a half-mile radius of the truck stop. An average suburban population density is assumed for the area residents results. Table A.5-2 presents the estimated nonradiological impacts for the No Action Alternative, UPF Alternative, and Upgrade-in-Place Alternative.

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Table A.5-2. Annual Nonradiological Transportation Impacts – No Action Alternative, UPF Alternative, and Upgrade-in-Place Alternative

Origin/ Destination Pair	Material Shipped	Total Mileage	Number of Accidents	Number of Accident Fatalities	Number of Nonradiological Emissions Fatalities
Pantex/Y-12	CSAs	17,700	6.06×10^{-3}	2.93×10^{-4}	3.41×10^{-5}

Source: NNSA 2008.

The impacts of transportation for the Capability-Based Alternative would be approximately one-fourth as much as the impacts presented in Tables A.5-1 and A.5-2 for the 50 unit option, and approximately one-twentieth as much for the No Net Production/Capability-Based Alternative.

APPENDIX B: NOTICE OF INTENT FOR THE Y-12 SITE WIDE ENVIRONMENTAL IMPACT STATEMENT AND OTHER FEDERAL REGISTER NOTICES

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Section 612—State Eligibility

Topic Addressed: Evaluation

○ Letter dated September 21, 2005 to Texas Commissioner of Education Shirley Neeley, regarding steps that the Department has taken to address educational challenges for displaced students resulting from Hurricane Katrina and advising the Texas Education Agency on how to ensure timely completion of evaluations of children suspected of having a disability in districts enrolling a significant number of displaced students.

○ Letter dated August 9, 2005 to Virgin Islands Educational Consultant Eleanor Hirsh, providing an explanation regarding new requirements relating to (1) pre-referral activities and timeliness of referrals for initial evaluation to determine eligibility for special education and related services; (2) use of evaluations conducted under Part C of IDEA to determine eligibility under Part B of IDEA; and (3) placement options for preschool-aged children with disabilities.

Topic Addressed: Maintenance of State Financial Support

○ Letter dated September 21, 2005 to Louisiana Superintendent of Education Cecil J. Picard, regarding the steps the Department is taking to assist the State and school districts in educating displaced students as a result of Hurricane Katrina and informing the State the Department will waive the State-level maintenance of effort requirement as permitted under section 612(a)(18)(C) of IDEA.

Section 613—Local Educational Agency Eligibility

Topic Addressed: Charter Schools

○ Letter dated September 13, 2005 to Hawaii Department of Education Special Education Director Dr. Paul Ban, regarding the requirements of Part B of IDEA that are applicable to public charter schools under Hawaii's unitary school system.

Section 615—Procedural Safeguards

Topic Addressed: Student Discipline

○ Letter dated July 28, 2005 to Charlotte-Mecklenburg, North Carolina Commissioner Bill James, regarding requirements applicable to disciplining students with disabilities.

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(Catalog of Federal Domestic Assistance Number 84.027, Assistance to States for Education of Children with Disabilities)

John H. Hager,

Assistant Secretary for Special Education and Rehabilitative Services.

[FR Doc. E5–6578 Filed 11–25–05; 8:45 am]

BILLING CODE 4000–01–P

DEPARTMENT OF ENERGY

National Nuclear Security Administration

Notice of Intent to Prepare a Site-Wide Environmental Impact Statement for the Y–12 National Security Complex

AGENCY: National Nuclear Security Administration, Department of Energy.

ACTION: Notice of Intent (NOI).

SUMMARY: Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 *et seq.*), the Council on Environmental Quality's (CEQ) and the U.S. Department of Energy's (DOE) regulations implementing NEPA (40 CFR Parts 1500–1508 and 10 CFR Part 1021, respectively), the National Nuclear Security Administration (NNSA), an agency within the DOE, announces its intent to prepare a Site-Wide Environmental Impact Statement (SWEIS) for the Y–12 National Security Complex (Y–12) located at the junction of Bear Creek Road and Scarboro Road in Anderson County, Tennessee, near the city of Oak Ridge, Tennessee. NNSA has determined that one or more of the proposals to be evaluated would be a major federal action that could significantly affect the quality of the human environment; therefore, in accordance with the DOE regulations implementing NEPA, preparation of a new SWEIS is appropriate.

The new SWEIS will evaluate new proposals as well as update the analyses presented in the original SWEIS (DOE/EIS–0309) issued in November 2001 (66 FR 56663, November 9, 2001). In its 2002 Record of Decision (ROD) (67 FR 11296, March 13, 2002), DOE announced its decision to continue operations at Y–12 and to construct and operate two new facilities: (1) The Highly Enriched Uranium Materials Facility (HEUMF) and (2) the Special Materials Complex (SMC). The HEUMF is currently under construction. The SMC was subsequently cancelled due to changing mission requirements and replaced by a smaller facility that pertains to purification only (*Supplement Analysis for Purification Facility, Site-Wide Environmental Impact Statement for the Y–12 National Security Complex*, DOE/EIS–0309/SA–1, August 2002), and the installation of two new pieces of equipment to allow reuse of parts rather than construction of a facility to manufacture new parts. The No Action Alternative for the new SWEIS is the continued implementation of the 2002 ROD, as modified by actions analyzed in subsequent NEPA reviews. Three action alternatives are proposed for consideration in the new SWEIS in addition to the No Action Alternative. Each alternative includes the No Action Alternative as a baseline. The three alternatives differ in that one includes a new fully modernized manufacturing facility optimized for safety, security and efficiency; another consists of upgrading the existing facilities to attain the highest level of safety, security and efficiency possible without construction of new facilities; and the third consists of operating the current facilities until they are no longer viable followed by deactivation of those facilities and cessation of the associated operations.

DATES: NNSA invites comments on the scope of the SWEIS. The public scoping period starts with the publication of this NOI in the Federal Register and will continue through January 9, 2006. NNSA will consider all comments received or postmarked through this date in defining the scope of the SWEIS. Scoping comments received after this date will be considered to the extent practicable. NNSA will hold public scoping meetings at 475 Oak Ridge Turnpike, Oak Ridge, Tennessee, in the U.S. Department of Energy Information Center on December 15, 2005, from 11 a.m. to 2 p.m. and 6 p.m. to 9 p.m. The public scoping meetings will provide the public with an opportunity to present comments, ask questions, and discuss issues with NNSA officials regarding the SWEIS. The NNSA has invited the Tennessee Department of Environment and Conservation to participate as a cooperating agency in the preparation of the SWEIS. By this

Notice of Intent, the NNSA requests all other federal, state, local and tribal agencies to express their interest in being designated as a cooperating agency in the preparation of the SWEIS.

ADDRESSES: For information concerning the SWEIS, please contact Ms. Pam Gorman, Y–12 SWEIS Document Manager, at (865) 576–9903 or e-mail at *gormanpl@yso.doe.gov*. Written comments on the scope of the SWEIS or requests to be placed on the document distribution list can be sent to the Y–12 SWEIS Document Manager, 800 Oak Ridge Turnpike, Suite A–500, Oak Ridge, TN 37830; by facsimile to (865) 482–6052; or by e-mail to *comments@y-12sweis.com*.

FOR FURTHER INFORMATION CONTACT: For general information on the DOE NEPA process, please contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance, EH–42, U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585, (202) 586–4600, or leave a message at 1–800–472–2756. Additional information regarding DOE NEPA activities and access to many NEPA documents, including the 2001 SWEIS, are available on the Internet through the NEPA Web site at *http://www.eh.doe.gov/nepa*.

SUPPLEMENTARY INFORMATION:

Background. Y–12 is located on the Oak Ridge Reservation (ORR), approximately 25 miles west of Knoxville, Tennessee. For purposes of the SWEIS, the Y–12 Site is defined as approximately 5,400 acres of the 33,749-acre ORR, bounded by the DOE Boundary and Pine Ridge to the north, Scarboro Road to the east, Bethel Valley Road to the south, west to Mount Vernon Road, and then extending west along Bear Creek Road to Gum Branch Road and a corridor along Bear Creek Road to the intersection of Route 95. Y–12 has an annual budget of approximately $865 million and employs approximately 6,000 people.

NNSA is responsible for providing the nation with nuclear weapons components and ensuring those components remain safe and reliable. Y–12 is the NNSA's primary site for enriched uranium processing and storage, and one of the primary manufacturing facilities for maintaining the U.S. nuclear weapons stockpile. Y–12's nuclear nonproliferation programs play a critical role in securing our nation and the world and in combating the spread of weapons of mass destruction.

Non-defense activities at Y–12 include environmental monitoring and remediation activities; deactivation and decontamination activities; management of waste materials; research activities operated by the Oak Ridge National Laboratory; support of other DOE programs and federal agencies through the Work-for-Others Program; the transfer of specialized technologies to the U.S. industrial base; and, the supply of specialized materials to DOE's foreign and domestic customers.

Alternatives for the SWEIS. Three action alternatives and a No Action Alternative have been identified for analysis in the SWEIS. The list is tentative and intended to facilitate public comment on the scope of this SWEIS. The No Action Alternative is defined by the 2002 ROD baseline, as amended by subsequent NEPA reviews. Alternative 1 includes the No Action Alternative and proposes to modernize the Y–12 National Security Complex around a modern Uranium Processing Facility (UPF). Alternative 2 includes the No Action Alternative and proposes extending the life of existing facilities with only the most cost effective modernization possible without replacing the current structures. Alternative 3 consists of reducing site operations as facilities reach the point where they can no longer be safely operated without significant repairs or modernization.

No Action Alternative. The No Action Alternative includes the continued implementation of the 2002 ROD as modified by subsequent actions which have undergone separate NEPA review. The following decisions announced in the 2002 ROD, modifications to these decisions, and actions undertaken since the 2002 ROD are included in the No Action Alternative.

1. Highly Enriched Uranium Materials Facility (HEUMF). The new HEUMF (now under construction) will store all highly enriched uranium that is not being used in manufacturing activities. The HEUMF—to be completed in 2007 and start full-scale operations in 2008—will reduce the current storage footprint, improve security and lower operating costs as described in DOE/EIS–0309.

2. Special Materials Complex (SMC). This project was cancelled because it was no longer required by the reduced manufacturing needs of the smaller weapons stockpile. The project was replaced by a new purification facility and installation of two pieces of equipment within an existing facility; these actions allow reuse of existing parts. (*Final Supplement Analysis for Purification Facility, Site-Wide Environmental Impact Statement for the Y–12 National Security Complex*, DOE/EIS–0309/SA–1, August 2002). The Supplement Analysis assessed whether the potential environmental impacts of the stand-alone purification facility, a component of the SMC analyzed in the Y–12 SWEIS, would require the preparation of a Supplemental SWEIS. The determination was made that proceeding with the purification facility would either reduce or not affect the environmental impacts of the SMC identified in the Y–12 SWEIS, and therefore no additional NEPA analysis was required.

3. Infrastructure Reduction Initiative (IRI). The IRI is a series of individual projects to remove excess buildings and infrastructure, with a goal of reducing the active footprint at Y–12 by 50 percent during the next decade. As of September 27, 2005, total operational space at Y–12 has been reduced by 1,119,910 square feet and 244 buildings have been demolished or removed. Over the past five years, each demolition project was reviewed pursuant to NEPA prior to initiation and found to be covered by the Categorical Exclusion established by 10 CFR 1021 Appendix B1.23 (Demolition and Subsequent Disposal of Buildings, Equipment, and Support Structures).

4. Manufacturing Support and Public Interface facilities. These privately developed facilities are technical, administrative, and light laboratory buildings that will be built on land transferred to a private entity. The managing and operating contractor of the Y–12 Plant may lease these facilities. They were included in an Environmental Assessment (EA) and a subsequent Finding of No Significant Impact (FONSI) (*Alternate Financed Facility Modernization EA and FONSI*, DOE/EA–1510, January 2005).

5. Transportation of Highly Enriched Uranium (HEU) from foreign locations to Y–12. Subsequent to issuance of the 2002 Record of Decision (ROD) (67 FR 11296, March 13, 2002), the Y–12 site was given the additional mission of securing and storing small quantities of HEU transported from foreign locations to prevent proliferation of nuclear weapons and to minimize or eliminate the use of HEU in civilian reactors. Environmental Assessments were prepared and FONSI's issued for these actions (*Environmental Assessment for the Transportation of Highly Enriched Uranium from the Russian Federation to the Y–12 Security Complex*, DOE/EA–1471, January 2004; *and Environmental Assessment for the Transportation of Unirradiated Uranium in Research Reactor Fuel from Argentina, Belgium, Japan and the Republic of Korea to the Y–12 National Security Complex*, DOE/EA–1529, June 2005).

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The No Action Alternative also includes the following other actions for which NEPA documentation is pending and expected to be completed prior to issuance of any ROD based on this SWEIS: (1) refurbishments or upgrades to Y–12 utility systems, such as those for potable water (*Environmental Assessment for the Y–12 Potable Water System Upgrade,* DOE/EA–1548; Final EA and a FONSI expected to be completed in January 2006); and (2) disposition of excess mercury in storage at Y–12 (an Environmental Assessment is currently being prepared and should be completed in early 2006).

Alternative 1. New Uranium Processing Facility (UPF). Under this alternative, NNSA would take all actions in the No Action Alternative, undertake a series of utilities modernization projects not assessed in previous NEPA documents, construct and operate a modern UPF sized to support the smaller nuclear weapon stockpile of the future, and take other actions as described below to create a modern weapon enterprise.

The UPF would be the keystone of the modernization efforts in this alternative. The UPF would consolidate all enriched uranium (EU) operations into an integrated manufacturing operation sized to satisfy all identified programmatic needs and would be sited adjacent to the HEUMF to allow the two facilities to function as one integrated operation. Extensive engineered security and safety features would combine with technical innovations such as agile machining to allow significant improvements in working conditions for production workers and security guards. Operations to be consolidated in the UPF are currently located in six facilities. After startup of UPF operations, some of these facilities would be used to consolidate non-EU operations, and others would be demolished.

Transition of EU production operations to the UPF and transition of EU storage operations into HEUMF (No Action Alternative) would create a new high-security area equal to 10 percent of the current high security protected area. The current high security protected area would revert to normal access.

Some other aspects of the site would be modernized, including upgrades to site electrical, compressed air, steam, and security systems. Nonnuclear operations and plant support functions would be consolidated into four new facilities adjacent to the new high-security area, and most of the Manhattan Project and Cold War structures on the site (excepting those with historical designations) could be demolished. The costs of nonnuclear modernization and building removal would be significantly reduced because the construction and demolition projects would not require the expensive security measures required for work within the high security protected area. Separate NEPA reviews would be conducted for each demolition project.

The new facilities, especially the UPF, would increase the safety of workers and the public by replacing many of the administrative controls in aging facilities with contemporary engineered safety features. Operating and security costs of the new facilities would be significantly less than those of the current facilities. Demolition of non-historic facilities would eliminate the safety and environmental risks of maintaining old deactivated structures.

Alternative 2. Upgrades to Existing Enriched Uranium and Other Processing Facilities. Under this alternative, NNSA would continue the No Action Alternative, undertake a series of utilities modernization projects not assessed in the previous NEPA documents, and upgrade the existing enriched uranium and nonnuclear processing facilities to contemporary environmental, safety, and security standards to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations.

Under this alternative, there would be no UPF, the high-security area would expand to include the HEUMF, and no parts of the current high-security area would revert to normal access. Existing production facilities would be modernized to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations; however, it would not be possible to attain the level of safety, security and efficiency possible in Alternative 1.

The current facilities were constructed during the Manhattan Project or in the early days of the Cold War when construction and safety standards were very different than today. Their modernization would require extensive changes to critical building sytems including electrical and fire protection systems. Ventilation systems would have to be re-engineered and replaced with modern systems. Some structures would require extensive re-enforcement to allow the seismic response required by current codes.

It would not be possible in all cases to modernize the existing structures to meet current operational, safety and security expectations. The age and configuration of some existing critical facilities preclude streamlined operations and also preclude some new safety and security features. Such facilities offer only limited opportunities to reduce operating and security costs or to enhance the safety of operations. While some improvements would be made to the existing facilties to address natural phenomena hazards such as earthquakes and tornadoes, the age of those facilities and their configuration may preclude cost-effective improvements in these critical areas to bring them up to current DOE standards.

Some other nonnuclear aspects of the site would be modernized, including upgrades to electrical, compressed air, steam, and security systems. Some nonnuclear operations and plant support functions would be consolidated into existing structures. Nonnuclear operations would be modernized through consolidation of operations into existing facilities with no new construction. Nonnuclear modernizations and demolition of unneeded Manhattan Project and Cold War facilities would be conducted within the expanded high security protected area at significantly higher costs than Alternative 1.

Alternative 3. Reduced Operations. NNSA would invest no additional funds beyond normal maintenance in the Y–12 National Security Complex. Facilities posing an unacceptable risk to workers or the public would be minimally upgraded if an inexpensive upgrade would allow operations to continue safely, or deactivated if the costs to operate safely exceeded the costs of normal maintenance. Although NNSA would maintain full operational readiness in Y–12 facilities and operations where that could be done safely with normal maintenance expenditures, operations would cease when expensive maintenance needs rendered facilities unviable. As NNSA retired unviable facilities, the operations in these facilities would cease and Y–12 would lose the ability to perform the missions located in these facilities.

NNSA would make the expenditures necessary to maintain safety and security for nuclear materials or other hazardous materials. Additionally, Y–12 would make the expenditures needed to continue dismantlement activities consistent with Presidential direction to reduce the nuclear weapons stockpile, even if those operations required significant maintenance expenditures. Demolition of excess facilities beyond that described in the No Action Alternative would be subject to a separate NEPA review if funds became available. This alternative differs from the No Action Alternative in that the No Action Alternative assumes sufficient expenditures to sustain operational capability, while the Reduced Operations Alternative assumes deactivation of facilities when their continued safe operation requires more than normal maintenance except where noted above.

Public Scoping Process. The scoping process is an opportunity for the public to assist the NNSA in determining the issues for impact analysis. A public scoping meeting will be held as noted under **DATES**. The purpose of the scoping meeting is to provide the public with an opportunity to present oral and written comments, ask questions, and discuss concerns regarding the new *SWEIS* with NNSA officials. Comments and recommendations can also be communicated to NNSA as noted earlier in this notice under **ADDRESSES**. The *SWEIS* public meetings will use a format to facilitate dialogue between NNSA and the public. NNSA welcomes specific comments or suggestions on the content of the document.

The potential scope of the SWEIS discussed in the previous portions of this NOI is tentative and is intended to facilitate public comment on the scope of the *SWEIS*. The SWEIS will describe the potential environmental impacts of the alternatives by using available data where possible and obtaining additional data where necessary. Copies of written comments and transcripts of oral comments provided to NNSA during the scoping period will be available at the U.S. Department of Energy Public Reading Room at 230 Warehouse Road, Oak Ridge, TN 37830, and on the internet at *http://www.y-12sweis.com*. The 2001 *SWEIS* is available on the internet at *http://www.eh.doe.gov/nepa/eis/eis0309/toc.html*.

SWEIS Preparation Process. The *SWEIS* preparation process begins with the publication of this NOI in the Federal Register. After the close of the public scoping period, NNSA will begin preparing the draft SWEIS. NNSA expects to issue the draft SWEIS for public review by next summer. Public comments on the draft SWEIS will be received during a comment period of at least 45 days following the U.S. Environmental Protection Agency publication of the Notice of Availability in the Federal Register. Notices placed in local newspapers will specify dates and locations for at least one public hearing on the draft SWEIS, and will establish a schedule for submitting comments on the draft, including a final date for submission of comments.

Issuance of the final SWEIS is scheduled for late 2006.

Classified Material. NNSA will review classified material while preparing this *SWEIS*. Within the limits of classification, NNSA will provide the public as much information as possible to assist its understanding and ability to comment. Any classified material needed to explain the purpose and need for the action, or the analyses in this *SWEIS*, will be segregated into a classified appendix or supplement, which will not be available for public review. However, all unclassified information or results of calculations using classified data will be reported in the unclassified section of the SWEIS, to the extent possible in accordance with Federal classification requirements.

Issued in Washington, DC, this 18th day of November, 2005.

Linton F. Brooks,

Administrator, National Nuclear Security Administration.

[FR Doc. 05–23369 Filed 11–25–05; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Western Area Power Administration

[Rate Order No. WAPA–125]

Loveland Area Projects

AGENCY: Western Area Power Administration, DOE.

ACTION: Notice of order concerning power rates.

SUMMARY: The Deputy Secretary of Energy confirmed and approved Rate Order No. WAPA–125 and Rate Schedule L–F6, placing firm electric service rates from the Loveland Area Projects (LAP) of the Western Area Power Administration (Western) into effect on an interim basis. The provisional rates will be in effect until the Federal Energy Regulatory Commission (Commission) confirms, approves, and places them into effect on a final basis or until they are replaced by other rates. The provisional rates will provide sufficient revenue to pay all annual costs, including interest expenses, and repay power investment and irrigation aid, within the allowable periods.

DATES: Rate Schedule L–F6 will be placed into effect on an interim basis on the first day of the first full billing period beginning on or after January 1, 2006, and will be in effect until the Commission confirms, approves, and places the provisional rates into effect on a final basis ending December 31, 2010, or until the rate schedule is superseded.

FOR FURTHER INFORMATION CONTACT: Mr. Joel K. Bladow, Regional Manager, Rocky Mountain Customer Service Region, Western Area Power Administration, 5555 East Crossroads Boulevard, Loveland, Colorado, 80538–8986, (970) 461–7201, or Mr. Daniel T. Payton, Rates Manager, Rocky Mountain Customer Service Region, Western Area Power Administration, 5555 East Crossroads Boulevard, Loveland, Colorado, 80538–8986, telephone (970) 461–7442, e-mail *dpayton@wapa.gov*.

SUPPLEMENTARY INFORMATION: The Deputy Secretary of Energy approved existing Rate Schedule L–F5 for LAP firm electric service on an interim basis on December 24, 2003 (Rate Order No. WAPA–105, 69 FR 644, January 6, 2004). The Commission confirmed and approved the rate schedule on a final basis on December 21, 2004, in FERC Docket No. EF04–5181–000 (109 FERC 62,228). The existing rate schedule is effective from February 1, 2004, through December 31, 2008.

Existing firm electric service Rate Schedule L–F5 is being superseded by Rate Schedule L–F6. Under Rate Schedule L–F5, the energy charge is 11.95 mills per kilowatthour (mills/kWh) and the capacity charge is $3.14 per kilowattmonth (kWmonth). The composite rate is 23.90 mills/kWh. The provisional rates for LAP firm electric service under Rate Schedule L–F6 are being implemented in two steps. The first step of the provisional rates for LAP firm electric service consists of an energy charge of 13.06 mills/kWh and a capacity charge of $3.43 per kWmonth, producing an overall composite rate of 26.12 mills/kWh on January 1, 2006. This represents a 9.3 percent increase when compared with the existing LAP firm electric service rate under Rate Schedule L–F5. The second step of the provisional rates for LAP firm electric service consists of an energy charge of 13.68 mills/kWh and a capacity charge of $3.59 per kWmonth, producing an overall composite rate of 27.36 mills/kWh on January 1, 2007. This represents an additional 5.2 percent increase.

By Delegation Order No. 00–037.00, effective December 6, 2001, the Secretary of Energy delegated: (1) The authority to develop power and transmission rates to Western's Administrator, (2) the authority to confirm, approve, and place such rates into effect on an interim basis to the Deputy Secretary of Energy, and (3) the authority to confirm, approve, and place into effect on a final basis, to remand or to disapprove such rates to the

Federal Register / Vol. 71, No. 4 / Friday, January 6, 2006 / Notices 927

Dated: December 23, 2005.

John Engbring,

Acting Manager, California/Nevada Operations Office, U.S. Fish and Wildlife Service.

Philip T. Feir,

Lieutenant Colonel, Commanding, San Francisco District, U.S. Army Corps of Engineers.

[FR Doc. 06–102 Filed 1–5–06; 8:45 am]

BILLING CODE 3710–19–M

DEPARTMENT OF ENERGY

National Nuclear Security Administration

Extension of Scoping Period for the Notice of Intent To Prepare a Site-Wide Environmental Impact Statement

AGENCY: National Nuclear Security Administration, DOE.

SUMMARY: The National Nuclear Security Administration (NNSA), an agency within the U.S. Department of Energy (DOE), is extending the scoping period for the Site-Wide Environmental Impact Statement (SWEIS) for the Y–12 National Security Complex (Y–12), located at the junction of Bear Creek Road and Scarboro Road in Anderson County, Tennessee, near the City of Oak Ridge, Tennessee.

DATES: The scoping period for the SWEIS is extended from January 9, 2006 to January 31, 2006. Comments received after that date will be considered to the extent practicable.

ADDRESSES: For information concerning the SWEIS, please contact Ms. Pam Gorman, Y–12 SWEIS Document Manager at (865) 576–9903 or e-mail at: *gormanpl@yso.doe.gov*. Written comments on the scope of SWEIS can be sent to: Y–12 SWEIS Document Manager, 800 Oak Ridge Turnpike, Suite A–500, Oak Ridge, Tennessee 37830; by facsimile to: (865) 482–6052 or by e-mail to: *comments@y-12sweis.com*.

FOR FURTHER INFORMATION CONTACT: For information about the DOE NEPA process, please contact: Ms. Carol Borgstrom, Director, Office of NEPA Policy and Compliance (EH–42), U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC 20585, (202) 586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION: On November 28, 2005 (70 FR 71270), NNSA issued an Notice of Intent (NOI) to prepare an SWEIS for the Y–12 National Security Complex. As originally announced in the NOI, DOE has conducted public scoping meetings on the SWEIS in Oak Ridge, Tennessee on December 15, 2005. The original public scoping period was to continue until January 9, 2006. However, in response to public comments, DOE is extending the public scoping period until January 31, 2006.

Issued in Washington, DC on January 3, 2006.

Alice C. Williams,

NNSA NEPA Compliance Officer.

[FR Doc. E6–32 Filed 1–5–06; 8:45 am]

BILLING CODE 6450–01–P

ENVIRONMENTAL PROTECTION AGENCY

[EPA–HQ–OPP–2005–0257; FRL–7756–6]

Lockheed Martin; Transfer of Data

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: This notice announces that pesticide related information submitted to EPA's Office of Pesticide Programs (OPP) pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug, and Cosmetic Act (FFDCA), including information that may have been claimed as Confidential Business Information (CBI) by the submitter, will be tranferred to Lockheed Martin in accordance with 40 CFR 2.307(h)(3) and 2.308(i)(2). Lockheed Martin has been awarded multiple contracts to perform work for OPP, and access to this information will enable Lockheed Martin to fulfill the obligations of the contract.

DATES: Lockheed Martin will be given access to this information on or before January 13, 2006.

FOR FURTHER INFORMATION CONTACT: Felicia Croom, Information Technology and Resources Management Division (7502C), Office of Pesticide Programs, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460–0001; telephone number: (703) 305–0786; e-mail address: *croom.felicia@epa.gov*.

SUPPLEMENTARY INFORMATION:

I. General Information

A. Does this Action Apply to Me?

This action applies to the public in general. As such, the Agency has not attempted to describe all the specific entities that may be affected by this action. If you have any questions regarding the applicability of this action to a particular entity, consult the person listed under **FOR FURTHER INFORMATION CONTACT**.

B. How Can I Get Copies of this Document and Other Related Information?

1. *Docket.* EPA has established an official public docket for this action under docket identification (ID) number EPA–HQ–OPP–2005–0257. The official public docket consists of the documents specifically referenced in this action, any public comments received, and other information related to this action. Although a part of the official docket, the public docket does not include Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. The official public docket is the collection of materials that is available for public viewing at the Public Information and Records Integrity Branch (PIRIB), Rm. 119, Crystal Mall #2, 1801 S. Bell St., Arlington, VA. This docket facility is open from 8:30 a.m. to 4 p.m., Monday through Friday, excluding legal holidays. The docket telephone number is (703) 305–5805.

2. *Electronic access.* You may access this **Federal Register** document electronically through the EPA Internet under the "**Federal Register**" listings at *http://www.epa.gov/fedrgstr/*.

EDOCKET, EPA's electronic public docket and comment system was replaced on November 25, 2005 by an enhanced federal-wide electronic docket management and comment system located at *http://www.regulations.gov/*. Follow the on-line instructions.

An electronic version of the public docket is available through EPA's electronic public docket and comment system, EPA Dockets. You may use EPA Dockets at *http://www.epa.gov/edocket/* to submit or view public comments, access the index listing of the contents of the official public docket, and to access those documents in the public docket that are available electronically. Although not all docket materials may be available electronically, you may still access any of the publicly available docket materials through the docket facility identified in Unit I.B.1. Once in the system, select "search," then key in the appropriate docket ID number.

II. Contractor Requirements

Under contract number 68–W–04–005, the contractor will perform the following:

1. Establish individual chemical identity records including systematic chemical name, CAS registry number, and other chemical name synonyms;
2. Establish inert ingredient mixture composition records;
3. Respond to internal OPP requests for elucidation of chemical identities in

APPENDIX C: CONSULTATION LETTERS AND BIOLOGICAL ASSESSMENT

NNSA National Nuclear Security Administration

Department of Energy

National Nuclear Security Administration
P. O. Box 2050
Oak Ridge, Tennessee 37831-8009

July 11, 2006

Dr. Lee Barclay, Field Supervisor
Fish and Wildlife Service, Cookeville Field Office
United States Department of Interior
446 Neal Street
Cookeville, Tennessee 38501

INFORMAL CONSULTATION UNDER SECTION 7 OF *THE ENDANGERED SPECIES ACT* FOR THE Y-12 SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT (SWEIS)

Dear Dr. Barclay:

In accordance with the *National Environmental Policy Act* (NEPA), the National Nuclear Security Administration (NNSA), an agency within the Department of Energy (DOE), is preparing a Site-Wide Environmental Impact Statement (SWEIS) for the Y-12 plant at the Oak Ridge Reservation, Oak Ridge, Tennessee. In addition to the No Action Alternative, the SWEIS will evaluate the following alternatives: (1) Uranium Processing Facility (UPF) Alternative; (2) Upgrade Existing Enriched Uranium Facilities; and (3) Reduced Operations Alternative.

Under the UPF Alternative, NNSA would construct and operate a modern UPF sized to support the smaller nuclear stockpiles of the future. Under the Upgrade Alternative, NNSA would continue modernization activities and upgrade the existing enriched uranium and non-nuclear processing facilities to contemporary environmental, safety, and security standards to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations. Under the Reduced Operations Alternative, NNSA would invest no additional funds beyond normal maintenance at the Y-12 plant. Facilities posing an unacceptable risk to worker safety or to the public would be minimally upgraded if a minimal inexpensive upgrade would allow operations to continue safely, or deactivated if the costs to operate safely exceeded the costs of normal maintenance.

The Y-12 plant consists of industrial type structures on previously disturbed land with limited habitat favorable for animal and plant species. The only federally listed plant or animal that has been identified near the facility is the gray bat (*Myotis grisescens*) which has been observed within the Oak Ridge Reservation. The gray bat is federally listed as endangered.

The Y-12 SWEIS study area (approximately 5,400 acres) includes upper Bear Creek and its tributaries. Past surveys of Bear Creek tributaries have identified a number of State-listed plants including *Lilium canadense* (Canada Lily), *Panax quinquefolius* (American Ginseng), and *Platanthera flava var. herbiola* (Tubercled Rein-orchid), and a State-listed fish species, *Phoxinus tennesseensis* (Tennessee Dace).

NNSA requests an updated list of protected species and habitat in the vicinity of the Y-12 plant site and solicits your recommendations and comments regarding this proposed action. Your input will be used in the preparation of the SWEIS. We would appreciate a reply to this letter by August 1, 2006.

If you need further information on this request, please call me at (865) 576-9903.

Sincerely,

Pamela L. Gorman

Pamela L. Gorman
SWEIS Document Manager
Y-12 Site Office

Department of Energy

National Nuclear Security Administration
P. O. Box 2050
Oak Ridge, Tennessee 37831-8009

July 11, 2006

Mr. Richard Kirk
Endangered Species Coordinator
Tennessee Wildlife Resources Agency
Ellington Agricultural Center
P.O. Box 40747
Nashville, Tennessee 37204

INFORMAL CONSULTATION UNDER SECTION 7 OF *THE ENDANGERED SPECIES ACT* FOR THE Y-12 SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT (SWEIS)

Dear Mr. Kirk:

In accordance with the *National Environmental Policy Act* (NEPA), the National Nuclear Security Administration (NNSA), an agency within the Department of Energy (DOE), is preparing a Site-Wide Environmental Impact Statement (SWEIS) for the Y-12 plant at the Oak Ridge Reservation, Oak Ridge, Tennessee. In addition to the No Action Alternative, the SWEIS will evaluate the following alternatives: (1) Uranium Processing Facility (UPF) Alternative; (2) Upgrade Existing Enriched Uranium Facilities; and (3) Reduced Operations Alternative.

Under the UPF Alternative, NNSA would construct and operate a modern UPF sized to support the smaller nuclear stockpiles of the future. Under the Upgrade Alternative, NNSA would continue modernization activities and upgrade the existing enriched uranium and non-nuclear processing facilities to contemporary environmental, safety, and security standards to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations. Under the Reduced Operations Alternative, NNSA would invest no additional funds beyond normal maintenance at the Y-12 plant. Facilities posing an unacceptable risk to worker safety or to the public would be minimally upgraded if a minimal inexpensive upgrade would allow operations to continue safely, or deactivated if the costs to operate safely exceeded the costs of normal maintenance.

The Y-12 plant consists of industrial type structures on previously disturbed land with limited habitat favorable for animal and plant species. The only federally listed plant or animal that has been identified near the facility is the gray bat (*Myotis grisescens*) which has been observed within the Oak Ridge Reservation. The gray bat is federally listed as endangered.

The Y-12 SWEIS study area (approximately 5,400 acres) includes upper Bear Creek and its tributaries. Past surveys of Bear Creek tributaries have identified a number of State-listed plants including *Lilium canadense* (Canada Lily), *Panax quinquefolius* (American Ginseng), and *Platanthera flava var. herbiola* (Tubercled Rein-orchid), and a State-listed fish species, *Phoxinus tennesseensis* (Tennessee Dace).

DOE requests an updated list of protected species and habitat in the vicinity of the Y-12 plant site and solicits your recommendations and comments regarding this proposed action. Your input will be used in the preparation of the SWEIS. We would appreciate a reply to this letter by August 1, 2006.

If you need further information on this request, please call me at (865) 576-9903.

Sincerely,

Pam Gorman
SWEIS Document Manager
Y-12 Site Office

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

July 26, 2006

Ms. Pamela L. Gorman
SWEIS Document Manager
Department of Energy
National Nuclear Security Administration
P.O. Box 2050
Oak Ridge, Tennessee 37831-8009

Re: FWS# 2006-EC-0282

Dear Ms. Gorman:

Thank you for your letter and enclosures received July 19, 2006, regarding the preparation of a Site-Wide Environmental Impact Statement (SWEIS) for the Y-12 plant at the Oak Ridge Reservation, Anderson County, Tennessee. U.S. Fish and Wildlife Service personnel have reviewed the information submitted and offer the following comments for consideration.

According to our records, the gray bat (*Myotis grisescens*) and Indiana bat (*Myotis sodalis*), federally listed endangered species, may occur in or near the Y-12 facility. Qualified biologists should assess potential impacts and determine if the proposed alternatives may affect the species. We recommend that you submit a copy of your assessment and the draft SWEIS to this office for review and concurrence. A finding of "may affect" could require the initiation of formal consultation procedures.

These constitute the comments of the U. S. Department of the Interior in accordance with provisions of the Endangered Species Act (87 Stat. 884, as amended: 16 U.S.C. 1531 et seq.) and the National Environmental Policy Act (42 U.S.C. 4321 -4347; 83 Stat. 852). We appreciate the opportunity to comment. Should you have any questions or need further assistance, please contact Steve Alexander of my staff at 931/528-6481, ext. 210, or via e-mail at *steven_alexander@fws.gov*.

Sincerely,

Lee A. Barclay, Ph.D.
Field Supervisor

DOE F 1325.8
(10/00)

United States Government **Department of Energy**

National Nuclear Security Administration

memorandum

DATE: June 13, 2007

REPLY TO
ATTN OF: Y12-30:Gorman

SUBJECT: **NATIONAL HISTORIC PRESERVATION ACT, SECTION 106 COMPLIANCE FOR THE Y-12 NATIONAL SECURITY COMPLEX SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT**

TO: Katatra Vasquez, Cultural Resource Management Coordinator, ORO

In accordance with the *National Environmental Policy Act* (NEPA), the National Nuclear Security Administration (NNSA), an agency within the Department of Energy (DOE), is preparing a Site-Wide Environmental Impact Statement (SWEIS) for the Y-12 National Security Complex (Y-12) at the Oak Ridge Reservation, Oak Ridge, Tennessee. In addition to the No Action Alternative, the SWEIS will evaluate the following alternatives: (1) Uranium Processing Facility (UPF) Alternative; (2) Upgrade Existing Enriched Uranium Facilities; and (3) Reduced Operations Alternative.

Under the UPF Alternative, NNSA would construct and operate a modern UPF sized to support the smaller nuclear stockpiles of the future. Under the Upgrade Alternative, NNSA would continue modernization activities and upgrade the existing enriched uranium and non-nuclear processing facilities to contemporary environmental, safety, and security standards to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations. Under the Reduced Operations Alternative, NNSA would invest no additional funds beyond normal maintenance at Y-12. Facilities posing an unacceptable risk to worker safety or to the public would be minimally upgraded if a minimal inexpensive upgrade would allow operations to continue safely, or deactivated if the costs to operate safely exceeded the costs of normal maintenance.

The proposed activities under consideration are located within the developed portion of the Y-12 plant area. The cultural resources of the Y-12 plant area have been previously inventoried and evaluated. A historic district has been proposed which encompasses the original Y-12 plant and consists of 72 contributing buildings and structures. Two buildings in the Y-12 plant have also been recognized as potential National Historic Landmarks as individual properties. Much of the Y-12 plant has been disturbed by past activities and the potential for discovery of archaeological resources eligible for inclusion in the National Register of Historic Places is considered low. No Native American or other ethnic traditional use areas, cemeteries, or religious sites are known to be present in the developed Y-12 plant area.

The proposed UPF site is in the Y-12 West Portal Parking Lot, collocated to the west of the Highly Enriched Uranium Manufacturing Facility (HEUMF). This site is outside of, but adjacent to, the existing Perimeter Intrusion, Detection, and Assessment System (PIDAS). This West Portal Parking Lot represents a large level site with minimal site preparation requirements.

DOE has determined that implementing the Y-12 SWEIS action alternatives may require undertakings that could have an adverse affect on historic properties, specifically buildings in the proposed Y-12 plant historic district. Potential impacts could include the physical destruction of historic properties, changes in the character of the use of historic properties, the neglect of properties leading to the deterioration, loss of components contributing to the integrity of historic properties, and alterations to the setting. NNSA will comply with provisions in the Programmatic Agreement and/or the final Cultural Resources Management Plan to evaluate, address, and mitigate possible adverse effects that would result from the Y-12 plant SWEIS action alternatives in consultation with your office and the Tennessee State Historic Preservation Office.

Upon your review and concurrence with the content of the package, please forward the report to the Tennessee State Historic Preservation Officer for concurrence. I request their concurrence by August 1, 2007.

If you have any questions or require additional information, please contact me at (865) 576-9903.

Pam Gorman

Pam Gorman
Y-12 NEPA Compliance Officer

Department of Energy

Oak Ridge Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

October 24, 2007

Dr. Joseph Garrison
Tennessee Historical Commission
Department of Environment and Conservation
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Dr. Garrison:

NOTIFICATION OF PROPOSED UNDERTAKING AND INITIATION OF CONSULTATION FOR THE Y-12 NATIONAL SECURITY COMPLEX SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT

The National Nuclear Security Administration (NNSA), an agency within the U.S. Department of Energy (DOE) has the responsibility to maintain and enhance the safety, reliability, and performance of the U.S. nuclear weapons stockpile to meet national security requirements. NNSA manages DOE's nuclear weapons programs and facilities, including those at the Y-12 National Security Complex (Y-12) located in Oak Ridge, Tennessee.

NNSA is preparing a *Site-Wide Environmental Impact Statement for the Y-12 National Security Complex* (Y-12 SWEIS). This Y-12 SWEIS will analyze the environmental impacts of reasonable alternatives for ongoing and foreseeable future operations, facilities, and activities at Y-12. Alternatives to be analyzed in the Y-12 SWEIS will include the No Action Alternative (Alternative 1), the Proposed Action to Construct and Operate a New Uranium Processing Facility Alternative (Alternative 2), an Upgrade to Existing Facilities Alternative (Alternative 3), and a Reduced Operations Alternative (Alternative 4).

The Y-12 SWEIS will assess the environmental impacts of operations on land uses and applicable plans, socioeconomic characteristics and environmental justice, community services, prehistoric and historic cultural resources, aesthetics and scenic resources, geology and soils, biological resources, water, noise, traffic and transportation, utilities and energy, materials and waste management, human health and safety, site contamination, and accidents. The NNSA has identified Alternative 2, the Proposed Action to Construct and Operate a New Uranium Processing Facility, as the preferred alternative. The enclosed map shows the location of the proposed New Uranium Processing Facility.

We have determined, in accordance with §800.3 of the Advisory Council on Historic Preservation's (Council) regulations for the protection of historic properties, that NNSA's proposed action in this SWEIS is (1) an undertaking, as defined in 36 *Code of Federal Regulations* (CFR) 800.16(y), and (2) is the type of activity that has the potential to cause effects on historic properties. In accordance with §800.8(c) of the Council's regulations, we are notifying you and the Council, by copy of this letter, that we intend to use the process and documentation required to comply with the National Environmental Policy Act (NEPA) to comply with Section 106 of the National Historic Preservation Act for this undertaking. In using the NEPA process in lieu of the procedures set forth in §800.3 through §800.6 of the Council's regulations (i.e., the Section 106 process), we will ensure the standards set forth in §800.8(c)(1) through §800.8(c)(5) are met.

Thank you for your attention to our notification of initiation of consultation. If you have any questions or need additional information, please contact me at (865) 576-0835.

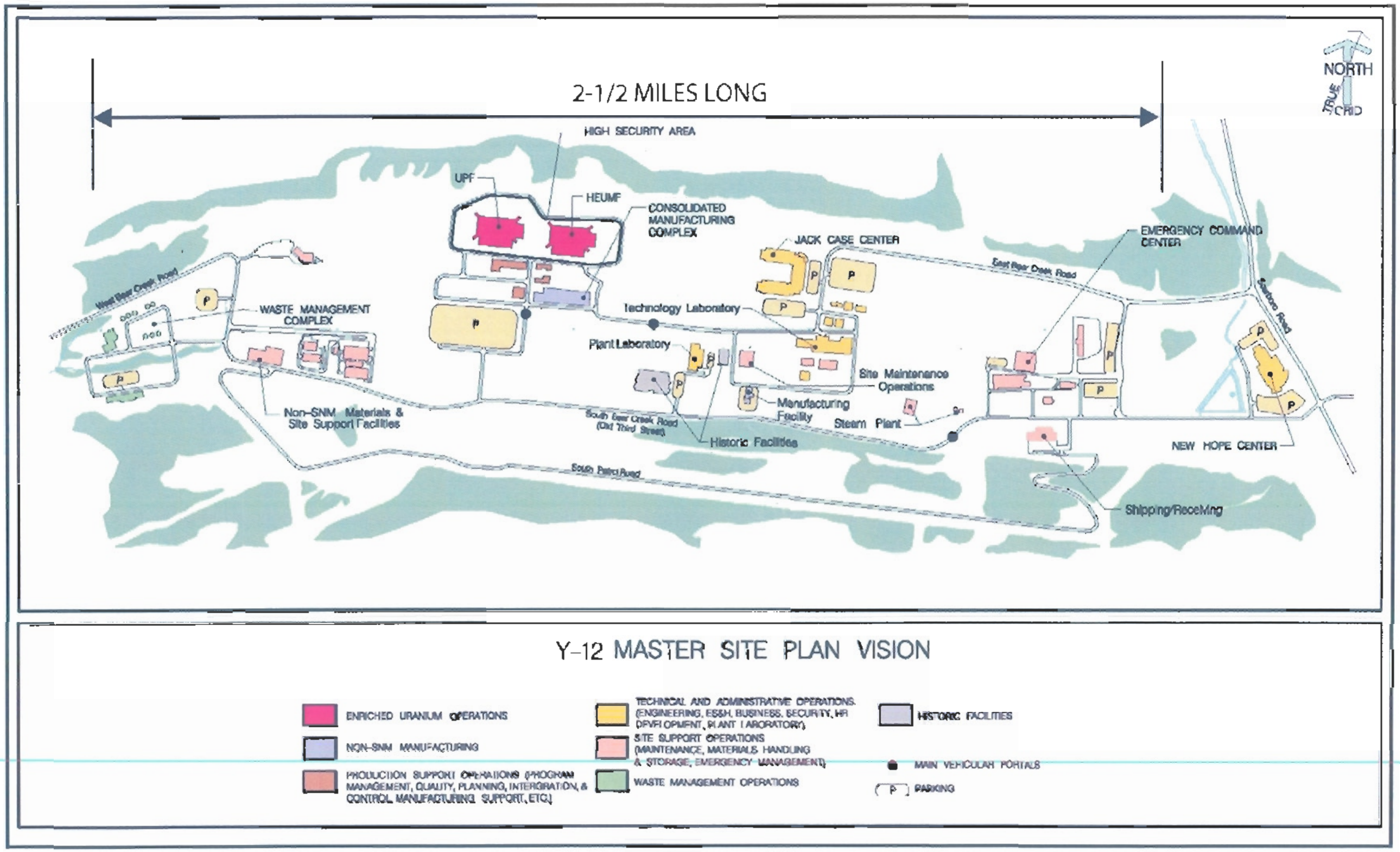
Sincerely,

Katatra C. Vasquez

Katatra C. Vasquez
Cultural Resources
Management Coordinator

Enclosure

cc w/enclosure:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council on Historic Preservation
David Allen, SE-32, ORO
Gary Hartman, SE-32, ORO
Randy Smyth, SE-30, ORO
Kevin Smith, NNSA, YSO
Pam Gorman, NNSA, YSO
Steve Wyatt, NNSA, YSO
Ted Sherry, NNSA, YSO
Terry Olberding, NNSA, YSO
Terry Slack, NNSA, YSO



Source: NNSA 2007.

Enclosure 1. The End State for the Modernization of Y-12.

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE. TN 37243-0442
(615) 532-1550

November 1, 2007

Ms. Katatra C. Vasques
Oak Ridge Operations Office
Post Office Box 2001
Oak Ridge, Tennessee, 37831

RE: DOE, Y-12 NATIONL SECURITY COMPLEX, OAK RIDGE, ANDERSON COUNTY

Dear Ms. Vasques:

In response to your request, received on Friday, October 26, 2007, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800. You may wish to familiarize yourself with these procedures (Federal Register, December 12, 2000, pages 77698-77739) if you are unsure about the Section 106 process.

Considering available information, we find that the project as currently proposed MAY ADVERSELY AFFECT PROPERTIES THAT ARE ELIGIBLE FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES. You should now begin immediate consultation with our office. Please direct questions and comments to Joe Garrison (615) 532-1550-103. We appreciate your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jyg

BIOLOGICAL ASSESSMENT

1.0 INTRODUCTION

This biological assessment (BA) evaluates the potential impacts of the proposed action at the Y-12 National Security Complex (hereafter referred to as the Y-12 Complex) on two federally listed bat species. Y-12 is one of three installations on the DOE Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee.

1.1 PURPOSE AND NEED FOR AGENCY ACTION

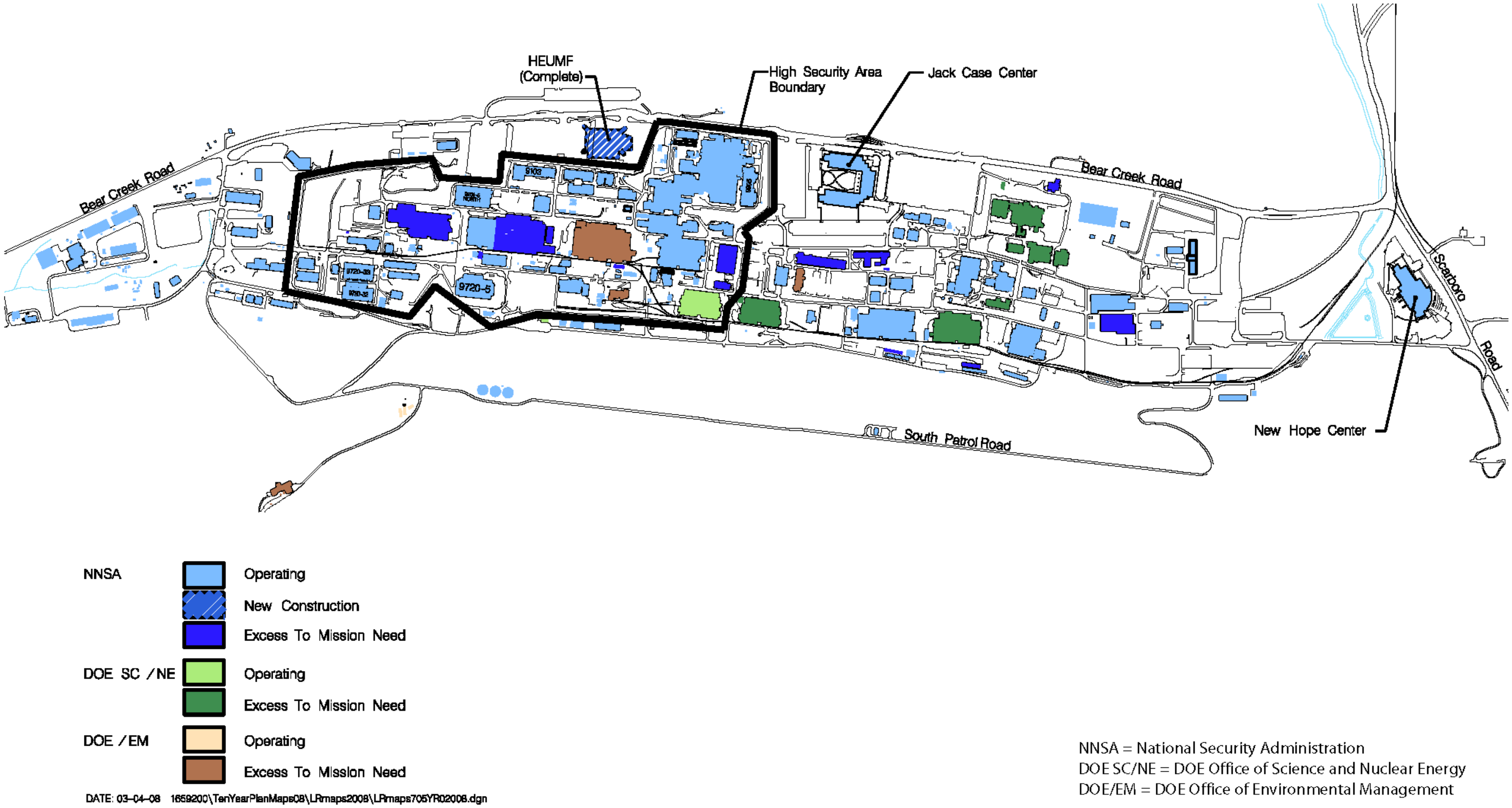
The National Nuclear Security Administration (NNSA), an agency within the U.S. Department of Energy (DOE), is the Federal agency responsible for maintaining and enhancing the safety, security, reliability, and performance of the nations' nuclear weapons stockpile, without nuclear testing.

As one of the NNSA major production facilities, the Y-12 Complex is the primary site for enriched-uranium processing and storage, and one of the primary manufacturing facilities for maintaining the U.S. nuclear weapons stockpile. Existing enriched-uranium operations at the Y-12 Complex are decentralized in several buildings that are not connected, old and oversized. Security, maintenance and safety have become increasingly costly and inefficient. Modernization of this infrastructure is a goal.

Previously, site-wide impacts of the Y-12 Modernization Program (DOE 2001) were assessed for the removal of excess buildings and the construction and operation of the Highly Enriched Uranium Metals Facility (HEUMF) and a Special Materials Complex (SMC). The SMC was subsequently cancelled and replaced by a smaller Purification Facility (DOE 2002a). The HEUMF is currently under construction. The current state of Y-12 is depicted in Figure 1.

1.2 PROPOSED ACTION

Four action alternatives are proposed for consideration in this SWEIS in addition to the No Action Alternative. Each alternative analyzed includes the No Action Alternative (Alternative 1) as a baseline. The three alternatives differ in that: Alternative 2 involves a new, fully modernized manufacturing facility (the Uranium Processing Facility [UPF]) optimized for safety, security, and efficiency; Alternative 3 involves upgrading the existing facilities to attain the highest level of safety, security and efficiency possible without constructing new facilities; and Alternatives 4 and 5 involve a reduction in the production capacity of Y-12 to support smaller stockpile requirements. Figure 2 shows the proposed location for the UPF.



Source: NNSA 2008a.

Figure 1. Major Operational Facilities Currently Supporting Y-12 Missions.

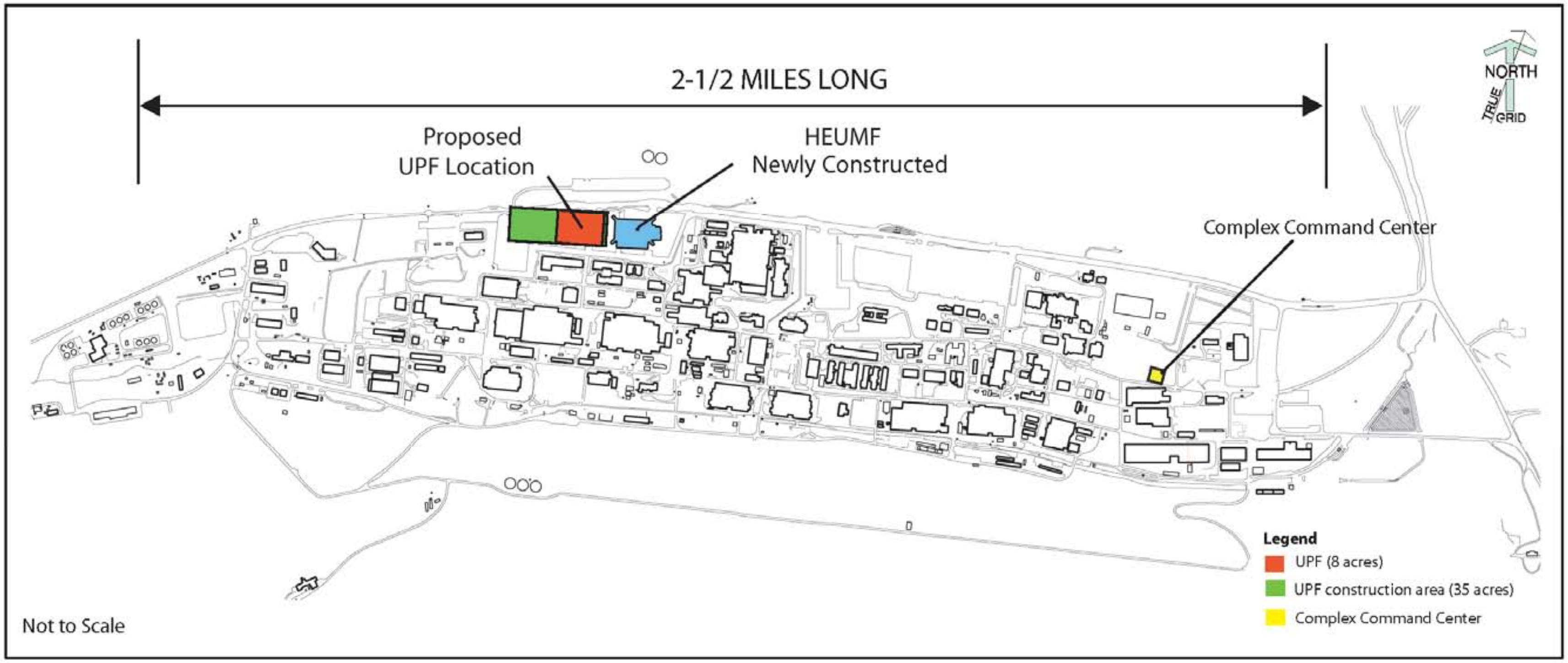


Figure 2. Location of the Proposed UPF and CCC Relative to Other Buildings at Y-12 Complex.

1.3 ECOLOGICAL DESCRIPTIONS OF THE SITE

ORR covers approximately 35,000 acres of mostly deciduous forested land in the Valley and Ridge physiographic province. Much of the land (20,000 acres) is designated for biological and ecological research as the Oak Ridge National Environmental Park. The ORR is bounded on the north by a residential section of the City of Oak Ridge and on the east, west and south by the Tennessee Valley Authority's Melton Hill and Watts Bar reservoirs on the Clinch and Tennessee rivers.

From south to north, the main ridges on the ORR are Copper, Haw, Chestnut, Pine, East Fork and Blackoak Ridge. Karst features, such as caves and sinkholes, are present mostly in the limestone of the Knox Group which includes Copper, Chestnut and Blackoak Ridge. Several preservation and conservation areas have been designated on Blackoak Ridge (Blackoak Ridge Conservation Easement) and Haw Ridge (Three Bend Scenic and Wildlife Management Refuge Area).

Bats are being managed on the ORR under a featured-species program established to inventory bat species, enhance woodland bat habitat using forestry management practices and protect cave bat habitat. Planned management activities (FY2007 to FY2012) include surveys for bats using mist nets, harp nets and acoustical identification systems (Giffen, Evans, and Parr 2007).

1.3.1 Y-12 Complex

The Y-12 Complex occupies a highly-industrialized area of 811 acres in the east end of Bear Creek Valley between Pine Ridge to the north and Chestnut Ridge to the south. Approximately 600 acres are presently enclosed by a security fence. Grass and unvegetated areas surround the entire facility for security purposes. There are no wetlands and limited forested areas within the Y-12 fenced boundary. The eastern portion of Y-12 is occupied by Lake Reality and the former New Hope Pond (now closed), maintenance facilities, office space, training facilities, change houses, and former Oak Ridge National Laboratory (ORNL) Biology Division facilities. The far western portion consists primarily of waste management facilities and construction contractor support areas. The central and west-central portions encompass the high-security portion, which supports the core NNSA missions.

1.3.2 Water Resources

Two creeks originate in the Y-12 Complex - East Fork Poplar Creek (EFPC) and Bear Creek. Upper EFPC flows east along the south side of the Y-12 Complex, and then flows north. Various Y-12 wastewaters discharge to the upper reaches of EFPC and much of the flow is fed by the Y-12 storm sewer system. Bear Creek drains only a small portion of the west end of the Y-12 Complex and flows southwest. It is mostly affected by stormwater runoff, groundwater infiltration, and tributaries that drain former waste disposal sites (DOE 2007).

Stream flow in upper EFPC was controlled until November 1988 by New Hope Pond. a settling basin which is now filled in and capped. The replacement basin, Lake Reality, is a lined basin of approximately 2.7 acres in area with a maximum depth of 16 feet and functions primarily as an emergency spill containment basin. Upper EFPC lacks riparian vegetation, is confined by riprap stream banks of limestone rock and is channelized. Stream substrate also consists of limestone rocks with some interspersed gravel. Stream width varies from 3 to 15 feet between the headwaters and Lake Reality.

After leaving the Y-12 Complex, lower EFPC flows northwest through densely forested secondary-growth hardwoods. Small portions of it flow through urban areas where no forest canopy is present. Unlike Bear Creek, EFPC is a sediment-rich stream. The predominant substrate is 1 to 4 inch rocks. Stream width varies from 10 to 25 feet. Average stream gradient is about 21 feet/mile. Urban runoff from the COR impacts lower EFPC for approximately 7 miles after it leaves the Y-12 Complex. The COR Sewage Treatment Plant discharges into lower EFPC at River Mile 7.5 (LMES 1995).

Upper Bear Creek is channelized and has a vegetated riparian zone. There are mature second-growth hardwood forests in the upper Bear Creek valley within 1 mile of the Y-12 Complex. Stream width and depth from the Y-12 Complex to the mouth of Bear Creek increase from 3 to 15 feet and 4 to 35 inches, respectively. At Hwy 95, the average flow in lower Bear Creek is approximately 2.4 million gallons per day (3.7 cubic feet per second). Except for a few impacted sections, Bear Creek contains a relatively small amount of sediment and is made up of many riffles and pools. About 65 percent of the Bear Creek watershed is wooded, predominantly in oak and oak-hickory associations on the upper slopes and ridge tops, with mixed hardwoods and planted pines along the creek and floodplain area (SAIC 2000).

Under DOE's wastewater discharge permits, stream water quality is monitored using the numbers and kinds of aquatic invertebrates living in stream sediments (benthic) as biological indicators of water quality. The presence and ratios of pollution-sensitive benthic insects are, of particular importance, including the mayflies, stoneflies and caddisflies (Ephemeroptera, Plecoptera, and Trichoptera – EPT). Mayflies are especially sensitive to some forms of pollution.

Benthic macroinvertebrate communities were monitored at three sites in East Fork Poplar Creek and at two reference streams in the spring of 2007. The macroinvertebrate communities at EFK 23.4 and EFK 24.4 remained degraded as compared with reference communities, especially in the richness of pollution-sensitive taxa. The pace of improvement in benthic macroinvertebrate communities has slowed in recent years at these sites in the upper reaches of East Fork Poplar Creek (DOE 2008).

1.3.3 Caves

Karst features including sinkholes and caves are shown in Figure 4.5.2-3 of the Draft SWEIS. Several caves have been identified within approximately 3 miles of the Y-12 Complex including Horseshoe Cave (TAN-17) and Linden School Cave (TAN-18) on Blackoak Ridge, Walker Branch Cave (TAN-43) on Chestnut Ridge, and Little Turtle Cave (TAN-38), Big Turtle Cave (TAN-15), Turtle Pit (TAN-40), Rainy Knob Cave (TAN-42) and two unnamed bluff caves on Copper Ridge. The Copper Ridge caves are all adjacent to the Clinch River/Melton Hill reservoir. The Freels Bend area of the reservoir contains Rainy Knob Cave and the Gallaher Bend area contains the turtle-cave complex and unnamed bluff caves.

None of the caves of the ORR are known to be gated to prevent human intrusion and protect resident bat species.

2.0 ORR SURVEYS FOR BATS

Several bat surveys have been performed on the ORR in recent years. Quantitative surveys usually consist of two methods: (1.) mist netting where the individual is actually captured and its species determined in-hand and (2.) acoustic surveys where the bat's ultrasonic call is recorded, displayed as a frequency-time representation and compared to a library of reference calls to determine species. The Anabat® system was used primarily but is just one of several systems for the recording and analysis of ultrasonic bat calls. Each method has advantages and disadvantages. Acoustic methods usually require mist netting to confirm species identification and, in the past, management decisions have not been based on acoustic identification only. Mist nets only capture a few of the many bats that fly in the vicinity of the nets, but acoustic methods record all species present at a particular site.

In 1992 and 1997, mist-net surveys were conducted by Harvey (Webb 2000) on lower EFPC and its tributaries including lower Bear Creek near the confluence with EFPC. During May 1992, 13 bats of 4 species (silver-haired bat [*Lasionycteris noctivagans*], 1; big brown bat [*Eptesicus fuscus*], 4; eastern pipistrelle [*Perimyotis subflavus*], 3; eastern red bat [*Lasiurus borealis*], 5) were mist netted at 5 sites during 7 nights. During 2 separate surveys in May-June and July 1997, 27 sites were mist-netted during 16 nights resulting in the capture of 14 bats of 6 species (silver-haired bat, 1; big brown bat, 6, eastern pipistrelle, 2; eastern red bat, 3; evening bat [*Nycticeius humeralis*], 1; northern long-eared bat [*Myotis septentrionalis*], 1). The lower reaches of EFPC and Bear Creek were reported to provide good gray bat foraging habitat and excellent Indiana bat summer roosting and foraging habitat at the time of the surveys. No gray or Indiana bats were recorded among 6 species captured (Harvey and Britzke 2003).

During July 2003, 22 bats of 3 species (big brown bat, 12; eastern pipistrelle, 5; eastern red bat, 5) were captured at 4 sites during 4 nights of mist-netting at upper and lower Bear Creek and upper EFPC. Bear Creek was expected to yield the most bats, but only 2 bats of one species were captured (both big brown bats). The most productive site was upper EFPC (near Scarboro Road) where 12 bats of 3 species were captured (big brown bat, eastern pipistrelle, eastern red bat). Acoustic surveys were conducted at East Walker Branch, upper and lower Bear Creek, and Freels Bend. A total of 1,096 ultrasonic call files were recorded of mostly the same 3 species as captured in mist nets. However, the presence of a gray bat was recorded at Freel's Bend on the shoreline of Melton Lake (Harvey and Britzke 2003). The Freels Bend area lies in Copper Ridge, approximately 3.5 miles south of the Y-12 Complex and contains a forested rocky limestone bluff with sinkholes and caves adjacent to the Clinch River Melton Hill reservoir.

During August of 2004, an acoustic bat identification system recorded 6,899 call files of 4 species at the K1007 P1 pond in the East Tennessee Technology Park (ETTP, formerly known as the K-25 Oak Ridge Gaseous Diffusion Plant) during 4 nights. Mist-netting was not performed since the pond is in an open area with no suitable netting sites. A majority of the calls recorded were those of eastern red bats but eastern pipistrelles, big brown bats and calls of the gray bat were also detected. The roost site/cave of the detected gray bats is unknown (Harvey and Britzke 2004). The K1007 P1 holding pond is an active 25 acre stormwater retention pond historically receiving wastes from an area lab drain and surrounded by open grass and roads (Goddard et al. 1995).

Two mist net surveys were performed at Parcel ED-6 at the east end of the ORR. The parcel consists of 336 ac of forested land on Blackoak Ridge containing four intermittent streams that drain to lower EFPC along the southern boundary. On July 29-August 1, 2005, two nets were operated for 2 nights at 3 sites capturing 67 bats of 3 species (big brown, 50; red bat, 12; and eastern pipistrelle, 5). On July 11-16, 2006, a second mist net survey was conducted at 3 additional locations selected by USFWS. Eight bats of 2 species were captured from 2 nets for 2 nights (big brown bat, 5 and red bat, 3). The survey also included a habitat assessment for the Indiana bat that found less than 20 percent of the parcel provided moderate quality summer habitat and less than 80 percent provided low-quality habitat. No Indiana or gray bats were captured at ED-6 (SAIC and BHE Environmental Inc 2007).

On July 24-28, 2006, a mist net survey at the entrance of 4 caves identified the following species:

- Big Turtle Cave – eastern pipistrelle and northern long-eared bat;
- Little Turtle Cave – eastern pipistrelle, little brown bat, northern long-eared bat, seminole bat (*Lasiurus seminolus*) and gray bat (*Myotis lucifugus*);
- Copper Ridge Cave – little brown bat and northern long-eared bat, and
- Pinnacle Cave – big brown bat.

The two gray bats were juveniles, newly able to fly (volant), so their summer roost is very likely in close proximity to Little Turtle Cave. These caves are located on Copper Ridge in the Gallaher Bend area, adjacent to the Clinch River/Melton Hill reservoir, and about 3-4 miles southwest of the Y-12 Complex.

3.0 ECOLOGICAL DESCRIPTION AND POTENTIAL IMPACTS OF THE PROPOSED PROJECT ON FEDERALLY LISTED BAT SPECIES.

Summarized below is the general ecology of federally listed bat species that potentially occur near the site and the expected impacts on them from the proposed project. Biological information on the species is derived from the published literature, reports and Internet resources listed under each species heading.

3.1 GRAY BAT (*Myotis grisescens*)

Listed as endangered since 1976, the gray bat is a year-round resident of caves and usually migrates seasonally between a winter hibernating cave and a summer maternity or roosting cave. The range of the gray bat is concentrated in the limestone cave (karst) region of Arkansas, Missouri, Kentucky, Tennessee, and Alabama but it is known to occur in adjacent states. About 95 percent of the species' total population (estimated at over 2.5 million) hibernates in only 17 caves -- 5 in Tennessee, 4 in Missouri, 5 in Arkansas, 2 in Kentucky and 1 in Alabama (Harvey and Redman 2003). Less than 5 percent of available caves (Tuttle 1979 as cited in Mitchell and Martin 2002) meet the necessary habitat requirements for gray bats which are caves warm in summer for digestion and rearing young and cool in fall/winter for inducing hibernation (Mitchell and Martin 2002). For management purposes, the U.S. Army Crops of Engineers (USACE) considers the gray bat a riparian species because it forages over water or in riparian areas of streams and lakes (Mitchell and Martin 2002). The USACE has specified that any activities that might adversely affect foraging habitat with 15.5 miles of gray bat caves should be carefully evaluated and modified to protect the habitat (Mitchell and Martin 2002).

Gray bats return to their winter and summer habitat year after year. They mate at hibernation caves upon arrival in September thru October. Females hibernate after mating but males and juveniles are active for several more weeks. Both males and females hibernate in the same caves in large clusters of several thousand bats with densities of approximately 170 per square foot (Harvey and Redman 2003). Hibernation cave temperatures average 42-52 degrees Farenheit (°F) which are slightly higher than Indiana bat preferences (38-43 °F). Indiana bats (*Myotis sodalis*) may hibernate in the same caves with gray bats but in different sections (Mitchell and Martin 2002).

Adult females emerge from hibernation first in late March and April, and disperse to summer caves. During spring and autumn transient periods, they may occupy a wide variety of caves. In the summer, the females form maternity colonies in large warm caves often containing streams. Summer colonies, especially maternity caves, are usually 1-2 miles from rivers and lakes where they forage. A single young is born in late May or early June and begins flying within 20 to 25 days after birth (Harvey and Redman 2003). Growth rates and survival of young increase with higher temperature at maternity roosts and with proximity of the roost to the nearest overwater foraging habitat. In the summer, males and non-reproductive yearling females occupy roosting caves separate from the maternity colony (Tuttle 1976 as cited in Mitchell and Martin 2002). As many as 6 different caves may be used during the summer (Mitchell and Martin 2002). Life spans are at least 14-15 years (Harvey and Redman 2003).

Gray bats may also roost in man-made structures including abandoned mines, barns (Gunier and Elder 1971 as cited in Mitchell and Martin, 2002) storm drains/sewers (Hayes and Bingham 1964, Elder and Gunier 1978, Timmerman and McDaniel 1992 as cited in Mitchell and Martin 2002), and deep vertical crevices under concrete bridges (Bennett 2003). Maternity colonies have also been reported in reservoir dam facilities (Lamb 2000 as cited in Mitchell and Martin 2002). Use of and numbers in caves and structures are estimated by the size of guano deposits and ceiling stains.

In the early evening, gray bats forage primarily over water with mayflies a major component of their diet. However, depending upon prey abundance in the habitat, they consume a variety of both aquatic and terrestrial flying insects particularly moths, flies, and beetles. Riparian and wetland habitats may also be important foraging sites (Mitchell and Martin 2002). The home range of a summer colony contains several roosting caves along approximately 50 miles of river or lake shoreline (Harvey and Redman 2003).

Site Occurrence of Gray Bat

The first reported occurrence at Y-12 was in November 1994, where a single dead juvenile gray bat was found in a display case in the Beta-3 building. Gray bats have been identified by acoustic methods near the Y-12 Complex at the Freels Bend area approximately 3.5 miles south (5.6 km), the K1007 P1 Holding Pond at ETTP approximately 9 miles east (14.5 km) and by mist-netting at Little Turtle cave approximately 3 miles southwest (5 km). The maternity roost for the mist-netted juvenile gray bat is likely very near Little Turtle Cave. Gray bats have not been observed foraging over streams such as upper EFPC or Bear Creek but have been identified on larger expanses of water such as the Melton Hill reservoir and K1007 P1 Holding Pond. Gray bats are known to occur on the ORR, although probably in low numbers.

Potential Impacts to Gray Bats

The potential impacts from construction and operation of the proposed action are identified for hibernating, roosting and foraging gray bats. The gray bat hibernates in caves in the winter, roosts in caves in the summer, and forages over streams, rivers and lakes.

Construction of the proposed facilities might result in impacts from:

- the physical disturbance by earthwork (siting, grading, excavations, etc.) to cave habitat or to riparian or wetland vegetation;
- existing soil contaminants in the construction area that might act as a source to surface water contamination;
- the movement of equipment causing physical harm to individual animals;
- noise disturbances requiring the animal to expend more energy or reducing the effectiveness of foraging or roosting;
- emissions or accidental releases or spills to waterways which might affect the water quality and the abundance of aquatic invertebrates;
- increased flow in streams from stormwater runoff causing increased flooding, physical changes to the streambed sediments, or resuspension of existing sediment contaminants; and
- increased soil erosion during storms causing increased turbidity and sediments entering the stream which impacts habitat for benthic insects used as prey by bats.

No caves are known to exist within the Y-12 Complex so none will be impacted by construction of the proposed facilities. The proposed UPF including construction laydown and staging areas are located in an area previously used for parking and adjacent to a previously developed industrial area with little natural habitat. The proposed UPF construction area is in the north central section of the complex and distant from the headwaters of upper EFPC and upper Bear Creek. No riparian or wetland vegetation will be cleared during construction of the proposed facilities. The proposed CCC is located adjacent to a 2.7 acre spill containment basin (Lake Reality). No direct impacts to caves or to riparian vegetation will result from the construction of the proposed facilities. Although the gray bat has been known to use man-made structures for roosting, structures near active facilities are expected to provide less suitable man-made habitat.

Existing soil contaminants in the construction area will be identified and removed prior to disturbance to prevent it from becoming a source of surface water contamination.

Any presence of equipment (e.g. skyscraper cranes), equipment movement or noise from construction activities would occur during the day, so no foraging gray bat would be disrupted. No significant emissions or effluents would be produced by construction of the proposed facilities that could directly impact foraging habitat, stream water quality or indirectly affect aquatic insects on which the bats might prey. Fueling activities will occur distant from streams and storm sewers to avoid impacts to streams. Releases or spills from transportation and waste-handling accidents are not expected to increase from the proposed action. Equipment for containment, prompt cleanup and response training for accidental spills would minimize the potential impacts. Standard best management practices (BMPs) for controlling soil erosion and stormwater flow from construction activities will minimize potential impacts to the streams from increased sedimentation and stormwater runoff. Construction BMPs include use of silt fences, hay bales, and prompt or interim revegetation to control soil erosion and settling/retention ponds to control stormwater runoff. Although impacts might occur from construction of the proposed facilities these impacts are not expected to adversely impact foraging habitat of the gray bat or water quality of streams.

Operation of the proposed facilities might result in impacts from:

- increased chemical or radiological toxicity of effluents or emissions which might affect bats, the availability of benthic insects or increase contaminants that bioaccumulate in the food chain and
- increased security lighting that would attract insects and bats.

Chemical and radiological exposure to humans and biota are expected to decrease from the increased efficiencies associated with the modernization of the proposed facilities. Y-12 is the source of mercury and other legacy contamination (PCB) in sediments of upper EFPC. Fish and other fauna of the upper EFPC floodplain continue to have high levels of contaminants. Some cleanup actions to remediate the mercury contamination have been completed; others are ongoing or planned. Surface water biota will continue to be monitored under the wastewater discharge permit and a Biological Monitoring and Abatement Program (BMAP).

Radiological exposure from the proposed UPF will not exceed dose limits for human exposures which are protective of wildlife. DOE has recently developed a graded approach to determine radiation doses to aquatic and terrestrial biota (DOE, 2002b). Newly proposed dose limits for aquatic (1 rad/day) and terrestrial (0.1 rad per day) biota are several orders of magnitude lower (0.1 rad/day approximately 36,500 mrem per year) than human dose limits (100 mrem per year). Initially during a screening phase, maximum radionuclide concentrations in surface water, sediment, and soil are compared to media-specific biota concentration guides (BCG). Site-specific sampling of biota, soil, sediment and/or surface water will follow where calculated absorbed dose rates exceed the dose limits. Locations on upper BC and upper EFPC are expected to undergo additional site-specific analyses. Sampling for terrestrial biota dose assessment was begun only recently (DOE 2007).

At night, the Y-12 Complex is currently well-lighted for security purposes, which attracts insects that might be used as prey by bats. The gray bat, however, is reported to forage primarily over water and avoids large cleared areas to escape predation. Operation of the proposed facilities is not expected to adversely impact gray bats.

The ORR reservation contains many acres of high quality gray bat habitat in the Copper Ridge Area with numerous caves adjacent to large bodies of water. The Y-12 Complex and nearby areas contain only marginal gray bat foraging habitat. Cave habitats on the ORR should be monitored periodically for the presence of gray bats and/or by visual estimates of guano and ceiling stains. Gray bat populations should be counted annually. Caves with gray bats may be considered for gating. If population counts decrease, the quality of foraging areas may be monitored for residues in guano (Mitchell and Martin 2002). DOE has previously committed to perform annual bat surveys as a part of wildlife management activities on the ORR (Giffen, Evans, and Parr 2007). Based on the information presented in this BA, the proposed action is not likely to adversely affect the gray bat.

3.2 INDIANA BAT (*Myotis sodalis*)

Listed as endangered in 1967, the Indiana bat uses two distinct habitat types – caves for winter hibernation and trees for summer maternity or roosting colonies. The range of the Indiana bat is also associated with the limestone cave region of the eastern US and areas north of the cave regions from Oklahoma, Iowa, and Wisconsin, east to Vermont and south to northwestern Florida (Harvey and Redman 2003). The present population is estimated at approximately 380,000 with approximately 80 percent hibernating at only 9 locations – 2 caves and a mine in Missouri, 3 caves in Indiana, and 3 caves in Kentucky (Harvey and Redman 2003). The nearest known hibernation cave to the ORR is in Blount County in the Great Smoky Mountains National Park (GSMNP). There are likely other caves in Tennessee that are known to or may support smaller hibernating populations of Indiana bats. Maternity roosts were found for the first time in the south in the Nantahala National Forest in 1999 and the GSMNP in 2001 (Britzke, Harvey, and Loeb, 2003). Individuals of the Indiana bat have also been recently collected in Cherokee National Forest near Tellico Lake in Monroe County, Tennessee during a 2007 bat survey (http://www.srs.fs.usda.gov/compass/issue9/issue9.pdf). These reports indicate that summer colonies may also be potentially present in east Tennessee.

Indiana bats, especially females, are known to return annually to specific roosting and foraging areas (Harvey and Redman 2003). They arrive near hibernation caves in early August through mid-September and begin to swarm and mate outside the cave entrances. Swarming continues into mid- to late-October. Hibernation occurs from October to April in large tightly-packed clusters of several thousand individuals with densities of approximately 300-400 per square foot (Harvey and Redman 2003). Hibernation caves have relatively high humidity (74-100 percent) and temperatures averaging 38-43 deg F which is slightly colder than the gray bat preference (42-52 deg F). Females depart the hibernation caves before males, forage outside the entrance and migrate to summer maternity roosts in mid-May. During the summer, Indiana bats are widely dispersed in suitable habitat, usually north of the hibernation caves. Movements of more than 300 miles (500 km) from the hibernating cave to maternity roosts have been documented (Kurta and Murray 2002 as cited in Britzke et al. 2003). Maternity colonies consist of more than

100 adult females roosting in tree cavities or under loose bark of dead and partially dead trees of many species (Harvey and Redman 2003) in agriculturally dominated landscapes but, recently, have been found in heavily forested areas (Britzke et al. 2003). Roost trees are often snags (dead trees) but may be shag-barked trees or trees with cavities or crevices of various species. If available, maternity colonies use numerous alternative roost trees in addition to a primary roost. Primary roost trees are generally taller than surrounding trees and exposed to direct sunlight (Britzke et al 2003). A single young is born during June and raised under loose tree bark often in wooded streamside habitat. The growth rate of offspring is increased by higher temperatures inside the roost (Britzke et al 2003). The summer roost of adult males is often near the maternity roost or near or in the hibernation caves. The longest life span for this species is less than 14 years (Harvey and Redman 2003).

Most Indiana bat roost sites are in trees, but some, especially males, have roosted in man-made structures (e.g., bat boxes, old church attics, barns, or wooden power poles) (USFWS Reynoldsburg Ohio Field Office, no date). Population numbers of Indiana bats are difficult to quantify. During hibernation, they are packed so tightly that exact numbers can only be estimated and they leave little evidence of their past use of caves so their historical population cannot be determined (Harvey and Redman 2003). It has also been reported that roost stains in caves historically used by Indiana bats have been observed (Tuttle and Kennedy, no date) and can be used to estimate past use.

Indiana bats forage within 3 miles of the maternity roost trees (Bennett 2003, USFWS Cookeville, no date) and lactating females are reported to feed primarily on small moths (Harvey and Redman 2003). Major food items are terrestrial insects from the canopy of riparian floodplain or upland forests. Aquatic insects such as caddisflies and stoneflies are also consumed from impounded bodies of water (Evans et al. 1998). Indiana bats tend to avoid vast open spaces (USFWS Reynoldsburg Ohio Field Office, no date).

Site Occurrence of Indiana Bat

The only record of Indiana bats on the ORR is a single specimen in the 1950s (USFWS 2000 as cited in Webb, 2000). No maternity roosts have been located on the ORR. However, since a winter hibernation cave is located in Blount County and summer maternity roosts have been identified recently in pine snags from the GSMNP and in forests from the Cherokee National Forest in Monroe County which are similar to habitats on the ORR, summer colonies may be present in east Tennessee. Mist net sampling and acoustic techniques have not identified Indiana bats foraging or roosting in suitable habitat on EFPC, Bear Creek or in caves within the ORR.

Reports suggest that most summer roosts are north of hibernation caves and occur in the more northerly parts of their range (Webb 2000). In lieu of conducting surveys, it is assumed that Indiana bats are present near the proposed action area. Indiana bats are assumed to occur on the ORR, more likely in summer, although probably in very low numbers.

Potential Impacts to Indiana Bat

The potential impacts from construction and operation of the proposed action are identified for hibernating, roosting and foraging Indiana bats. The Indiana bat hibernates in caves, roosts in the summer in forests, and forages over streams, rivers, lakes and in wooded riparian and upland habitat.

Construction of the proposed facilities might result in impacts from:

- the physical disturbance by earthwork (siting, grading, excavations, etc.) to cave habitats, upland forested areas or to vegetation outside of the cave or adjacent to waterbodies;
- existing soil contaminants in the construction area that might act as a source to surface water contamination;
- the movement of equipment causing physical harm to individual animals;
- noise disturbances requiring the animal to expend more energy or reducing the effectiveness of foraging or roosting;
- emissions or accidental releases or spills to waterways which might affect the water quality and the abundance of aquatic invertebrates;
- increased flow in streams from stormwater runoff causing increased flooding, physical changes to the streambed sediments, or resuspension of existing sediment contaminants; and
- increased soil erosion during storms causing increased turbidity and sediments entering the stream which impacts habitat for benthic insects used as prey by bats.

No caves are known to exist within the Y-12 Complex so none will be impacted by construction of the proposed facilities. The proposed UPF including construction laydown and staging areas are located in an area previously used for parking and adjacent to a previously developed industrial area with little natural habitat. The proposed UPF construction area is in the north central section of the complex and distant from streams and forest land. No riparian vegetation or forested areas will be cleared during construction of the proposed facilities. The proposed CCC is located adjacent to a 2.7 acre spill containment basin (Lake Reality). Although the Indiana bat has been known to use man-made structures for roosting, structures near active facilities are expected to provide less suitable man-made habitat. Existing soil contaminants in the construction area will be identified and removed prior to disturbance to prevent it from becoming a source of surface water contamination.

Although no wooded areas will be cleared, a few single trees or snags (dead trees) may be removed. Any potential adverse impacts to the Indiana bat would be eliminated by not cutting any trees or clearing snags during the Indiana bat's summer roosting season. The Indiana bat maternity roosting season is considered to begin on April 1st and last through August 15th, when maternity colonies begin to disperse. However, depending on the climatic conditions in a particular year, females and young-of-the-year may remain in the maternity roost through mid-October. Tree removal would be avoided between April 1 and October 15 in areas of suitable maternity roosting habitat (USFWS Cookeville, no date). If tree removal cannot be avoided during the summer, emergence surveys may be performed, in concurrence with USFWS, on single trees in marginal roosting habitat to determine the presence of bats. Tree removal will immediately follow the emergence survey if results are favorable to avoiding adverse impacts to tree roosting bats.

Any presence of equipment (e.g. skyscraper cranes), equipment movement or noise from construction activities would occur during the day, so no foraging Indiana bat would be disrupted. No significant emissions or effluents would be produced by construction of the proposed facilities that could directly impact roosting or foraging habitat, upland forests, wetlands or streams that could indirectly affect the abundance of aquatic or terrestrial insects on which the bats might prey. Fueling activities will occur distant from streams and storm sewers to avoid impacts to streams. Releases or spills from transportation and waste-handling accidents are not expected to increase from the proposed action. Equipment for containment, prompt cleanup and response training for accidental spills would minimize the potential impacts. Standard best management practices (BMPs) for controlling soil erosion and stormwater flow from construction activities will minimize potential impacts to the streams from flooding, increased sedimentation and stormwater runoff. Construction BMPs include use of silt fences, hay bales, and prompt or interim revegetation to control soil erosion and settling/retention ponds to control stormwater runoff. Although impacts might occur from construction of the proposed facilities these impacts are not expected to adversely impact roosting or foraging habitat of the Indiana bat, water quality of streams, or upland forested areas.

Operation of the proposed facilities might result in impacts from:

- increased chemical or radiological toxicity of effluents or emissions which might affect bats, the availability of benthic insects or increase contaminants that bioaccumulate in the food chain and
- increased lighting that would attract insects which might be used as prey by bats.

Chemical and radiological exposure to humans and biota are expected to decrease from the increased efficiencies associated with the modernization of the proposed facilities. Y-12 is the source of mercury and other legacy contamination (PCB) in sediments of upper EFPC. Fish and other fauna of the upper EFPC floodplain continue to have high levels of contaminants. Some cleanup actions to remediate the mercury contamination have been completed; others are ongoing or planned. Aquatic and terrestrial biota will continue to be monitored under BMAP.

Radiological exposure from the proposed UPF will not exceed dose limits for human exposures which are protective of wildlife. DOE has recently developed a graded approach to determine radiation doses to aquatic and terrestrial biota (DOE, 2002b). Newly proposed dose limits for aquatic (1 rad/day) and terrestrial (0.1 rad per day) biota are several orders of magnitude lower (0.1 rad/day approximately 36,500 mrem per year) than human dose limits (100 mrem per year). Initially during a screening phase, maximum radionuclide concentrations in surface water, sediment, and soil are compared to media-specific biota concentration guides (BCG). Site-specific sampling of biota, soil, sediment and/or surface water will follow where calculated absorbed dose rates exceed the dose limits. Locations on upper Bear Creek and upper EFPC are expected to undergo additional site-specific analysis. Sampling for terrestrial biota dose assessment was begun only recently (DOE 2008).

At night, the Y-12 Complex is currently well-lighted for security purposes, which attracts insects and potentially, bats. The Indiana bat, however, is reported to forage over water or upland forests and avoids large cleared areas to escape predation. Operation of the proposed facilities is not expected to adversely impact Indiana bats.

The ORR reservation contains many acres of high quality Indiana bat habitat with upland forest and dead pine snags adjacent to large bodies of water. Whereas, the Y-12 Complex and nearby areas contain only marginal summer roosting and foraging habitat for the Indiana bat. Summer colonies of Indiana bats are more dispersed in forests and more difficult to detect and monitor in annual surveys than gray bats. High quality Indiana bat roosting habitat on the ORR should be identified and monitored periodically (Mitchell and Martin 2002). DOE has previously committed to perform annual bat surveys as a part of wildlife management activities on the ORR (Giffen, Evans, and Parr 2007). Based on the information presented in this BA, the proposed action is not likely to adversely affect the Indiana bat.

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APPENDIX D: HUMAN HEALTH AND ACCIDENTS

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This appendix to the Y-12 Site-Wide Environmental Impact Statement (SWEIS) provides supplemental information pertaining to potential human health impacts associated with radiation exposures, chemical exposures, accidents, and worker safety issues due to operations under Alternative 1 (No Action Alternative) and those proposed under Alternative 2 (New Uranium Processing Facility Alternative) Alternative 3, (Upgrade in-Place Alternative), Alternative 4 (Capability-Based Alternatives), and Alternative 5 (No Net Production/Capability-sized UPF Alternative) analyzed in this Y-12 SWEIS. Located at the end of this appendix is a separate reference section.

D.1 RADIOLOGICAL IMPACTS ON HUMAN HEALTH

D.1.1 Radiation and Radioactivity

Radiation is everywhere. Although most radiation occurs naturally, a small percentage is manmade. Humans are constantly exposed to naturally occurring radiation through sources such as the solar system and the earth's rocks and soils. This type of radiation is referred to as *background radiation,* and it always surrounds us. Background radiation remains relatively constant over time and is present in the environment today just as it was hundreds of years ago. Manmade sources of radiation include medical and dental x-rays, radio and television transmissions, household smoke detectors, and materials released from nuclear and coal-fired power plants. The following sections describe some important principles concerning the nature, types, sources, and effects of radiation and radioactivity.

D.1.1.1 *What Is Radiation?*

All matter in the universe is composed of tiny particles called atoms, and it is the activity of these particles that produces radiation. While the atom is infinitesimally small, it is composed of even smaller particles, called electrons, protons, and neutrons. *Electrons* are negatively charged particles that are principally responsible for chemical reactivity. *Protons* are positively charged particles, and *neutrons* are neutral. Protons and neutrons are located in the center of the atom, called the nucleus. Electrons reside in a designated space around the *nucleus*. The total number of protons in an atom is called its *atomic number*.

Atoms of different types are known as elements. There are over 100 natural and manmade elements. Atoms of the same element always contain the same number of protons and electrons, but may differ by their number of constituent neutrons. Atoms of an element having a different number of neutrons are called the *isotopes* of the element. The total number of protons and neutrons in the nucleus of an atom is called its *mass number,* which is used to name the isotope. For example, the element uranium has 92 protons. Therefore, all isotopes of uranium have 92 protons. Each isotope of uranium is designated by its unique mass number: ^{238}U, the principal naturally occurring isotope of uranium, has 92 protons and 146 neutrons; ^{234}U has 92 protons and

142 neutrons; and ^{235}U has 92 protons and 143 neutrons. Atoms can lose or gain electrons in a process known as *ionization*.

Ionizing radiation has enough energy to free electrons from atoms, creating ions that could cause biological damage. Although it is potentially harmful to human health, ionizing radiation is used in a variety of ways, many of which are familiar to us in our everyday lives. An x-ray machine is one form of ionizing radiation. Likewise, most home smoke detectors use a small source of ionizing radiation to detect smoke particles in the room's air. The two most common mechanisms in which ionizing radiation is generated are the electrical acceleration of atomic particles such as electrons (as in x-ray machines) and the emission of energy from nuclear reactions in atoms. Examples of ionizing radiation include alpha, beta, and gamma radiation.

Alpha radiation occurs when a particle consisting of two protons and two neutrons is emitted from the nucleus. Alpha particles, because of their relatively large size, do not travel very far and do not penetrate materials well. Alpha particles lose their energy almost as soon as they collide with anything, and therefore a sheet of notebook paper or the skin's surface can be used to block the penetration of most alpha particles. Alpha particles only become a source of radiation dose after they are inhaled, ingested, or otherwise taken into the body.

Beta radiation occurs when an electron or positron is emitted from an atom. Beta particles are much lighter than alpha particles and therefore can travel faster and farther. Greater precautions must be taken to stop beta radiation. Beta particles can pass through a sheet of paper but can be stopped by a thin sheet of aluminum foil or glass. Most of the radiation dose from beta particles occurs in the first tissue they penetrate, such as the skin, or dose may occur as the result of internal deposition of beta emitters.

Gamma and x-ray radiation are known as electromagnetic radiation and are emitted as energy packets called *photons*, similar to light and radio waves, but from a different energy region of the electromagnetic spectrum. Gamma rays are emitted from the nucleus as waves of pure energy, whereas x-rays originate from the electron field surrounding the nucleus. Gamma rays travel at the speed of light, and because they are so penetrating, concrete, lead, or steel is required to shield them. For example, to absorb 95 percent of the gamma energy from a ^{60}Co source, 6 centimeters of lead, 10 centimeters of iron, or 33 centimeters of concrete would be needed.

The neutron is another particle that contributes to radiation exposure, both directly and indirectly. Indirect exposure is associated with the gamma rays and alpha particles that are emitted following neutron capture in matter. A neutron has about one quarter of the weight of an alpha particle and can travel 2.5 times faster than an alpha particle. Neutrons are more penetrating than beta particles, but less penetrating than gamma rays. They can be shielded effectively by water, graphite, paraffin, or concrete.

Some elements such as uranium, radium, plutonium, and thorium, share a common characteristic: they are unstable or radioactive. These radioactive isotopes are called *radionuclides* or *radioisotopes*. As these elements attempt to change into more stable forms, they emit invisible rays of energy or particles at rates which decrease with time. This emission is known as radioactive decay. The time it takes a material to lose half of its original radioactivity is referred to as its half-life. Each radioactive isotope has a characteristic half-life. The half-life may vary from a millionth of a second to millions of years, depending upon the radionuclide. Eventually, the radioactivity will essentially disappear.

As a radioactive element emits radioactivity, it often changes into an entirely different element that may or may not be radioactive. Eventually, however, a stable element is formed. This transformation may require several steps, known as a decay chain. Radium, for example, is a naturally occurring radioactive element with a half-life of 1,622 years. It emits an alpha particle and becomes radon, a radioactive gas with a half-life of only 3.8 days. Radon decays to polonium and, through a series of steps, to bismuth, and ultimately to lead.

Nonionizing radiation bounces off or passes through matter without displacing electrons. Examples include visible light and radio waves. At this time, scientists are unclear as to the effects of nonionizing radiation on human health. In this Y-12 SWEIS, the term radiation is used to describe ionizing radiation.

D.1.1.2 *How is Radiation Measured?*

Scientists and engineers use a variety of units to measure radiation. These different units can be used to determine the amount, and intensity of radiation. Radiation can be measured in *curies*, *rads*, or *rems*. The *curie* describes the activity of radioactive material. The rate of decay of 1 gram of radium is the basis of this unit of measure. It is equal to 3.7×10^{10} disintegrations (decays) per second.

The *rad* is used to measure the absorbed dose of radiation. One rad is equal to the amount of radiation that leads to the deposition of 0.01 joule of energy per kilogram of absorbing material.

A *rem* is a measurement of the dose from radiation based on its biological effects. The rem is used to measure the effects of radiation on the body. As such, 1 rem of one type of radiation is presumed to have the same biological effects as 1 rem of any other type of radiation. This standard allows comparison of the biological effects of different types of radiation. Note that the term millirem (mrem) is also often used. A mrem is one one-thousandth (0.001) of a roentgen equivalent man (rem).

D.1.1.3 *How Does Radiation Affect the Human Body?*

Ionizing radiation affects the body through two basic mechanisms. The ionization of atoms can generate chemical changes in body fluids and cellular material. Also, in some cases the amount of energy transferred can be sufficient to actually knock an atom out of its chemical bonds, again resulting in chemical changes. These chemical changes can lead to alteration or disruption of the normal function of the affected area. At low levels of exposure, such as the levels experienced in an occupational or environmental setting, these chemical changes are very small and ineffective. The body has a wide variety of mechanisms that repair the damage induced. However, occasionally, these changes can cause irreparable damage that could ultimately lead to initiation of a cancer, or change to genetic material that could be passed to the next generation. The probability for the occurrence of health effects of this nature depends upon the type and amount of radiation received, and the sensitivity of the part of the body receiving the dose.

At much higher levels of acute exposure, at least 10 to 20 times higher than the legal limits for occupational exposures (the limit for annual occupational exposures is 5 rem), damage is much more immediate, direct, and observable. Health effects range from reversible changes in the blood to vomiting, loss of hair, temporary or permanent sterility, and other changes leading ultimately to death at acute exposures (above about 100 times the regulatory limits). In these cases, the severity of the health effect is dependent upon the amount and type of radiation received. Exposures to radiation at these levels are quite rare, and, outside of intentional medical procedures for cancer therapy, are almost always due to accidental circumstances.

For low levels of radiation exposure, the probabilities for induction of various cancers or genetic effects have been extensively studied by both national and international expert groups. The problem is that the potential for health effects at low levels is extremely difficult to determine without extremely large, well-characterized populations. For example, to get a statistically valid estimate of the number of cancers caused by an external dose equivalent of 1 rem, 10 million people would be required for the test group, with another 10 million for the control group. The risk factors for radiation-induced cancer at low levels of exposure are very small, and it is extremely important to account for the many nonradiation-related mechanisms for cancer induction, such as smoking, diet, lifestyle, chemical exposure, and genetic predisposition. Refer to the glossary for the definition of risk. These multiple factors also make it difficult to establish cause-and-effect relationships that could attribute high or low cancer rates to specific initiators.

The most significant ill-health effects that result from environmental and occupational radiation exposure are cancer fatalities. These ill-health effects are referred to as “latent” cancer fatalities (LCFs) because the cancer may take many years to develop and for death to occur. Furthermore, when death does occur, these ill-health effects may not actually have been the cause of death.

Health impacts from radiation exposure, whether from sources external or internal to the body, generally are identified as somatic (affecting the individual exposed) or genetic (affecting descendants of the exposed individual). Radiation is more likely to produce somatic effects rather than genetic effects. The somatic risks of most importance are the induction of cancers.

For a uniform irradiation of the body, the incidence of cancer varies among organs and tissues. The thyroid and skin demonstrate a greater sensitivity than other organs; however, such cancers also produce relatively low mortality rates because they are relatively amenable to medical treatment. Because fatal cancer is the most serious effect of environmental and occupational radiation exposures, this SWEIS presents estimates of LCFs rather than cancer incidence. The numbers of LCFs can be used to compare the risks among the various alternatives. Nonfatal cancers can be estimated by comparing them with the LCF estimates (see Table D.1.1.3-1).

Table D.1.1.3-1. Nominal Health Risk Estimators Associated With Exposure to 1 Rem of Ionizing Radiation.

Exposed Individual	Fatal Cancer	Nonfatal Cancer
Worker	0.0006	0.0008
Public	0.0006	0.0008

Source: DOE 2002d.

D.1.1.4 *What are Some Types of Radiation Dose Measurements?*

The amount of ionizing radiation that the individual receives during the exposure is referred to as *dose*. An external dose is delivered only during the actual time of exposure to the external radiation source. An internal dose, however, continues to be delivered as long as the radioactive source is in the body, although both radioactive decay and elimination of the radionuclide by ordinary metabolic processes decrease the dose rate with the passage of time. The measurement of radiation dose is called *radiation dosimetry* and is completed by a variety of methods depending upon the characteristics of the incident radiation.

External radiation is measured as a value called deep dose equivalent. Internal radiation is measured in terms of the committed effective dose equivalent (CEDE). The sum of the two contributions (deep dose equivalent and CEDE) provides the total dose to the individual, called the total effective dose equivalent (TEDE). Often the radiation dose to a selected group or population is of interest and is referred to as the collective dose equivalent, with the measurement units of *person-rem*.

D.1.1.5 *What are Some Sources of Radiation?*

Several different sources of radiation have been identified. The majority of them are naturally occurring or background sources, which can be categorized as cosmic, terrestrial, or internal radiation sources. Manmade radiation sources include consumer products, medical sources, and other miscellaneous sources. The average American receives a total of about 360 mrem per year from all sources of radiation, both natural and manmade.

Cosmic radiation is ionizing radiation resulting from energetically charged particles from space that continuously hit the earth's atmosphere. These particles and the secondary particles and photons they create are referred to as cosmic radiation. Because the atmosphere provides some shielding against cosmic radiation, the intensity of this radiation increases with altitude above sea level. For example, a person in Denver, CO, is exposed to more cosmic radiation than a person in New Orleans, LA. The average annual dose to persons in the United States is about 27 mrem. The average cosmogenic dose contribution (mostly due to carbon-14) adds another 1 mrem. The average dose equivalent in Tennessee is about 45 mrem per year. When shielding and the time spent indoors are considered, the dose for the surrounding population is reduced to about 36 mrem per year.

Terrestrial radiation is radiation emitted from the radioactive materials in the earth's rocks, soils, and minerals. Radon, radon progeny, potassium, isotopes of thorium, and isotopes of uranium are the elements responsible for most terrestrial radiation. The average annual dose from terrestrial radiation is about 28 mrem, but the dose varies geographically across the country. Typically reported values are about 16 mrem on the Atlantic and Gulf coastal plains and about 63 mrem on the eastern slopes of the Rocky Mountains. The average external gamma exposure rate in the vicinity of the Oak Ridge Reservation (ORR) is about 51 mrem per year.

Internal radiation arises from the human body metabolizing natural radioactive material that has entered the body by inhalation ingestion, or through an open wound. Natural radionuclides in the body include isotopes of uranium, thorium, radium, radon, bismuth, polonium, potassium, rubidium, and carbon. The major contributors to the annual dose equivalent for internal radioactivity are the short-lived decay products of radon which contribute about 200 mrem per year. The average dose from other internal radionuclides is about 39 mrem per year, most of which results from potassium-40 and polonium-210.

Consumer products also contain sources of ionizing radiation. In some products, like smoke detectors and airport x-ray machines, the radiation source is essential to the operation of the product. In other products, such as televisions and tobacco products, the radiation occurs incidentally to the product function. The average annual dose from consumer products is about 10 mrem.

Medical source radiation is an important diagnostic tool and is the main source of exposure to the public from manmade radiation. Exposure is deliberate and directly beneficial to the patient exposed. In general, medical exposures from diagnostic or therapeutic x-rays result from beams directed to specific areas of the body. Thus, all body organs generally are not irradiated uniformly. Nuclear medicine examinations and treatments involve the internal administration of radioactive compounds or radiopharmaceuticals by injection, inhalation, consumption, or insertion. Even then, radionuclides are not distributed uniformly throughout the body. Radiation and radioactive materials also are used in the preparation of medical instruments, including the sterilization of heat-sensitive products such as plastic heart valves. Diagnostic x-rays result in an average annual exposure of 39 mrem. Nuclear medical procedures result in an average annual exposure of 14 mrem. It is recognized that the averaging of medical doses over the entire population does not account for the potentially significant variations in annual dose among individuals, where greater doses are received by older or less healthy members of the population.

A few additional sources of radiation contribute minor doses to individuals in the United States. The doses from nuclear fuel cycle facilities, such as uranium mines, mills, and fuel processing plants, nuclear power plants, and transportation routes have been established to be less than 1 mrem per year. Radioactive fallout from atmospheric atomic bomb tests, emissions of radioactive material from U.S. Department of Energy (DOE) facilities, emissions from certain mineral extraction facilities, and transportation of radioactive materials contributes less than 1 mrem per year to the average individual dose. Air travel contributes approximately 1 mrem per year to the average dose. Due to radioactive material found in coal, coal-fired power plants are also a source of radiation, but contribute less than 1 mrem per year to the average individual dose.

D.1.2 Radioactive Materials at Y-12

The release of radiological contaminants into the environment at Y-12 occurs almost exclusively as a result of Y-12 production, maintenance, and waste management activities. This section describes the primary radioactive sources at Y-12, how DOE regulates radiation and radioactive materials, and the data sources and methodologies used to evaluate the potential health effects of radiation exposure to the worker and public.

D.1.2.1 *What Are Some Y-12 Sources That May Lead to Radiation Exposure?*

Historically, Y-12 has conducted many operations that involve the use of enriched, natural, and depleted uranium. These have included recovery and recycle operations; purification processes; and metal forming, machining, and material handling operations. The releases from these operations consisted primarily of uranium particulates, fumes, and vapors. Under the current Y-12 mission to dismantle weapons components, store nuclear material, and pursue new technologies, uranium remains the primary radionuclide. In addition to the Y-12 operations, the Oak Ridge National Laboratory (ORNL) also operates research facilities located at Y-12. The ORNL facilities emit a variety of radionuclides from small-scale research projects conducted by the Life Sciences Division and Chemical Technology Division laboratories.

Potential radiation exposures at Y-12 could result primarily from process materials, industrial radiation generation equipment, and criticality or nuclear accidents. The most common process materials are enriched uranium and depleted uranium. Both materials are primarily alpha emitters. However, ^{235}U does emit low-level gamma radiation. In addition, protactinium, neptunium, and thorium have been detected as secondary radionuclides. Most of the external dose from depleted uranium results from the ^{234}Th and ^{234}Pa daughter products, with ^{234}Pa being the stronger contributor, due to its emission of a strong beta particle as well as several gamma and x rays.

Airborne emissions contribute the most significant potential for radiation dose at Y-12. National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations specify that any source that potentially can contribute greater than 0.1 mrem per year TEDE to an off site individual is to be considered a “major source” and emissions from that source must be continuously sampled. As such, there are a number of process exhaust stacks at Y-12 that are considered major sources. At the end of 1999, Y-12 had 51 active stacks that were being monitored.

In addition to major sources, there are a number of minor sources that have the potential to emit radionuclides to the atmosphere. Minor sources are composed of any ventilation systems or components such as vents, laboratory hoods, room exhausts, and stacks that do not meet the criteria for a major source but are located in or vent from a radiological control area. Emissions from Y-12 room ventilation systems are estimated from radiation control data collected on airborne radioactivity concentrations in the work areas. Other emissions from unmonitored processes and laboratory exhausts are categorized as minor emission sources. There were 11 unmonitored areas of uranium emissions from process stacks, and 32 minor emission points were identified from ORNL activities at facilities within the boundary of Y-12. Eight minor emission points were identified at the Analytical Chemistry Organization (ACO) Union Valley Laboratory.

In addition, there are also five areas of potential fugitive and diffuse sources at Y-12, consisting of a contaminated metal salvage yard, three storage areas, and a tooling lay-down area. Diffuse and fugitive sources include any source that is spatially distributed, diffuse in nature, or not emitted with forced air from a stack, vent, or other confined conduit. They include emissions from sources where forced air is not used to transport the radionuclides to the atmosphere. In this case, radionuclides are transported entirely by diffusion or thermally driven air currents. Typical examples include emissions from building breathing; resuspension of contaminated soils, debris, or other materials; unventilated tanks; ponds, lakes, and streams; wastewater treatment systems; outdoor storage and processing areas; and leaks in piping, valves, or other process equipment.

Liquid discharges are another source of radiation release and exposure. Three types of liquid discharge sources at Y-12 include treatment facilities, other point- and area-source discharges, and in-stream locations. In addition, the sanitary sewer is monitored since Y-12 is permitted to discharge domestic wastewater to the city of Oak Ridge publicly owned treatment works (POTW).

D.1.2.2 *How Does DOE Regulate Radiation Exposure?*

The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by the DOE for its contractor facilities. Under conditions of the *Atomic Energy Act* (as amended by the *Price-Anderson Amendments Act of 1988*), DOE is authorized to establish Federal rules controlling radiological activities at the DOE sites. The act also authorizes DOE to impose civil and criminal penalties for violations of these requirements. Some Y-12 activities are also regulated through a DOE Directives System that is contractually enforced.

Occupational radiation protection is regulated by the Occupational Radiation Protection Rule, 10 *Code of Federal Regulations* (CFR) Part 835. DOE has set occupational dose limits for an individual worker at 5,000 mrem per year. Accordingly, Y-12 has set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material as low as reasonably achievable (ALARA). The Y-12 ALARA administrative control level for the whole body is 1,500 mrem per year for enriched uranium operation workers and 1,000 mrem per year for other Y-12 workers.

Environmental radiation protection is currently regulated contractually with DOE Order 5400.5. This Order sets annual dose standards to members of the public, as a consequence of routine DOE operations, of 100 mrem through all exposure pathways. The Order requires that no member of the public receive an annual dose greater than 10 mrem from the airborne pathway and 4 mrem from ingestion of drinking water. In addition, the dose requirements in the *National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities* (40 CFR Part 61, Subpart H) limit exposure to the maximally exposed individual (MEI) of the public from all air emissions to 10 mrem per year.

Limits of exposure to members of the public and radiation workers are derived from International Commission on Radiological Protection (ICRP) recommendations. The U.S. Environmental Protection Agency (EPA) uses the National Council on Radiation Protection and Measurements and the ICRP recommendations and sets specific annual exposure limits (usually less than those specified by the ICRP) in *Radiation Protection Guidance to Federal Agencies* documents. Each regulatory organization then establishes its own set of radiation standards. The various exposure limits set by DOE and the EPA for radiation workers and members of the public are given in Table D.1.2.2-1.

Table D.1.2.2-1. Exposure Limits for Members of the Public and Radiation Workers.

Guidance Criteria (organization)	Public Exposure Limit at the Site Boundary	Worker Exposure Limit
10 CFR Part 835 (DOE)	--	5,000 millirem per year [a]
10 CFR 835.1002 (DOE)	--	1,000 millirem per year [b]
DOE Order 5400.5 (DOE) [c]	10 millirem per year (all air pathways) 4 millirem per year (drinking water pathways) 100 millirem per year (all pathways)	--
40 CFR Part 61 (EPA)	10 millirem per year (all air pathways)	--
40 CFR Part 141 (EPA)	4 millirem per year (drinking water pathways)	--

[a] Although this is a limit (or level) that is enforced by DOE, worker doses must be managed in accordance with as low as is reasonably achievable principles. Refer to footnote b.
[b] This is a control level. It was established by DOE to assist in achieving its goal to maintain radiological doses as low as is reasonably achievable. The Y-12 ALARA administrative control level for the whole body is 1,500 mrem per year for enriched uranium operation workers and 1,000 mrem per year for other Y-12 workers
[c] Derived from 40 CFR Part 61, 40 CFR Part 141, and 10 CFR Part 20.

D.1.3 Data Sources Used to Evaluate Public Health Consequences from Routine Operations

Because Y-12 operations have the potential to release measurable quantities of radionuclides to the environment that result in exposure to the worker and the public, Y-12 conducts environmental surveillance and monitoring activities. These activities provide data that are used to evaluate radiation exposures that contribute doses to the public. Each year, environmental data from ORR and each of the facilities, including Y-12, are collected and analyzed. The results of these environmental monitoring activities are summarized in the ORR's *Annual Site Environmental Report* (ASER). The environmental monitoring conducted at Y-12 consists of two major activities: effluent monitoring and environmental surveillance.

Effluent monitoring involves the collection and analysis of samples or measurements of liquid (waterborne) and gaseous (airborne) effluents prior to release into the environment. These analytical data provide the basis for the evaluation and official reporting of contaminants, assessment of radiation and chemical exposures to the public, and demonstration of compliance with applicable standards and permit requirements.

Environmental surveillance data provide a direct measurement of contaminants in air, water, groundwater, soil, food, biota, and other media subsequent to effluent release into the environment. These data verify Y-12's compliance status and, combined with data from effluent monitoring, allow the determination of chemical and radiation dose and exposure assessment of

Y-12 operations and effects, if any, on the local environment. The effluent and environmental surveillance data presented in the ASER were used as the primary source of data for the analysis of radiation exposure to the public for the No Action Alternative.

D.2 METHODOLOGY FOR ESTIMATING RADIOLOGICAL IMPACTS

D.2.1 Airborne Radionuclides

The public health consequences of radionuclides released to the atmosphere from operations at Y-12 were characterized and calculated in the ASER. Radiation dose to the maximally exposed offsite individuals, to onsite members of the public where no physical access controls are managed by DOE, and to the entire population residing within 50 miles of the center of ORR. The dose calculations were made using the CAP-88 package (version 3) of computer codes (EPA 2008), which was developed under EPA sponsorship to demonstrate compliance with 40 CFR Part 61, Subpart H, which governs the emissions of radionuclides other than radon from DOE facilities. This package implements a steady-state Gaussian plume atmospheric dispersion model to calculate concentrations of radionuclides in the air and on the ground and uses Regulatory Guide 1.109 (NRC 1977) food-chain models to calculate radionuclide concentrations in foodstuffs (vegetables, meat, and milk) and subsequent intakes by humans.

A total of 8 emission points at the Y-12 complex, each of which includes one or more individual sources, was modeled during 2004. Table D.2.1-1 is a list of the emission point parameter values and receptor locations used in the dose calculations.

Meteorological data used in the calculations for 2007 were in the form of joint frequency distributions of wind direction, wind speed class, and atmospheric stability category. During 2007, rainfall, as averaged over the four rain gauges located on ORR, was 91.1 centimeters. The average air temperature was 70 degrees Fahrenheit (°F), and the average mixing-layer height was 1,936 feet. The mixing height is the depth of the atmosphere adjacent to the surface within which air is mixed (DOE 2008).

For occupants of residences, the dose calculations assume that the occupant remained at home (actually, unprotected outside the house) during the entire year and obtained food according to the rural pattern defined in the NESHAP background documents (EPA 1989). This pattern specifies that 70 percent of the vegetables and produce, 44.2 percent of the meat, and 39.9 percent of the milk consumed are produced in the local area (e.g., a home garden). The remaining portion of each food is assumed to be produced within 50 miles of ORR. The same assumptions are used for occupants of businesses, but the resulting doses are divided by 2 to compensate for the fact that businesses are occupied for less than one-half a year and that less than one-half of a worker’s food intake occurs at work. For collective effective dose equivalent (EDE) estimates, production of beef, milk, and crops within 50 miles of ORR was calculated using production rates provided with CAP-88 (DOE 2008).

Table D.2.1-1. Emission Point Parameters and Receptor Locations Used in the Dose Calculations.

Source ID	Stack height (m)	Stack diameter (m)	Effective exit gas velocity (m/s)	Exit gas temperature (°C)	Distance (m) and Direction to the Maximally Exposed Individual			
					Y-12 maximum		ORR maximum	
Y-9422-22 Air Stripper	3.96	0.153	0	Ambient	614	NNW	614	NNW
Y-9616-7 Degas	12.20	0.2	4.36	Ambient	4184	NE	4184	NE
Y-9616-7 Lab Hood	12.20	0.25	0.69	Ambient	4184	NE	4184	NE
Y-9623 Lab Hood	8.50	0.25	0.64	Ambient	2496	NE	2496	NE
Y-Monitored	20.00	0	0	Ambient	2306	ENE	2306	ENE
Y-Union Valley Lab	4.27	0.762	13.08	Ambient	751	WSW	751	WSW
Y-Unmonitored Processes	20.00	0	0	Ambient	2306	ENE	2306	ENE
Y-Unmonitored Lab Hoods	20.00	0	0	Ambient	2306	ENE	2306	ENE

Source: DOE 2005a.

D.2.2 Surface Water

Radionuclides discharged to surface waters from the Y-12 Complex enter the Clinch River via Bear Creek and East Fork Poplar Creek (EFPC), both of which enter Poplar Creek before it enters the Clinch River, and by discharges from Rogers Quarry into McCoy Branch and then into Melton Hill Lake. This section discusses the potential radiological impacts of these discharges to persons who drink water; eat fish; and swim, boat, and use the shoreline at various locations along the Clinch and Tennessee rivers.

For assessment purposes, surface waters potentially affected by ORR are divided into seven segments: (1) Melton Hill Lake above all possible ORR inputs, (2) Melton Hill Lake, (3) Upper Clinch River (from Melton Hill Dam to confluence with Poplar Creek), (4) Lower Clinch River (from confluence with Poplar Creek to confluence with the Tennessee River), (5) Upper Watts Bar Lake (from near confluence of the Clinch and Tennessee Rivers to below Kingston), (6) Lower System (the remainder of Watts Bar Lake and Chicamauga Lake to Chattanooga), and (7) Poplar Creek (including the confluence of EFPC).

Two methods are used to estimate potential radiation doses to the public. The first method uses radionuclide concentrations in the medium of interest (i.e., in water and fish) determined by laboratory analyses of water and fish samples. The second method calculates possible radionuclide concentrations in water and fish from measured radionuclide discharges and known or estimated stream flows. The advantage of the first method is the use of radionuclide concentrations measured in water and fish; disadvantages are the inclusion of naturally occurring radionuclides (i.e., K-40 and natural uranium, thorium, and their progeny), the possible inclusion of radionuclides discharged from sources not part of ORR, the possibility that some radionuclides of ORR origin might be present in quantities too low to be measured, and the possibility that the presence of some radionuclides might be misstated (e.g., present in a quantity below the detection limit). Estimated doses from measured radionuclide concentrations are presented without and with contributions of naturally occurring radionuclides. The advantages of the second method are that most radionuclides discharged from ORR will be quantified and that naturally occurring radionuclides will not be considered or will be accounted for separately; the disadvantage is the use of models to estimate the concentrations of the radionuclides in water and fish. Both methods use the same models (DOE 2008) to estimate radionuclide concentrations in media and at locations other than those that are sampled (e.g., downstream). However, combining the two methods should allow the potential radiation doses to be bounded.

In the following drinking water and fish subsections, the estimated maximum dose is based on either the first method, which uses radionuclide concentrations measured in the medium of interest (i.e., in water and fish), or by the second method, which calculates possible radionuclide concentrations in water and fish from measured radionuclide discharges and known or estimated stream flows.

Drinking Water. Several water treatment plants that draw water from the Clinch and Tennessee River systems could be affected by discharges from ORR. No in-plant radionuclide concentration data are available for any of these plants; all of the dose estimates given below are likely high because they are based on water concentrations before it enters the processing plants. For purposes of assessment, it was assumed that the drinking water consumption rate for the maximally exposed individual is 730 liters per year and the drinking water consumption rate for the average person is 370 liters per year. The average drinking water consumption rate is used to estimate the collective dose. At all locations in 2007, the estimated maximum doses to a person drinking water were calculated using measured radionuclide concentrations in off-site surface water and exclude naturally occurring radionuclides (DOE 2008).

Fish. Fishing is quite common on the Clinch and Tennessee River systems. For purposes of assessment, it was assumed that avid fish consumers would have eaten 21 kilograms of fish during 2007 and that the average person, who is used for collective dose calculations, would have consumed 6.9 kilograms of fish. As mentioned above, the estimated maximum effective dose will be based on either the first method, measured radionuclide concentrations in fish, or by the second method, which calculates possible radionuclide concentrations in fish from measured radionuclide discharges and known or estimated stream flows and excludes naturally occurring radionuclides (DOE 2008).

Other Uses. Other uses of ORR area waterways include swimming or wading, boating, and use of the shoreline. A highly exposed other user was assumed to swim or wade for 30 hours per year, boat for 63 hours per year, and use the shoreline for 60 hours per year. The average individual, who is used for collective dose estimates was assumed to swim or wade for 10 hours per year, boat 21 hours per year, and use the shoreline for 20 hours per year. Measured and calculated concentrations of radionuclides in water and the LADTAP XL code (DOE 2008) were used to estimate potential effective doses from these activities. At all locations in 2004, the estimated highly exposed individual effective doses were based on measured offsite surface water radionuclide concentrations and exclude naturally occurring radionuclides. When compared with doses from eating fish from the same waters, the doses from these other uses are relatively insignificant (DOE 2008).

D.2.3 Other Environmental Media

The CAP-88 computer codes are used to calculate radiation doses from ingestion of meat, milk, and vegetables that contain radionuclides released to the atmosphere. These doses are included in the dose calculations for airborne radionuclides. However, some environmental media, including the three mentioned, are sampled as part of the surveillance program. The following dose estimates are based on environmental sampling results and may include contributions from radionuclides occurring in the natural environment, released from ORR, or both (DOE 2008).

Milk. Milk collected at two locations at a distance from ORR contained detected strontium-90 concentrations (DOE 2008). At all three locations, tritium was detected in the samples. The sample data were used to calculate potential doses to hypothetical persons who drank 310 liters (NRC 1977) of sampled milk during the year. These hypothetical persons could have received a dose of about 0.07 mrem from drinking milk from the near locations and about 0.007 mrem from the remote location, excluding the contribution from naturally occurring radionuclides (DOE 2008).

Food Crops. The food-crop sampling program is described in the 2007 ASER (DOE 2008). Samples of tomatoes, lettuce, and turnips were obtained from six local gardens. These vegetable represent fruit-bearing, leafy, and root vegetables. All radionuclides found in the food crops are found in the natural environment and in commercial fertilizers, and all but two radionuclides also are emitted from ORR. Dose estimates are based on hypothetical consumption rates of vegetables that contain statistically significant amounts of detected radionuclides that could have come from ORR. Based on a nationwide food consumption survey (EPA 1997), a hypothetical home gardener was assumed to have eaten 32 kilograms of homegrown tomatoes, 10 kilograms of homegrown lettuce, and 37 kilograms of homegrown turnips. The hypothetical gardener could have received a 50-year committed effective dose of between 0.007 and 0.1 mrem, depending on garden location. Of this total, between 0 and 0.05 mrem could have come from eating tomatoes, between 0.007 and 0.04 mrem from eating lettuce, and between 0.02 and 0.09 mrem from eating turnips. The highest dose to a gardener could have been about 0.1 mrem from consuming all three types of homegrown vegetables (DOE 2008).

White-Tailed Deer. The Tennessee Wildlife Resources Agency (TWRA) conducted three 2-day deer hunts during 2007 on the Oak Ridge Wildlife Management Area, which is part of ORR (see Sect. 6.7). During the hunts, 361 deer were harvested and were brought to the TWRA checking station. At the station, a bone sample and a tissue sample were taken from each deer and were field-counted for radioactivity to ensure that the deer met wildlife release criteria (less than 20 picocuries (pCi) per gram of beta-particle activity in bone or 5 pCi per gram of cesium-137 in edible tissue). Three deer exceeded the limit for beta-particle activity in bone and were confiscated. The remaining 358 deer were released to the hunters.

Tissue samples collected in 2007 from 12 deer (9 released and 3 retained) were subjected to laboratory analysis. Comparison of the field to analytical cesium-137 concentrations results found that the field concentrations were greater than the analytical results with the exception of one retained deer. All were less than the administrative limit of 5 pCi per gram. The strontium-90 concentrations analyzed in these tissue samples were all less than the minimum detectable levels. Using analytical tissue data and actual deer weights, the estimated doses for these 12 deer ranged between 0.4 to 1 mrem (DOE 2008).

Canada Geese. During the 2007 goose roundup, 202 geese were weighed and subjected to whole-body gamma scans. The geese were field-counted for radioactivity to ensure that they met wildlife release criteria (less than 5 pCi per gram of cesium-137 in tissue). The average cesium-137 concentration was 0.19 pCi per gram, with maximum cesium-137 concentration in the released geese of 0.4 pCi per gram. Most of the cesium-137 concentrations were less than minimum detectable activity levels. If a person consumed a released goose with an average weight of 8.2 pounds and an average cesium-137 concentration of 0.19 pCi per gram, the estimated dose would be about 0.02 mrem. It is assumed that approximately half the weight of a Canada goose is edible. The maximum estimated dose to an individual who consumed a hypothetical released goose with the maximum cesium-137 concentration of 0.4 pCi per gram and the maximum weight of 11 pounds was about 0.05 mrem (DOE 2008).

It is possible that one person could eat more than one goose that spent time on ORR. Most hunters harvest on average one to two geese per hunting season. If one person consumed two geese of maximum weight with the highest measured concentration of cesium-137, that person could have received a dose of about 0.1 mrem (DOE 2008).

Eastern Wild Turkey. Two wild turkey hunts were held on the reservation in 2007, one on March 31–April 1 and the other on April 14–15. Thirty-one birds were harvested, and none were retained. The average cesium-137 concentration measured in the released turkeys was 0.1 pCi per gram, and the maximum cesium-137 concentration was 0.21 pCi per gram. The average weight of the turkeys released was about 18.9 pounds. The maximum turkey weight was about 23.2 pounds.

If a person consumed a wild turkey with an average weight of 18.9 pounds and an average cesium-137 concentration of 0.1 pCi per gram, the estimated dose would be about 0.02 mrem. The maximum estimated dose to an individual who consumed a hypothetical released turkey with the maximum cesium-137 concentration of 0.21 pCi per gram and the maximum weight of 23.2 pounds was about 0.06 mrem. It is assumed that approximately half the weight of a wild turkey is edible. The dose from one person consuming two average weight turkeys with average cesium-137 concentrations was estimated to be about 0.04 mrem. No tissue samples were analyzed in 2007 (DOE 2008).

The collective dose from consuming all the harvested wild turkey meat (31 birds) with an average field-derived cesium-137 concentration of 0.1 pCi per gram and average weight of 18.9 pounds is estimated to be about 0.0007 person-rem (DOE 2008).

D.3 RISK CHARACTERIZATION AND INTERPRETATION OF RADIOLOGICAL DATA

DOE recommends a risk estimator of 6×10^{-4} excess (above those naturally occurring) fatal cancers per person-rem of dose in order to assess health effects to the public and to workers (DOE 2002d). The probability of an individual worker or member of the public contracting a fatal cancer is 6×10^{-7} per millirem. Radiation exposure can also cause nonfatal cancers and genetic disorders. Because fatal cancer is the most serious effect of environmental and occupational radiation exposures, this SWEIS presents estimates of LCFs rather than cancer incidence. Nonfatal cancers can be estimated by comparing them with the LCF estimates (see Table D.1.1.3-1).

The radiation exposure risk estimators are denoted as excess because they result in fatal cancers above the naturally occurring annual rate, which is 171.4 per 100,000 population nationally (Ries et al. 2002). Thus, approximately 1,782 fatal cancer deaths per year would be expected to naturally occur in the approximately 1,040,041 people surrounding Y-12. The doses to which they are applied is the effective dose equivalent, which weights the impacts on particular organs so that the dose from radionuclides that affect different organs can be compared on a similar (effect on whole body) risk basis. All doses in this document are effective dose equivalent unless otherwise noted.

The number of LCFs in the general population or in the workforce is determined by multiplying 600 LCFs per million person-rem with the calculated collective population dose (person-rem), or calculated collective workforce dose (person-rem). For example, in a population of 100,000 people exposed only to natural background radiation of 0.3 rem per year, 18 cancer fatalities per year would be inferred to be caused by the radiation (100,000 persons x 0.3 rem per year × 0.0006 cancer fatalities per person-rem = 18 cancer fatalities per year).

Sometimes calculations of the number of excess cancer fatalities associated with radiation exposure do not yield whole numbers and, especially in environmental applications, may yield numbers less than 1.0. For example, if a population of 100,000 were exposed as above, but to a total dose of only 0.001 rem, the collective dose would be 100 person-rem, and the corresponding estimated number of cancer fatalities would be 0.06 (100,000 persons × 0.001 rem × 0.0006 cancer fatalities/person-rem = 0.06 fatal cancers).

A nonintegral number of cancer fatalities such as 0.06 should be interpreted as a statistical estimate. That is, 0.06 is interpreted as the average number of deaths that would result if the same exposure situation were applied to many different groups of 100,000 people. In most groups, no person (0 people) would incur a cancer fatality from the 0.001 rem dose each member would have received. In a small fraction of the groups, one fatal cancer would result; in exceptionally few groups, two or more fatal cancers would occur. The average number of deaths over all the groups would be 0.06 fatal cancers (just as the average of 0, 0, 0, and 1 is 1/4, or 0.25). The most likely outcome is 0 cancer fatalities.

These same concepts apply to estimating the effects of radiation exposure on a single individual. Consider the effects, for example, of exposure to background radiation over a lifetime. The "number of cancer fatalities" corresponding to a single individual's exposure over a (presumed) 72-year lifetime to 0.3 rem per year is the following:

$$1 \text{ person} \times 0.3 \text{ rem/year} \times 72 \text{ years} \times 0.0006 \text{ cancer fatalities/person-rem} = 0.013 \text{ cancer fatalities}$$

This could be interpreted that the estimated effect of background radiation exposure on the exposed individual would produce a 1.3 percent chance that the individual might incur a fatal cancer caused by the exposure.

Health effects resulting from exposure to both airborne and waterborne radionuclides may also be evaluated by comparing estimated concentrations to established radionuclide-specific, risk-based concentration values. For example, DOE Order 5400.5 establishes Derived Concentration Guidelines (DCGs) for the inhalation of air and the ingestion of water. The DCG is the concentration of a given radionuclide for one exposure pathway (e.g., ingestion of water) that would result in a TEDE of 100 mrem per year to a reference man, as defined by the International ICRP Publication 23 (ICRP 1975).

To ensure that exposure via the drinking water pathway is limited to the established 4 mrem per year, 4 percent of the DCG values are used as comparison values. Members of the public are assumed to ingest 730 liters per year (2 liters per day) of water or to inhale 8,400 cubic meters per year (23 cubic meters per day) of air at the DCG level. The exposure is assumed to occur 24 hours per day for 365 days per year. The DCG values are used as reference concentrations for conducting environmental protection programs at DOE sites, as screening values for considering best available technology for treatment of liquid effluents, and for making dose comparisons. Using radiological data, percentages of the DCG for a given isotope are calculated.

D.4 RISK ESTIMATES AND HEALTH EFFECTS FOR POTENTIAL RADIATION EXPOSURES TO WORKERS

For the purpose of evaluating radiation exposure, Y-12 workers may be designated as radiation workers, nonradiation workers, or visitors based upon the potential level of exposure they are expected to encounter in performing their work assignments.

Radiation workers are either B&W Y-12 employees, or subcontractors whose job assignments place them in proximity to radiation-producing equipment and/or radioactive materials. These workers are trained for unescorted access to radiological areas, and may also be trained radiation workers from another DOE site. These workers are assigned to areas that could potentially contribute to an annual TEDE of more than 100 mrem per year. All trained radiation workers wear dosimeters.

Nonradiation workers may be either B&W Y-12 employees or subcontractors who are not currently trained as radiation workers but whose job assignment may require their occasional presence within a radiologically controlled area with an escort. They may be exposed to transient radiation fields as they pass by or through a particular area, but their job assignments are such that annual dose equivalents in excess of 100 mrem are unlikely. Based upon the locations where such personnel work on a daily basis, they may be issued a Personal Nuclear Accident Dosimeter.

Visitors are individuals who do not perform routine work at Y-12. They are not trained radiation workers and are not expected to receive 100 mrem in a year. Their presence in radiological areas is limited, in terms of time and access. These individuals generally enter specified radiological areas on a limited basis for walk-through or tours with a trained escort. As appropriate, visitors participate in dosimetry monitoring when requested by the hosting division.

D.4.1 Radiological Health Effects for Workers

A primary goal of the Y-12 Radiation Protection Program is to keep worker exposures to radiation and radioactive material ALARA. Such a program must evaluate both external and internal exposures with the goal to minimize worker radiation dose. The worker radiation dose presented in this SWEIS is the total TEDE incurred by workers as a result of normal operations. This dose is the sum of the external whole body dose, including dose from both photons and neutrons, and internal dose, as required by 10 CFR Part 835. The internal dose is the 50-year CEDE. These values are determined through the Y-12 External and Internal Dosimetry Programs.

The External Dosimetry Program at Y-12 provides personnel monitoring information necessary to determine the dose equivalent received following external exposure of a person to ionizing radiation. The program is based on the concepts of effective dose equivalent, as described in publications of the ICRP and the International Commission on Radiation Quantities and Units.

Internal dose monitoring programs are conducted at Y-12 to estimate the quantity and distribution of radionuclides to which a worker may have been exposed. The internal dose monitoring program consists of urinalysis, fecal analysis, lung counting, continuous air monitoring, and retrospective air sampling. Dose assessments are generally based on bioassay data. Bioassay monitoring methods and participation frequencies are required to be established for individuals who are likely to receive intakes that could result in a CEDE that is greater than 100 mrem.

The implementation of the New Uranium Processing Facility (UPF) Alternative would result in a net decrease in the number of radiation workers at Y-12 and their radiation dose. For the Upgrade in-Place Alternative there would be no change in the number of radiation workers at Y-12 and their radiation dose from the No Action Alternative. Under the Capability-Based Alternatives, the number of radiation workers at Y-12 and their radiation dose would decrease from the No Action Alternative. The radiation doses and projected health effects for each of the alternatives are presented in Table D.4.1-1.

Table D.4.1-1. Annual Radiation Doses and Health Impact to the Total Monitored Workers at Y-12 for the Alternatives.

	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized UPF Alternative	No Net Production/ Capability-sized UPF Alternative
Y-12 Monitored Workers	2,400	2,050 [a]	2,400	1,825[c]	1,600[d]
Average Individual Worker Dose (mrem)	20.6	10.3 [b]	20.6	10.3	10.3
Collective Worker Dose (person-rem)	49.4	21.1 [e]	49.4	18.8 [e]	16.5 [e]
Latent Cancer Fatalities	0.03	0.013	0.03	0.01	0.009

a - The total number of monitored workers at Y-12 for the UPF Alternative was derived by reducing the No Action Alternative workforce by 635 to reflect the reductions associated with more efficient operations in the UPF (less 235 workers) and other reductions (400 workers), including the consolidation of the Protected Area from 150 acres to 15 acres. Of these 635 fewer workers, 350 are "radiation workers".
b - Average dose for UPF assumes the internal dose is reduced by 50 percent.
c – Capability-sized UPF Alternative assumes an approximately 25 percent reduction in UPF personnel, which would reduce the total Y-12 monitored workers to 1,825 (see Section 3.2.4).
d – No Net Production/Capability-sized UPF Alternative assumes an approximately 33 percent reduction in UPF personnel, which would reduce the total Y-12 monitored workers to 1,600 (see Section 3.2.5).
e – After UPF becomes operational, NNSA has estimated that the total dose associated with Y-12 operations could be reduced to approximately 2 person-rem (Gorman 2009). For the bounding analysis, this SWEIS assumes the average worker dose would be reduced by 50 percent, but acknowledges that the dose could be even smaller.
Source: REMS 2007, Gorman 2009.

D.5 RISK ESTIMATES AND HEALTH EFFECTS FOR POTENTIAL RADIATION EXPOSURES TO MEMBERS OF THE PUBLIC

D.5.1 Airborne Radionuclides

The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 occurs almost exclusively as a result of plant production, maintenance, and waste management activities. NESHAP regulations for radionuclides require continuous emission sampling of major sources (a “major source” is considered to be any emission point that potentially can contribute more than 0.1 mrem per year EDE to an off-site individual). During 2004, 42 of the 55 stacks suitable for continuous monitoring were judged to be major sources. Eighteen of the stacks with the greatest potential to emit significant amounts of uranium are equipped with alarmed breakthrough detectors, which alert operations personnel to process-upset conditions or to a decline in filtration-system efficiencies, allowing them to investigate and correct the problem before a significant release occurs. As of January 1, 2004, Y-12 had continuous monitoring capability on a total of 55 stacks, 46 of which were active and 9 of which were temporarily shut down. Emissions from unmonitored process and laboratory exhausts, categorized as minor emission sources, are estimated according to calculation methods approved by the EPA. In 2004, there were 46 unmonitored processes operated by Y-12. These are included as minor sources in the Y-12 source term.

Uranium and other radionuclides are handled in millicurie quantities at facilities within the boundary of Y-12. Twenty-nine minor emission points were identified from laboratory activities at facilities within the boundary of Y-12. In addition, the Y-12 Analytical Chemistry Organization laboratory is operated in a leased facility that is not within the ORR boundary; it is located approximately a mile east of Y-12, on Union Valley Road. The emissions from the Analytical Chemistry Organization Union Valley laboratory are included in the Y-12 Complex source term. Eight minor emission points were identified at the laboratory. The releases from these emission points are minimal, however, and have a negligible impact on the total Y-12 dose.

Emissions from Y-12 room ventilation systems are estimated from radiation control data collected on airborne radioactivity concentrations in the work areas. Areas where the monthly average concentration exceeded 10 percent of the DOE derived air concentration worker-protection guidelines are included in the annual emission estimate. An estimated 0.01 Ci (2.17 kilograms) of uranium was released into the atmosphere in 2007 as a result of Y-12 activities. The specific activity of enriched uranium is much greater than that of depleted uranium, and about 80.0 percent of the curie release was composed of emissions of enriched uranium particulate, even though approximately 6.0 percent of the total mass of uranium released was enriched material.

Summary of Health Effects from Airborne Radionuclides. The dose received by the hypothetical MEI for Y-12 under the No Action Alternative was calculated to be 0.15 mrem based on both monitored and estimated emissions data (DOE 2008). This dose would be well below the NESHAP standard of 10 mrem for protection of the public (DOE 2008). The major radionuclide emissions from Y-12 are U-234, U-235, U-236, and U-238. The total dose to the population residing within 50 miles of ORR during 2007 (approximately 1,040,041 people) from Y-12 air emissions under the No Action Alternative was calculated to be about 1.5 person-rem (DOE 2008). For the Upgrade in-Place Alternative, the radiological airborne emissions and resulting impacts from upgraded enriched uranium (EU) facilities would remain unchanged from the No Action Alternative.

Although the design for a UPF is not completed, it is anticipated that implementation of the UPF Alternative would reduce the airborne emissions concentrations for Y-12 from those under the No Action Alternative and Upgrade-in Place Alternative. NNSA has estimated that uranium emissions from the UPF would be reduced by approximately 30 percent compared to the No Action Alternative. Under the Capability-sized UPF Alternative and the No Net Production/Capability-sized UPF Alternative, activities that release radiological emissions would be reduced, resulting in lower emission levels relative to the No Action Alternative. NNSA estimates that uranium emissions would decrease by approximately 40 percent for the Capability-sized UPF Alternative and approximately 50 percent for the No Net Production/Capability-sized UPF Alternative. The potential radiological doses and impacts to the MEI of the public and the population within 50 miles from Y-12 air emissions for all alternatives are presented in Tables D.5.1-1 and D.5.1-2.

Table D.5.1–1. Annual Radiation Doses from Y-12 Air Emissions.

	Alternatives				
	No Action	**UPF**	**Upgrade in-Place**	**Capability-sized UPF**	**No Net Production/Capability-sized UPF**
Dose to the MEI (mrem/year)	0.15	0.1	0.15	0.09	0.08
Offsite Population Dose (person-rem/year) [ab]	1.5	1.0	1.5	1.0	0.8

[a] Population residing within 50 miles of ORR
[b] Based on total of airborne emissions and liquid effluents

Table D.5.1–2. Annual Radiation Health Impacts from Y-12 Air Emissions.

	Alternatives				
	No Action	**UPF**	**Upgrade in-Place**	**Capability-sized UPF**	**No Net Production/Capability-sized UPF**
Latent Cancer Fatality to the MEI	9.0×10^{-8}	6.0×10^{-8}	9.0×10^{-8}	5.0×10^{-8}	4.0×10^{-8}
Latent Cancer Fatalities in the Offsite Population [ab]	0.0009	0.0006	0.0009	0.0005	0.0005

[a] Population residing within 50 miles of ORR.
[b] Based on total of airborne emissions and liquid effluents

D.5.2 Waterborne Radionuclides

D.5.2.1 *Effluent Monitoring*

A radiological monitoring plan is in place at the Y-12 Complex to address compliance with DOE orders and NPDES Permit TN002968. The permit, issued in 1995, required the Y-12 Complex to reevaluate its radiological monitoring plan and to submit results from the monitoring program quarterly as an addendum to the NPDES discharge monitoring report. There were no discharge limits set by the NPDES permit for radionuclides; the requirement is to monitor and report.

The radiological monitoring plan also addresses monitoring of the sanitary sewer. The Y-12 Complex is permitted to discharge domestic wastewater to the city of Oak Ridge publicly owned treatment works under Industrial and Commercial User Wastewater Discharge Permit No. 1-91. As required by the discharge permit, radiological monitoring of this discharge is conducted and reported to the city of Oak Ridge, although there are no city-established limits. Potential sources of radionuclides discharging to the sanitary sewer have been identified in previous studies at the Y-12 Complex as part of an initiative to meet the “as low as reasonably achievable” goals.

Radiological monitoring of storm water is also required by the NPDES permit. A comprehensive monitoring plan has been designed to fully characterize pollutants in storm water runoff. The most recent revision of the plan incorporates radiological-monitoring requirements. There are 75 storm water outfalls and monitoring points located at the Y-12 Complex, and the NPDES permit requires characterization of a minimum of 25 storm water outfalls per year.

D.5.2.2 *Results*

In 2004, the total mass of uranium and associated curies released from the Y-12 Complex at the easternmost monitoring station, Station 17 on Upper East Fork Poplar Creek (UEFPC), and at the westernmost monitoring station, at Bear Creek kilometer (BCK) 4.55 (the former NPDES outfall 304), was 303 kilograms, or 0.200 curies (Table D.5.2.2-1). The total release is calculated by multiplying the average concentration (grams per liter) by the average flow (million gallons per day). Converting units and multiplying by 365 days per year yields the calculated discharge.

The City of Oak Ridge Industrial and Commercial User Wastewater Discharge Permit allows the Y-12 Complex to discharge wastewater to be treated at the Oak Ridge publicly owned treatment works through the East End Sanitary Sewer Monitoring Station, also identified as SS6. Compliance samples are collected there. Results of radiological monitoring are reported to the city of Oak Ridge in quarterly monitoring reports.

Uranium remains the dominant radiological constituent and increases during storm flow. This increase is likely due to increased groundwater flow and storm water runoff from historically contaminated areas.

Table D.5.2.2-1. Release of Uranium from the Y-12 Complex to the Off-site Environment as a Liquid Effluent, 2000–2004.

Year	Quantity released	
	Ci	kg
Station 17		
2000	0.063	126
2001	0.043	82
2002	0.062	140
2003	0.073	167
2004	0.067	161
Outfall 304		
2000	0.093	168
2001	0.065	136
2002	0.070	141
2003	0.078	179
2004	0.133	142

Summary of Health Effects from Waterborne Radionuclides

For liquid effluents, the MEI dose to a member of the public from consumption of fish, drinking water, and participation in other water uses from the Clinch River would not be expected to change for all alternatives. For liquid effluents, the MEI dose to a member of the public would be approximately 0.006 mrem per year (DOE 2008). Statistically, an annual dose of 0.006 mrem would result in a latent cancer fatality (LCF) risk of 4.0×10^{-9}. The committed collective EDE to the population residing within a 50-mile radius of ORR from liquid effluents would be about 6.3 person-rem per year (DOE 2008). Statistically, a dose of 6.3 person-rem would result in 0.004 LCFs annually.

D.6 HAZARDOUS CHEMICAL IMPACTS TO HUMAN HEALTH

D.6.1 Chemicals and Human Health

Chemicals are ever present in our environment. We use chemicals in our everyday tasks—as pesticides in our gardens, cleaning products in our homes, insulating materials in buildings, and as ingredients in medications. Potentially hazardous chemicals can be found in all of these products, but usually the quantities are not large enough to cause adverse health effects.

In contrast to home use, chemicals used in industrial settings are often found in concentrations that may affect the health of individuals in the workplace and in the surrounding community. The following sections describe both the carcinogenic and noncarcinogenic effects of chemicals on the body and how these effects are assessed.

D.6.1.1 *How Do Chemicals Affect the Body?*

Industrial pollutants may be released either intentionally or accidentally to the environment in quantities that could result in health effects to those who come in contact with them. Chemicals that are airborne, or released from stacks and vents, can migrate in the prevailing wind direction for many miles. The public may then be exposed by inhaling chemical vapors or particles of dust contaminated by the pollutants. Additionally, the pollutants may be deposited on the surface soil and biota (plants and animals) and subsequent human exposure could occur. Chemicals may also be released from industries as liquid or solid waste (effluent) and can migrate or be transported from the point of release to a location where exposure could occur.

Exposure is defined as the contact of a person with a chemical or physical agent. For exposure to occur, a chemical source or contaminated media such as soil, water, or air must exist. This source may serve as a point of exposure, or contaminants may be transported away from the source to a point where exposure could occur. In addition, an individual (receptor) must come into either direct or indirect contact with the contaminant. Contact with a chemical can occur through ingestion, inhalation, dermal contact, or external exposure. The exposure may occur over a short (acute or sub-chronic) or long (chronic) period of time. These methods of contact are typically referred to as exposure routes. The process of assessing all of the methods by which an individual might be exposed to a chemical is referred to as an exposure assessment.

An exposure assessment is the determination or estimation (qualitative or quantitative) of the magnitude, frequency, duration, route of exposure, and receptor population for each pathway evaluated. During the exposure assessment process, the assessor:

- Characterizes the exposure setting in an effort to identify the potentially exposed populations (receptors), their activity patterns, and any other characteristics that might increase or decrease their likelihood of exposure.
- Determines exposure pathways based on the characterization of the exposure setting, identifying the unique mechanisms by which a population may be exposed to the contaminants.

- Quantifies the exposure to a contaminant by estimating concentrations using environmental data to which a receptor may be exposed.
- Calculates a chemical-specific intake (referred to as the chronic daily intake) and/or a radionuclide-specific dose for each exposure pathway.

Once an individual is exposed to a hazardous chemical, the body's metabolic processes typically alter the chemical structure of the compound in its efforts to expel the chemical from the system. For example, when compounds are inhaled into the lungs they may be absorbed depending on their size (for particulates) or solubility (for gases and vapors) through the lining of the lungs directly into the blood stream. After absorption, chemicals are distributed in the body and may be metabolized, usually by the liver, into metabolites that may be more toxic than the parent compound. The compound may reach its target tissue, organ, or portion of the body where it will exert an effect, before it is excreted via the kidneys, liver, or lungs. The relative toxicity of a compound is affected by the physical and chemical characteristics of the contaminant, the physical and chemical processes ongoing in the human body and the overall health of an individual. For example, infants, the elderly, and pregnant women are considered more susceptible to certain chemicals.

Chemicals have various types of effects on the body. Generally, when considering human health, chemicals are divided into two broad categories: chemicals that cause health effects but do not cause cancer (noncarcinogens) and chemicals that cause cancer (carcinogens). Note that exposure to some chemicals can result in the manifestation of both noncarcinogenic health effects and an increased risk of cancer.

D.6.1.2 *Chemical Noncarcinogens*

Chemical noncarcinogens are chemicals or compounds that when introduced to the human body via ingestion, inhalation, or dermal absorption may result in a systemic effect if the intake exceeds a level that can be effectively eliminated. For example, a noncarcinogenic chemical or compound may affect the central nervous system, renal (kidney) function, or other systems that have an effect on the body's metabolic processes. They may also cause milder effects such as irritation to the eyes or skin, or asthmatic attacks. The level of the effects are directly related both to the chemical and the level of exposure.

For many noncarcinogenic effects, the body is equipped with protective mechanisms that must be overcome before an adverse effect is manifested from a chronic chemical exposure. For example, where a large number of cells perform the same or similar function, the cell population may have to be significantly depleted before an effect is seen. The body can tolerate a range of exposure where there is essentially no change in expression of adverse effects. This is known as the "threshold" or "nonstochastic" concept and has been observed in multiple animal studies. The results of these animals studies are a set of guidelines that serve as the basis for the development of noncarcinogenic toxicity values.

D.6.1.3 *Chemical Carcinogens*

Over the past century, many chemicals have been identified that cause cancer in humans. Examples of these carcinogens include asbestos in insulation, vinyl chloride in the rubber industry, and benzene in solvents. Cancers caused by industrial chemicals can occur in any organ in the body, including the respiratory tract, bladder, bone marrow, gastrointestinal tract, or liver. Unlike noncancer effects, cancer-causing agents are assumed to have no safe intake or dose levels.

Currently, chemicals are categorized as either confirmed human carcinogens, suspected human carcinogens, or confirmed animal carcinogens. For cancer agents (including all radionuclides), EPA provides toxicity information that can be used to determine the probability that cancer may occur. The toxicity factors used to assess exposures to carcinogens are referred to as cancer slope factors (CSFs). The CSFs represent the slope of the dose-response curve from various toxicity studies. Most of the CSFs for nonradionuclides were developed based on the data from chemical-specific 2-year animal studies.

D.6.2 How Does DOE Regulate Chemical Exposures?

D.6.2.1 *Environmental Protection Standards*

DOE Order 450.1 requires implementation of sound stewardship practices that are protective of the air, water, land, and other natural and cultural resources impacted by the DOE operations and by which DOE cost-effectively meets or exceeds compliance with applicable environmental; public health; and resource protection laws, regulations, executive orders, and DOE requirements. The objective is accomplished by implementing Environmental Management Systems (EMSs) at DOE sites. An EMS is a continuing cycle of planning, implementing, evaluating, and improving processes and actions undertaken to achieve environmental goals. Applicable Federal and state environmental acts/agreements include:

- *Resource Conservation and Recovery Act* (RCRA)
- *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) as amended by the *Superfund Amendments and Reauthorization Act* (SARA)
- *Federal Facility Compliance Agreement*
- *Endangered Species Act*
- *Safe Drinking Water Act*
- *Clean Water Act* (which resulted in the establishment of the NPDES and pretreatment regulations for POTW)
- *Clean Air Act* (Title III, Hazardous Air pollutants Rad-NESHAP, Asbestos NESHAP)
- *Toxic Substances Control Act* (TSCA)
- *Federal Insecticide, Fungicide, and Rodenticide Act*

Many of these acts/agreements include environmental standards that must be met to ensure the protection of the public and the environment. Most of the acts/agreements require completed permit applications in order to treat, store, dispose of, or release contaminants to the environment. The applicable environmental standards and reporting requirements are set forth in the issued permits and must be met to ensure compliance.

The *Emergency Planning and Community Right-To-Know Act*, also referred to as SARA Title III, requires reporting of emergency planning information, hazardous chemical inventories, and environmental releases to Federal, state, and local authorities. The annual Toxic Release Inventory Report addresses releases of toxic chemicals into the environment, waste management activities, and pollution prevention activities associated with those chemicals.

D.6.2.2 *Regulated Occupational Exposure Limits*

Occupational limits for hazardous chemicals are regulated by DOE by the adoption and imposition of certain Occupational Safety and Health Act regulations. The permissible exposure limits (PELs) represent the legal concentration levels, according to the Occupational Health and Safety Administration (OSHA), that are safe for 8-hour exposures without causing noncancer health effects. Other agencies, including the National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) provide guidelines. The NIOSH guidelines are Recommended Exposure Limits and the ACGIH guides are Threshold Limit Values (TLVs). Occupational limits are further defined as time-weighted averages (TWAs), or concentrations for a conventional 8-hour workday and a 40-hour workweek, to which it is believed nearly all workers may be exposed, day after day, without adverse effects. Often ceiling limits, or airborne concentrations that should not be exceeded during any part of the workday, are also specified. In addition to the TWA and ceiling limit, short-term exposure limits may be set. Short-term exposure limits are 15-minute TWA exposures that should not be exceeded at any time during a workday, even if the 8-hour TWA is within limits. OSHA also uses action levels to trigger certain provisions of a standard, for instance appropriate workplace precautions, training, and medical surveillance, for workers whose exposures could approach the PEL.

D.7 IMPACTS TO WORKER SAFETY

Y-12 worker risks from radiation and chemical hazards are closely controlled by health and safety requirements. In addition to these risks, workers at Y-12 have the potential for industrial accidents, injuries, and illnesses due to everyday operations. Due to these potential impacts, injury and illness rates are included in this SWEIS.

The Safety Program at Y-12 encompasses the DOE Orders described below and implements the Integrated Safety Management System as the facility safety structure. The objective of the Integrated Safety Management System is to provide a safe workplace to perform work safely while protecting the worker, the public, and the environment. Integrated Safety Management System principles include the line management responsibility for safety, clear lines of authority for ensuring safety, input and support from all workers, and the effective hazard controls to ensure the safety of work.

D.7.1 Department of Energy Regulation of Worker Safety

10 CFR Part 851, *Worker Safety and Health Program*, regulates the health and safety of workers at all DOE sites. This comprehensive standard directs the contractor facilities to establish the framework for an effective worker protection program that will reduce or prevent injuries, illnesses, and accidental losses by providing DOE contractor workers with a safe and healthful workplace. Baseline exposure assessments are outlined in this requirement, along with day-by-day health and safety responsibilities.

Industrial hygiene limits for occupational chemical exposures at Federal sites are regulated by 29 CFR Part 1910 and 29 CFR Part 1926, *Occupational Safety and Health Standards*, including the PELs set by OSHA. DOE requires that all sites comply with the PELs unless a lower limit (more protective) exists in the ACGIH TLVs.

The Y-12 Safety Program conducts investigations of plant accidents according to DOE Order 225.1A, *Accident Investigations,* and reports work-related fatalities, injuries, and illnesses according to DOE Order 231.1, *Environment, Safety and Health Reporting*.

D.7.2 Y-12 Injury/Illness Rates

The Y-12 worker non-fatal injury/illness rates for Federal, Management and Operating (M&O) contractor, site security, and subcontractor personnel were used to calculate the 4-year average (2005–2008) injury/illness rate per 100 workers (or 200,000 hours). These 4-year averages are expressed in terms of Total Recordable Cases (TRCs) and Days Away, Restricted or on Job Transfer (DART) (formerly Lost Workdays (LWDs)). At Y-12, from 2005 through 2008, there was an average of almost 116 TRCs and 3,571 DARTs each year (DOE 2009a). Dividing the TRCs each year by the total number hours worked and then multiplying by 200,000, the TRC Rate (TRCR) was obtained for each year and then the average TRCR was derived for the 4-year period. The average TRCR for Y-12 is 2.02; which means that 2.02 TRCs may be expected per 100 workers each year. Using a similar calculation for DARTs, the average DART Rate for Y-12 from 2005 through 2008 is 63.18 per 100 workers each year.

The 4-year average injury/illness rate was used to calculate the total number of Y-12 worker non-fatal injury/illness per year, assuming the 4-year average rate would remain constant. Table D.7.2-1 presents the recordable cases of injuries that would be expected for the entire Y-12 workforce under each of the alternatives during operations.

During the 4-year averaging period there were no fatalities at Y-12, although there was one fatality reported for Oak Ridge Operations, which includes Y-12 (DOE 2009a). So, while the calculated annual fatality rate per 100 workers at Y-12 is zero, the calculated rate for Oak Ridge Operations is 0.00035 fatalities per year per 100 workers. Because there is always the potential for a worker fatality, Table D.7.2-1 shows less than one worker fatality per year.

Table D.7.2-1. Annual Calculated Nonfatal TRCs and DARTs for the Y-12 Workforce During Operations.

	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized UPF Alternative	No Net Production/ Capability-sized UPF Alternative
Number of Workers	6,500	5,950	6,500	3,900	3,400
Total Recordable Cases	131	120	131	79	69
DART	4,107	3,759	4,107	2,464	2,148
Fatalities	<1	<1	<1	<1	<1

During construction, the UPF would have the highest potential for occupational injuries due to the fact that the UPF would require the greatest construction workforce. For the total construction duration, approximately 2,900 worker-years would be required to construct the UPF. The TRCR for construction in the state of Tennessee during 2007 was 5.2 and the DART rate was 2.7 (BLS 2009). The worker fatality rate for construction in Tennessee during 2007 was 10.5 per 100,000 workers (BLS 2009a); that would be equivalent to 0.011 fatalities per 100 workers. Table D.7.2-2 presents the TRC, DART, and worker fatality rates that would be expected based on statewide statistics during construction based on the largest applicable workforce for each alternative. It should be noted that the worker fatality record for Y-12 for construction is significantly better than for the state as a whole, given that there have been no construction-related fatalities during construction of the HEUMF.

Table D.7.2-2. Annual Calculated Nonfatal TRCs and DARTs for the Y-12 Construction Workforce.

	No Action Alternative	UPF Alternative	Upgrade in-Place Alternative	Capability-sized UPF Alternative	No Net Production/ Capability-sized UPF Alternative
Number of Workers	0	950	300	850	850
Total Recordable Cases[a]	0	49	16	44	44
DART[a]	0	26	8	23	23
Fatalities[a]	0	0.105	0.033	0.093	0.093

[a] TRC, DART, and fatalities rates for construction in the state of Tennessee in 2007 were 5.2, 2.7, and 0.011, respectively (BLS 2009, BLS 2009a).

D.8 EPIDEMIOLOGIC STUDIES

Several epidemiologic studies have been completed on Y-12 workers to evaluate potential health effects from radiation and chemical exposures. Y-12 workers have also been included in many site-wide Oak Ridge Operations (ORO) health studies. In addition to these reviews, community-wide health patterns have been studied in Anderson and Roane counties. A synopsis of many of these studies is presented in this section.

D.8.1 Background

Epidemiology is the study of the distribution and determinants of disease in a population. In epidemiologic studies, the distribution of disease is considered in relation to time, place, and person. Populations may be characterized by age, race, and gender distributions, as well as by social characteristics related to health (e.g., income and education), occupation, susceptibility to disease, and exposure to specific agents. Determinants of disease include the causes of disease, and factors that influence the risk of disease. Epidemiologic studies often lead to an understanding of the causes of disease.

The study of the health effects associated with ionizing radiation was first published in the 1930s to evaluate the incidence of cancer among painters who had used radium to paint watch dials from 1910 to 1920. The research and manufacture of nuclear weapons and subsequent radiation exposure occurred beginning in the late 1930s. Since that time, because of the concern with potential adverse health effects, numerous epidemiologic studies have been conducted among workers involved in the manufacture and testing of nuclear weapons. More recently, concerns about the effects of radiological contaminants on public health have resulted in health studies among communities that surround DOE facilities.

D.8.2 Types of Epidemiologic Studies

Ecological Studies. Ecological studies compare associations between people living in geographical areas with disease frequency. A group of people, rather than the individual, is the unit of comparison. Groups can be chosen by neighborhood, city, county, or region where demographic information and incidence and mortality data are available. The differences in the rates of disease between geographical areas can be correlated to certain distinct factors, such as the proximity to a paper factory. An example of an ecological study is the comparison of lung cancer mortality rates among communities with respect to distance from chemical industries.

The major disadvantage of ecological studies is that the measure of exposure is based on the average level of exposure in the community, when what is really of interest is each individual's exposure. Ecological studies do not take into account other factors such as age, race, and individual behaviors that may also be related to disease. As such, these types of studies may lead to incorrect conclusions. For example, the cause of lung cancer in the example above may be explained by a higher percentage of cigarette smoking among individuals in a community with the chemical industries rather than the industrial pollutants themselves. These incorrect conclusions are called an "ecologic fallacy." Due to these limitations, ecological studies are helpful only as initial steps in an investigation to determine the cause of disease.

Cohort Studies. Cohort studies include an identified population that can be classified as being exposed or not exposed to an agent of interest. Occupational studies fit well with a cohort study because workers have an individual work history which can provide the data on exposure for the pattern of disease (or mortality) of interest. Characterization of the exposure may be qualitative (e.g., high, low, or no exposure) or very quantitative (e.g., chemicals in milligrams per cubic meter [mg/m^3]). Job titles and area measurements are often used to estimate exposure in the absence of personal data.

In the cohort study, individuals are tracked for a period of time, and cause of death recorded. In general, overall rates of death and cause-specific rates of death have been assessed for workers at Y-12, and data sources are available from the DOE Comprehensive Epidemiologic Data Resource (CEDR) Program (CEDR 2000). Death rates for the exposed population are compared with death rates of workers who did not have the exposure (internal comparison), or they are compared with expected death rates based on the U.S. population or state death rates (external comparison). If the death rates vary from what is expected, an association is said to exist between the disease and exposure.

Most cohort studies at Y-12 have been historical cohort studies or studies of past exposures. This type of study can be a problem if the exposure records are incomplete. Y-12 studies often have used internal and external estimates of radiation exposure by job classification to approximate missing exposure data. Cohort studies require extremely large populations and are expensive to conduct. While they are not appropriate for studying rare diseases, they may, however, provide a direct estimate of the risk of death from a specific disease and allow an investigator to evaluate many disease end points.

Case-Control Studies. Case-control studies begin with the identification of individuals with a disease (cases) and match them with individuals without the disease (controls). The choice of controls is important because they must be individuals who are at risk for the disease and are representative of the population that generated the cases. Cases and controls are then compared by the proportion of individuals exposed to the agent of interest. Case-control studies are also called "retrospective studies" because they start with people with the disease and look back in their history for exposure. These studies are well suited for rare disease and are generally used to examine the relationship between a specific disease and exposure.

D.8.3 Community Health Studies

A number of health studies have been conducted in the city of Oak Ridge and its surrounding communities, particularly the Scarboro Community, located approximately 2 miles from Y-12. In the fall of 1998, the Joint Center for Political and Economic Studies, a policy research institution, was tasked by DOE to help the Scarboro residents interpret some of these health studies. The Center reviewed the following studies:

- Oak Ridge Health Agreement Steering Panel Study on the health effects of ORR pollutants
- Oak Ridge Reservation Annual Site Environmental Report, 1998
- Scarboro Community Environmental Study
- Analysis of Respiratory Illnesses Among Children in the Scarboro Community

The Joint Center completed the work in October 2000 with the issuance of five summary publications. While these summaries generated no new epidemiological analyses, they served to help the community understand the purpose and results of the studies.

D.8.4 Oak Ridge Health Studies

The State of Tennessee and DOE signed an agreement in July 1991, allowing the Tennessee Department of Health to sponsor the Oak Ridge Health Studies. An independent group was formed to identify the important historical materials and emission sources from the Oak Ridge sites and to identify any adverse health effects caused by these materials to the surrounding communities. To provide direction and to ensure the independence of the studies, the Oak Ridge Health Agreement Steering Panel was formed, including a panel of experts and local citizens. Project oversight was provided through the Tennessee Department of Health.

A dose reconstruction feasibility study (Phase I) was initiated in 1992 and the contract was awarded to ChemRisk by the State of Tennessee. They reviewed documents and concluded that there was enough information available to reconstruct past releases and offsite doses caused by radioactive and hazardous materials. They also indicated that potential harm to the surrounding population may have occurred from releases of the following contaminants: (1) mercury releases from Y-12, (2) PCBs from all sites, (3) radioactive iodine from ORNL, and (4) radionuclide releases from ORNL. A full-dose, in-depth reconstruction study was initiated in 1994 to investigate these priority contaminants, the quantity released to the environment, and the potential adverse effects to the health of the surrounding population. The Steering Panel added further study of uranium releases because of the historical role of Oak Ridge's uranium work. The mercury, PCB, and uranium investigations are included in this document, since they are relevant to Y-12.

Mercury Health Studies. The Health Studies' investigators reported that the past estimated mercury releases for Y-12 were too low. According to the researchers' estimates, Y-12 released about 70,000 pounds of mercury into the atmosphere from vents and 280,000 pounds into the EFPC between 1950 and 1982. The total of these, about 350,000 pounds, exceeded by about 60,000 pounds previously published estimate by DOE's 1980s Mercury Task Force. The investigators evaluated the toxic effects from elemental mercury, inorganic mercury and organic mercury. The concluded that the greatest potential health risk from the elemental mercury releases was to children in the Scarboro community, living one-half mile from Y-12, and to farm residents along EFPC who may have inhaled enough to cause damage to the central nervous system between 1953 and 1959. The hazard from organic mercury, specifically methyl mercury, was estimated to be most toxic to people who ate large amounts of fish from Poplar Creek, the Clinch River, or Watts Bar Lake during this period. Pregnant women who ate fish from these sources between the late 1950s and early 1960s risked brain damage to their fetuses. They estimated that the number of fetuses exposed at a potentially toxic level was likely nearer to 100 than 1,000.

PCB Health Studies. The Health Studies reported that the estimates of PCB releases from ORR were difficult to quantify since PCBs were not considered hazardous prior to the early 1970s, so releases were not monitored. In 1977, the manufacture of PCBs was banned in the United States. People eating fish from the Clinch River were reported as being at the greatest risk for illness from the PCB releases from ORR. The report cited the Y-12 releases into EFPC on the east side of the plant as being of particular concern since the creek flows directly through the Oak Ridge community after leaving the plant. The researchers concluded that some fishermen at the Clinch

River and Watts Bar Reservoir have eaten enough fish from these sources to affect their health, but estimates of how many have been affected are not possible at this time. The investigators estimated that fewer than three excess cancers have been caused by PCBs from ORR. They recommend further studies of fish and turtle consumption, PCB blood levels in people consuming fish, PCB levels in core samples from the Clinch River and the Watts Bar Reservoir, PCB levels in the soils near EFPC, and PCB levels in cattle grazing near the creek.

Uranium Health Studies. The Health Studies investigators reported that the DOE reports of uranium releases have been understated. The study estimates Y-12 released about 50,000 kg of uranium to the air from 1944 to 1995, more than seven times the 6,535 kg previously acknowledged by DOE. Using the new data, the investigators calculated health risks to nearby residents, using a conservative screening method so as not to underestimate the risks. The new risk for cancer for residents included residents of the Scarboro community. The analyses reported career screening indexes that were slightly lower than the investigator's decision guide for carcinogens, but with a great deal of uncertainty. In response to this information, investigators have recommended a more extensive screening of uranium on ORR.

D.8.5 Agency for Toxic Substances and Disease Registry PCB Studies

The Agency for Toxic Substances and Disease Registry (ATSDR) is a governmental agency established to conduct public health assessments of Federal facilities and to carry out any needed follow-up health activities. These activities include health studies, registries, medical monitoring, and health education. To help characterize environmental contamination in the Oak Ridge area, ATSDR screened more than 500 persons for PCB and blood mercury levels in September 1997. Blood samples were obtained from 116 persons who met the criteria and volunteered, including 13 residents of the Scarboro community. Participants were interviewed, and blood samples were obtained for PCBs and mercury in the blood. The study found the participants had PCB levels and blood mercury levels comparable to levels found in the general population. Only 5 (4 percent) of the persons tested had elevated PCB levels (> 20 μg per cubic meter). Four of the five had PCB levels between 20 and 30 μg per cubic meter and one had a serum PCB level of 103.8 μg per cubic meter, which is higher than levels generally found. As for blood mercury, only one individual had their total blood mercury greater than 10 μg per cubic meter, which is considered elevated. The remaining participants had total blood mercury levels similar to the general population.

D.8.6 Cancer Mortalities in Children

In response to a British study reporting increased leukemia and lymphoma in children living near nuclear plants in the United Kingdom, the National Cancer Institute (NCI) initiated a study of cancer mortality in the areas surrounding U.S. nuclear facilities (Jablon et al. 1991) cancer deaths were compared in counties surrounding nuclear facilities with control counties from the same region. They also compared cancer deaths before start-up of the nuclear facility with cancer deaths after start-up. The study areas included nine DOE facilities, including Oak Ridge Operations, 52 commercial nuclear electric plants, and one former commercial fuel reprocessing plant. Anderson County and Roane County were included in the review and were compared locally to Blount, Bradley, Coffee, Jefferson, and Hamblen counties in Tennessee, and

Henderson County in North Carolina. Three comparison counties were matched with each county studies. For childhood leukemia, when compared to the control counties, there were fewer leukemia deaths after start-up than before. For the DOE facilities, operations began before the study time period, the year 1950, but there was no facility with significantly elevated childhood leukemia mortality. The same results were obtained for mortality due to leukemia for all ages. The relative risk (in this study, the comparison of ratios of the standardized mortality ratios (SMRs) for the study and control counties) for the DOE sites for mortality due to all types of cancer, except leukemia, were significantly high (1.04) after start-up but smaller than the rate-ratio before start-up (1.06). The study did report a significant increased incidence of childhood leukemia for one commercial site, but it predated the start-up of the nuclear facility. The authors concluded that the results do not prove the absence of an effect, but if an effect is present, it is too small to be observed by these methods.

Tennessee Medical Management, Inc. compared Tennessee, Oak Ridge, Anderson County, and Roane County cancer mortality and incidence data with the expected deaths and incidence rates for the U.S. for 1990 and for the interval 1988 through 1990. Actual deaths in Oak Ridge, as well as cancer deaths, were fewer than expected. Anderson County deaths from all causes and cancer deaths were equivalent to expected rates, as were Roane County deaths. The study also compared new cancer cases. Anderson County showed a higher incidence of lung and bronchial cancer than expected, and fewer than expected leukemias, stomach and small intestine cancers, and colon cancers.

D.8.7 Site-wide Studies of Oak Ridge Workers

D.8.7.1 *Mortality of Nuclear Workers in Oak Ridge*

A 1997 report, titled *A Mortality Study of Employees of the Nuclear Industry in Oak Ridge, Tennessee* (Frome et al. 1997), expanded on an earlier study of the health of workers employed at the nuclear plants in Oak Ridge. The previous study had only included white males employed exclusively at ORNL and had excluded workers moving between plants. This study included 106,020 workers, employed for at least 30 days at any of the Oak Ridge nuclear facilities between 1943 and 1984 whose records were without critical errors (e.g., unknown sex, race, date of birth, or employment dates). The objectives of the expanded study were to include individuals omitted from the earlier study to compare the mortality patterns of workers among the Oak Ridge facilities, to address errors of redundancy when workers employed at more than one facility were included in the analysis, and to conduct dose-response analyses for workers exposed to external radiation. The most significant excess cancer mortality associated with external radiation was found in lung cancer for white males, with an SMR of 1.18 (1,849 deaths). An SMR of 1.12 (1,568 deaths) was reported for nonmalignant respiratory disease. The study reported a strong socioeconomic effect with the lung cancer results, and baseline rates were higher for Y-12 workers and workers employed at more than one facility. The authors acknowledged that information on cigarette smoking for this cohort of workers was not available for analysis and may have been a confounder.

D.8.7.2 *Lung Cancer Mortality Study*

A case-control study (Dupree et al. 1995) of 787 lung cancer deaths from four uranium processing operations, including Y-12, Fernald Feed Materials and Production Center, and the Mallinckrodt Chemical Works, was conducted to investigate the relationship between lung cancer and uranium dust exposure. The cases consisted of workers who were employed in the facilities for at least 183 days, died before January 1, 1983, and had lung cancer listed anywhere on the death certificate. Each case was matched with a control by facility, race, gender, and birth and hire dates within 3 years. Included in the history of the cohort was information on smoking, first pay code (to estimate socioeconomic status), complete work histories, and occupational radiation monitoring records. Annual radiation dose to the lungs from deposited uranium was estimated for each individual and annual external dose was determined for workers who had dosimetry measurements available. Smoking (ever/never used tobacco) and pay code (monthly/nonmonthly) were potential confounders considered in the analysis. The odds ratios for lung cancer mortality for seven cumulative internal dose groups did not demonstrate increasing risk with increasing dose. An odds ratio of 2.0 was estimated for those exposed to 25 rads or more, but the 95 percent confidence interval of -.20 to 20 exhibited great uncertainty in the estimate. The study also suggested workers hired at age 45 years or older showed an exposure effect.

D.8.8 Y-12 Worker-Specific Studies

D.8.8.1 *Y-12 Worker Cohort Study*

Polednak and Frome reported a study of 18,869 white male workers employed at Y-12 between 1943 and 1947 and followed through 1974. The cohort included workers exposed to internal (alpha) and external (beta) radiation through the inhalation of uranium dusts, electrical workers who performed maintenance in the exposure areas, and other workers who were not exposed. The study did not include personnel monitoring for exposures to uranium dust, but inferred monitoring results were matched with the work area and job. The SMR for lung cancer was elevated among workers employed for 1 year or more compared with workers employed less than 1 year and was more pronounced in workers hired at 45 years of age or older (SMR - 1.51; 95 percent CI 1.01-2.31). Among the workers employed after the age of 44, the SMR for lung cancer was greatest for electrical workers (SMR - 1.55, 7 observed), alpha chemistry workers (SMR - 3.02, 7 observed), and beta process workers (SMR - 1.51, 11 observed). SMRs were also elevated for mental psychoneurotic, personality disorders (SMR - 1.36, 36 observed), emphysema (SMR - 1.16, 100 observed), diseases of the bones and organs of movement (SMR - 1.22, 11 observed), and external causes of death (SMR - 1.09, 623 observed).

D.8.8.2 *Cancer Mortality Among Y-12 Rad Workers*

In 1988, a study was conducted of Y-12 white male workers employed for at least 30 days from 1947 to 1979 (Checkoway et al. 1988). The study included exposures to alpha and gamma radiation from insoluble uranium compounds. A statistically significant increase in deaths from lung cancer (SMR-1.36, 89 observed; 95 percent CI -1.09-1.67) was observed when compared with the U.S. lung cancer rates, but not when compared with Tennessee lung cancer rates (SMR-1.18, 95 percent CI - 0.95-1.45). Positive dose-response trends were seen for lung cancer mortality with respect to cumulative alpha and gamma radiation, with the most notable trend occurring for gamma radiation among workers who received greater than or equal to 5 rem of alpha radiation. When a 10-year latency assumption was applied, these trends diminished. The authors noted the observed dose-response trends, while based only on small numbers, point to a potential carcinogenic effect to the lung from relatively low-dose radiation. In addition, nonstatistically significant increases were observed for all cancers (SMR - 1.01, 196 observed), diseases of the blood-forming organs (SMR - 1.48, 3 observed), kidney cancer (SMR - 1.22, 6 observed), and other lymphatic cancers (SMR -1.86, 9 observed). Brain and central nervous system cancer mortality was also higher than expected, but without a dose-response trend.

D.8.8.3 *Cancer Mortality Among Minority Rad Workers*

Loomis and Wolf updated the Checkoway study to include the years through 1990 and to include African-American and white female workers and men of other races (Loomis and Wolf 1996). The exposures for the cohort included low dose, internal, alpha radiation and external, penetrating radiation plus beryllium, mercury, solvents, and other industrial compounds. The authors reported a low total mortality for all Y-12 workers and a total cancer mortality as expected. For the entire cohort, nonstatistically significant excesses were observed for pancreatic cancer (SMR - 1.36, 34 observed), skin cancer (SMR - 1.07, 11 observed), breast cancer (females only, SMR - 1.21, 11 observed), prostate cancer (SMR - 1.31, 36 observed), kidney cancer (SMR - 1.30, 16 observed), brain cancer (SMR -1.29, 20 observed), cancers of other lymphatic tissues (SMR - 1.32, 22 observed), and diseases of the blood-forming organs (SMR-1.23, 6 observed). The lung cancer mortality was statistically significant (SMR - 1.17, 202 observed; 95 percent CI 1.01-1.34), especially for white males (SMR - 1.20, 194 observed; 95 percent CI - 1.04-1.38). The lung cancer excess was greatest among those workers hired prior to 1954 (SMR - 1.27, 161 observed), with 5 to 20 years of employment and with 10 to 30. Another finding was evidence of excess breast cancer mortality among the 1,073 female workers (SMR 1.21; 95 percent CI - 0.60-2.17). The authors suggested more work needed to be done on lung cancer mortality due to radiation exposure and to the potential link between beryllium and lung cancer.

D.8.9 Health Effects of Mercury Exposure

A study of mortality patterns of all workers employed at least 5 months at Y-12 between January 1, 1953, and April 30, 1958 was published in 1984 (Cragle et al. 1984). Mercury was used during this timeframe to produce enriched lithium. The group was divided into mercury-exposed and nonmercury-exposed by results of urinalysis supplied by the site. Vital status follow-up was complete through the end of 1978 and SMRs were calculated. There were no differences in mortality patterns for the mercury-exposed, when compared to the nonmercury exposed. Excesses of lung cancer mortality were observed in both groups of workers and were not related to the mercury exposure (exposed SMR=1.34; 42 observed, 31.36 expected; nonexposed SMR=1.34, 71 observed, 52.9 expected). The authors stated that mortality is not the optimal end point to assess mercury-related health effects.

Another study of mercury workers (Albers et al. 1988) assessed neurological function and mercury exposure. The clinical study examined 502 Y-12 workers, 247 of whom worked in the mercury process 20 to 35 years prior to the examination. Several correlations between increasing mercury exposure and declining neurological function were discovered. An exposure assessment was determined for each mercury worker during the time of employment in the mercury process. Workers with at least one urinalysis equal to or greater than 0.6 mg/L of mercury showed decreased strength, coordination, and sensation along with increased tremor and prevalence of Babinski and snout reflexes when compared to the 255 non-exposed workers. Clinical polyneuropathy was associated with the level of the highest exposure but not with the duration of exposure.

D.8.10 Ongoing Studies of Y-12 Workers and the Community

DOE, along with U.S. Department of Health and Human Services, has published a *Draft Agenda for Public Health Activities for Fiscal Years 1999 and 2000 at U.S. Department of Energy Sites* (DOE 1999a). Included in this report are several ongoing occupational health studies dealing with Y-12.

Public Health Assessment. The ATSDR is involved in an ongoing study of the public health impact from releases of hazardous materials from ORR. This assessment will help identify and characterize both the current and past exposures of offsite populations to radiologic and chemical contaminants. Morbidity and mortality data to identify increased rates of health outcomes associated with these materials are also included in this study.

DOE Beryllium Worker Medical Surveillance Program. Y-12 beryllium workers are included in the DOE Beryllium Worker Medical Surveillance Program currently under way to detect and diagnose chronic beryllium disease. Information from this program is being used to evaluate worker protection and control measures, to monitor trends in chronic beryllium disease frequency, and to strengthen work planning to minimize worker exposures. A communication effort to educate workers about chronic beryllium disease is included.

DOE’s Former Worker Program. Under DOE’s Former Worker Program, Dr. Eula Bingham of the University of Cincinnati, in cooperation with the United Brotherhood of Carpenters Health and Safety Fund and several other groups, is directing the Former Construction Workers Project. Phase I of the project has identified approximately 800 former construction workers. Phase II will focus on medical screening of workers exposed to asbestos, beryllium, noise, silica, solvents, and heavy metals.

Mortality Among Female Nuclear Weapons Workers. NIOSH is sponsoring the State University of New York in a study of mortality among female nuclear weapons workers. This includes female workers from 12 DOE sites and will be the largest study of mortality among the 80,000 females employed by DOE. Risk estimates will be developed for exposure to ionizing radiation and chemical hazards.

Lung Cancer and Leukemia Case-Control Studies. NIOSH has two ongoing case-control studies combining multiple DOE sites, including Oak Ridge, to answer specific cancer questions. One study is attempting to define the relationship between lung cancer and external radiation exposure. The second study, the largest of its kind, is exploring the relationship between external radiation and leukemia risk among 250 workers with leukemia compared to similar workers without leukemia.

Chemical Laboratory Workers Mortality Study. NIOSH has an ongoing cohort mortality study assessing potential worker exposures to groups of chemicals and ionizing radiation and their relationship to mortality patterns. This is in response to other studies, outside DOE, indicating an increased risk of cancers among chemical laboratory workers.

D.9 FACILITY RADIOLOGICAL ACCIDENT SCENARIOS

This section presents the estimated consequences of accidents that could occur at Y-12 as required by the *National Environmental Policy Act* (NEPA). The scenarios described here define the bounding envelope of accidents—that is, any other reasonably foreseeable accident at Y-12 would be expected to have similar or smaller consequences. These accident analyses are conservative, with little or no credit taken for existing preventative and mitigating features in each building or operation analyzed or the safety procedures that are mandatory at Y-12.

This section describes how locations or operations were selected for analysis, the computer codes used to estimate consequences, the development of the scenarios and assumptions about source terms, the selection of computer modeling and a description of the results, and predicted health effects.

D.9.1 Approach to the Analysis of Potential Accidents

D.9.1.1 *Overview*

Accident scenarios have been developed to reflect the broad range of accidents that might occur at Y-12. The scenarios are specific to particular buildings and operations. The following terms are used to define the scenarios:

- A reasonably foreseeable accident could include an accident with "impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason" (40 CFR 1502.22). "Credible" means having reasonable grounds for believability, and the "rule of reason" means that the analysis is based on scientifically sound judgment.
- An accident is bounding if no reasonably foreseeable accident with greater consequences can be identified. A bounding envelope is a set of individual bounding accidents covering the range of probabilities and possible consequences.

A deterministic, nonprobabilistic approach was used to develop the accident scenarios, including those scenarios without a specific initiating cause. The wide range of postulated accidents characterizes the range of impacts associated with the operation of Y-12. The postulated accident scenario for radioactive material can be reasonably evaluated in terms of the effective dose equivalent, and from this, the bounding scenario can be determined.

D.9.1.2 *Selection of Buildings and Operations for Accident Scenarios*

Developing accident scenarios began with reviewing the all Y-12 facilities with emphasis on building hazard classification and radionuclide inventories (including type, quantity, and physical form) and storage and use conditions. First, administrative buildings without radioactive materials were excluded. Then, buildings ranked as low hazard and those without radioactive materials were eliminated from consideration. The potential offsite consequences of facilities screened out would be well bounded by Y-12's bounding accident scenarios.

The next step in the selection process was to identify the most current documentation describing/quantifying the hazards associated with each facility's operation. Current safety documentation, which is either classified or contains Unclassified Controlled Nuclear Information that is not releasable to the general public, was obtained for these facilities, and reviewed to determine a reasonable range of bounding accidents for Y-12. These documents included the following:

- Safety Analysis Report for the 9215 Complex, Y/MA-7886, Rev. 4, Effective 12/08/2005
- Safety Analysis Report for the 9204-2E Facility, Y/SAR-003, Rev. 4, Effective 12/01/2005
- Safety Analysis Report for the 9204-2 Facility, Y/SM-SAR-005, Rev. 4, Effective 12/20/2005
- Safety Analysis Report for the 9204-4 Facility, Y/SAR-004, Rev. 4, Effective 02/24/2005
- Safety Analysis Report for the Nuclear Material Safeguarded Shipping and Storage Facility, Y/SAR-10, Rev. 5, Effective 12/21/2005
- Preliminary Documented Safety Analysis for the Highly Enriched Uranium Materials Facility, Y/HEU-0091 Rev. 0, 08/17/04
- Basis for Interim Operation for the Enriched Uranium Operations Complex, Y/MA-7254, Rev. 18, Effective 09/23/2004
- Safety Analysis Report for 9212 Complex, Y/MA-7926, Rev. 1, 11/18/05 (Approved not yet effective)
- Safety Analysis Report for Building 9995, Y/ENG/SAR-79, Rev. 4, 05/20/2005, Effective 06/22/2005
- Safety Analysis Report for Building 9201-5/5E, Y/NA-1836, Rev. 3, 05/16/2005, Effective 06/30/2005
- Safety Analysis Report for Buildings 9201-5N/5W, Y/NA-1839, Rev. 3, 05/16/2005, Effective 06/30/2005

Section D.9.3 uses unclassified and publicly-releasable data derived from these safety documents to define the accident scenarios for each facility. Section D.9.4 presents the impacts from these accidents.

In developing the accident analyses for this SWEIS, malevolent acts (theft, sabotage, terrorism) were considered (see Appendix E, Section E.2.14). Although it is not possible to predict whether intentional attacks would occur at Y-12, or the nature of the types of attacks that might be made, NNSA has evaluated scenarios involving malevolent, terrorist, or intentionally destructive acts at Y-12 in an effort to assess potential vulnerabilities and identify improvements to security procedures and response measures in the aftermath of the attacks of September 11, 2001. Those evaluations are classified. Security at NNSA facilities is a critical priority for the NNSA, and NNSA continues to identify and implement measures designed to defend against and deter attacks at its facilities.

In this appendix, NNSA also considers the impacts of a non-malevolent, non-intentional aircraft crash into Y-12 facilities. [Note: this aircraft crash is separate from a malevolent, intentionally destructive act with an aircraft, which was considered in the deliberate scenarios discussed above]. This analysis considered the potential for aircraft crashes involving all types of aircraft, including general aviation, air carriers, air taxis, and military aircraft. Of these categories, the probability that an air carrier, air taxi, or military aircraft could crash into a Y-12 facility is so low (less than 1×10^{-7} chance of occurring annually) as to not be considered as a credible accident scenario. Therefore, aircraft crashes at Y-12 involving aircraft other than general aviation were not considered reasonably foreseeable. Therefore, the aircraft crash accident scenarios discussed in this appendix are for general aviation aircraft.

General aviation includes the subcategories of single-engine piston, multiengine aircraft, and helicopter aircraft. Helicopter velocities are generally lower than that of fixed-wing aircraft and single-engine aircraft engines are generally heavier than multiengine aircraft engines for equivalent performance. Therefore, the consequences of a large single-engine piston aircraft impacting facilities at the Y-12 site bound the reasonably foreseeable accidents into Y-12 facilities.

The frequency evaluation for an aircraft crash uses a formula which considers the following factors:

1. The number of operations (N)
2. The probability that the plane will crash (P)
3. Given a crash, the probability that it will occur in a 1-square-mile area where the facility is located (f)
4. The effective area of the facility (A)

Site-specific values for each of these factors were determined and used to derive the frequency values listed in Table D.9.3-1.

D.9.2 Consequence Analysis

Y-12 uses radioactive materials in a wide variety of operations including scientific research and development, machining and inspection, chemical processing, analytical chemistry metallurgy, weapon component processing, and as calibration and irradiation sources. Radioactive materials are collected as waste products in forms varying from contaminated materials and equipment to contaminated trash and liquids.

This section analyzes postulated accidents that could result in radioactive material releases. It describes how bounding scenarios were selected for analysis, discusses the computer code that was used in the analysis as well as assumptions about weather conditions and atmospheric dispersion, presents the bounding scenarios, and estimates the potential health effects.

D.9.2.1 *Atmospheric Dispersion Modeling*

Consequences of accidental radiological releases were determined using the MACCS2 computer code (Chanin and Young 1998). MACCS2 is a United States Department of Energy/Nuclear Regulatory Commission (DOE/NRC) sponsored computer code that has been widely used in support of probabilistic risk assessments for the nuclear power industry and in support of safety and NEPA documentation for facilities throughout the DOE complex.

The MACCS2 code uses three distinct modules for consequence calculations: The ATMOS module performs atmospheric transport calculations, including dispersion, deposition, and decay. The EARLY module performs exposure calculations corresponding to the period immediately following the release; this module also includes the capability to simulate evacuation from areas surrounding the release. The EARLY module exposure pathways include inhalation, cloudshine, and groundshine. The CHRONC module considers the time period following the early phase; i.e., after the plume has passed. CHRONC exposure pathways include groundshine, resuspension inhalation, and ingestion of contaminated food and water. Land use interdiction (e.g., decontamination) can be simulated in this module. Other supporting input files include a meteorological data file and a site data file containing distributions of the population and agriculture surrounding the release site.

Because of assumptions used in this SWEIS analysis, not all of the code's capabilities were used. It was conservatively assumed that no special actions would be taken to avoid or mitigate exposure to the general population following an accidental release of radionuclides. For example, there would be no evacuation or protection of the surrounding population nor would there be interdiction to prevent ingestion of food grown downwind of the release.

Ten radial rings and 16 uniform direction sectors were used to calculate the collective dose to the offsite population. The radial rings were every 1 mile to 5 miles, a ring at 10 miles, and every 10 miles, from 10 to 50 miles starting at the distribution center. Due to the small expanse of the Y-12 site, a single center of distribution, located at the Y-12 West meteorological tower was used to represent all releases. The location of the offsite MEI was assumed to be along the emergency response boundary (ERB) or, for elevated or buoyant releases, at the point of greatest offsite consequence. In practice, all elevated or buoyant release MEIs were in fact located at the ERB. Similarly, the noninvolved onsite worker location was taken as 100 meters from the release in any direction.

Population and individual doses were statistically sampled by assuming an equally likely accident start time during any hour of the year. All hours were sampled. The results from each of these samples were then sorted to obtain a distribution of results (radiation dose), from which the results were extracted and presented in this Y-12 SWEIS.

MEI and noninvolved worker doses were calculated using conservative assumptions, such as the wind blowing toward the MEI and locating the receptor along the plume centerline. The doses (50-year committed effective dose equivalent) were converted into LCFs using the factor of 6×10^{-4} LCFs per person-rem for both members of the public and workers (DOE 2002d); calculated LCFs were doubled for individual doses greater than 20 rem (NCRP 1993a). The MEI and non-involved worker are assumed to be exposed for the duration of the release; they or DOE would take protective or mitigative actions thereafter if required by the size of the release. Exposure to the general population continues after the release as a result of resuspension and inhalation, external exposure and ingestion of deposited radionuclides.

D.9.2.2 *Mitigation Measures*

Mitigations to exposure and therefore mitigations to dose that would affect the postulated results of the accident scenarios are discussed below. In general, no mitigation was assumed for emergency response in the consequence analysis.

Emergency Response and Protective Actions

Y-12 has detailed plans for responding to accidents of the type described here, and the response activities would be closely coordinated with those of local communities such as Alameda County. Y-12 personnel are trained and drilled in the protective actions to be taken if a release of radioactive or otherwise toxic material occurs. Refer to Appendix I for further details on Y-12 emergency planning and response information.

The underlying principle for the protective action guides (PAGs) is that under emergency conditions all reasonable measures should be taken to minimize the radiation exposure of the general public and emergency workers. In the absence of significant constraints, protective actions could be implemented when projected doses are lower than the ranges given in the PAGs. No credit was taken for emergency response and protective actions in the consequence analysis.

High Efficiency Particulate Air Filtration

In all areas where unconfined plutonium or other radioactive materials can be handled and can exist in a dispersible form, high-efficiency particulate air (HEPA) filters provide a final barrier against the inadvertent release of radioactive aerosols into the outside environment. However, these filters would not trap volatile fission products such as the noble gases and iodine; such gases would be released into the outside environment.

HEPA filter efficiencies are 99.99 percent or greater with the minimum efficiency of 99.97 percent for 0.3-micron particles, the size most easily passed by the filter. To maximize containment of particles and provide redundancy, two HEPA filters in series are used. These HEPA filters are protected by building design features against the consequences of an earthquake or fire. Credit was taken for filtration in the consequence analysis when ventilation and building containment were shown by analysis to survive during the accident.

D.9.3 Description of Accident Scenarios

From the safety documents obtained through the process described in Section D.9.1.2, the next step was to identify potential accident scenarios and source terms (release rates and frequencies) associated with those facilities. Table D.9.3–1 lists the results of this process, and contains the accident name, its frequency, and its source term. Tables D.9.3-2 and D.9.3-3 lists the source term released to the environment following a Uranium solution. Table D.9.3-4 lists the estimated direct radiation dose from an unshielded criticality accident.

Table D.9.3-1. Potential Facility Accident Scenarios.

Accident	Frequency	Source Term or Hazard	Notes/Assumptions
EU Metal Fabrication Complex			
Local fire	$10^{-2} – 10^{-4}$	N/A, No radiological consequences	
Uranium Metal Criticality	$10^{-2} – 10^{-4}$	See Table D.9.3-2 and Table D.9.3-4	$1.0×10^{18}$ fissions
Major fire	$10^{-4} – 10^{-6}$	EU = 17.9 kg (sum of metal and chips) DU = 452 kg (sum of metal and chips)	Release height = ground level Release duration = 1 hour
Aircraft Crash – Initiator for major fire	$1.5×10^{-5} – 2.2×10^{-5}$	See major fire	
Tanker Truck Accident – Initiator for major fire	$10^{-4} – 10^{-6}$	See major fire	
Earthquake	$10^{-2} – 10^{-4}$	Same as criticality	
High Winds	$10^{-2} – 10^{-4}$	Same as earthquake	
Rain/Snow	$10^{-2} – 10^{-4}$	Same as earthquake	
Assembly			
Uranium Metal Criticality	$10^{-2} – 10^{-4}$	See Table D.9.3-2 and Table D.9.3-4	$1.0×10^{18}$ fissions
Explosion	$10^{-4} – 10^{-6}$	2 kg EU (sum of metal and chips) 0.04 kg DU (sum of metal and chips)	Release height = 7.6 m Release duration =1 hour
Fire	$10^{-4} – 10^{-6}$	Same as explosion	Release height = 7.6 m Release duration = 2 hours
Earthquake	$10^{-2} – 10^{-4}$	Bounded by fire	
Wind	$10^{-1} – 10^{-2}$	None	
Flood	$10^{-2} – 10^{-4}$	None	
Aircraft crash	$\sim 2×10^{-5}$	Bounded by fire	
Manufacturing QE			
Uranium Metal Criticality	$10^{-2} – 10^{-4}$	See Table D.9.3-2 and Table D.9.3-4	$1.0×10^{18}$ fissions
Local fires	$10^{-2} – 10^{-4}$	No radiological releases	
Large Building Fire	$10^{-4} – 10^{-6}$	2.6 kg EU 54 kg DU 172 kg Th	Release height =<10 m Release duration = 1 hour
Aircraft Crash – Initiator for large building fire	$4.5×10^{-5} – 5.0×10^{-5}$	See large building fire	
Tanker Truck explosion – Initiator for large building fire	$10^{-4} – 10^{-6}$	See large building fire	
Earthquake	$10^{-2} – 10^{-4}$	Bounded by criticality	
Wind	$10^{-2} – 10^{-4}$	Bounded by criticality	
Rain/Snow	$10^{-2} – 10^{-4}$	Bounded by criticality	

Table D.9.3-1. Potential Facility Accident Scenarios (*continued*).

Accident	Frequency	Source Term or Hazard	Notes/Assumptions
EU Warehouse			
Uranium Metal Criticality	$10^{-2} – 10^{-4}$	See Table D.9.3-2 and Table D.9.3-4	$1.0×10^{18}$ fissions
Fire	$10^{-4} – 10^{-6}$	EU = 22.6 kg DU = 20.1 kg U-233 = 0.0066 kg Th = 0.13 kg (the above all represent the sum of metals, oxides, and combustibles) Pu = $1.0×10^{-6}$ kg Np-237 = $1.6×10^{-5}$ kg	Release height = 4 m Release duration = 1 hour
Aircraft crash – Initiator of fire	$1.2×10^{-5}$	Same as fire	
Earthquake-induced loss of confinement	$10^{-2} – 10^{-4}$	EU = 1.3 kg DU = 0.06 kg Th = 0.03 kg (the above all represent the sum of metals, oxides, and combustibles)	Release height = ground level Release duration = 15 min
Wind	$10^{-2} – 10^{-4}$	Bounded by criticality and fire	
Flood	$10^{-2} – 10^{-4}$	Bounded by criticality	
Lightning	$10^{-4} – 10^{-6}$	Bounded by fire	
Design-basis fires[1]	$10^{-2} – 10^{-4}$	EU = 2.58 kg DU = 0.55 kg	Release height = 11.3 m Release duration = 1 hour
HEUMF			
Uranium Metal Criticality	$10^{-2} – 10^{-4}$	See Table D.9.3-2 and Table D.9.3-4	$1.0×10^{18}$ fissions
Earthquake	$10^{-2} – 10^{-4}$	None	
Wind	$10^{-2} – 10^{-4}$	None	
Rain/Snow	$10^{-2} – 10^{-4}$	None	
Flood	$10^{-2} – 10^{-4}$	Bounded by criticality	
EU Operations			
Uranium Metal Criticality	$10^{-2} – 10^{-4}$	See Table D.9.3-2 and Table D.9.3-4	$1.0×10^{18}$ fissions
Uranium Solution Criticality	$10^{-2} – 10^{-4}$	See Table D.9.3-3 and Table D.9.3-4	$3.28×10^{18}$ fissions
Local fires	$10^{-2} – 10^{-4}$	8 kg EU (includes aqueous and organic solutions)	Release height = ground level Release duration = 15 min

[1] The source term for a design-basis fire at the HEUMF has been identified as the bounding (largest possible) source term, and reasonably bounds the source term that might result from any aircraft crash, whether malevolent or non-malevolent.

Table D.9.3-1. Potential Facility Accident Scenarios (*continued*).

Accident	Frequency	Source Term or Hazard	Notes/Assumptions
EU Operations (continued)			
Large fire	$10^{-4} – 10^{-6}$	14.8 kg EU (includes metals, oxides, and aqueous and organic solutions)	Release height = "roof level" Release duration = 1 hour
Explosions	$10^{-2} – 10^{-4}$	None – localized effects only	
Aircraft crash	$10^{-4} – 10^{-6}$	37.8 kg EU (includes metals, chips, oxides, and aqueous and organic solutions)	Release height = "roof level" Release duration = 15 min
Earthquake-induced fire	$10^{-2} – 10^{-4}$	Same as large fire	
Wind	$10^{-2} – 10^{-4}$	Bounded by earthquake	
Rain/Snow	$10^{-2} – 10^{-4}$	Bounded by earthquake	
Lightning	$10^{-2} – 10^{-4}$	Same as local fire	
Analytical Laboratory			
Uranium Metal Criticality	$10^{-2} – 10^{-4}$	See Table D.9.3-2 and Table D.9.3-4	$1.0×10^{18}$ fissions
Large fire	$10^{-2} – 10^{-4}$	0.06 kg EA (includes solutions, metals, oxides, etc.)	
Aircraft crash	$1.4×10^{-5}$	Same as large fire	
Machine Shop Special Materials			
Large fire	$10^{-4} – 10^{-6}$	96.6 kg DU (includes metals, fines, and oxides)	Release height = ground level Release duration = 1 hour
Inadvertent water leak into furnace	$10^{-2} – 10^{-4}$	32 kg DU	Release height = ground level Release duration = "short" (assume 15 min)
Machine Shop DU/Binary			
Large fire	$10^{-4} – 10^{-6}$	31.3 kg DU (includes bulk metal, chips, and fines)	Release height = "elevated" Release duration = 1 hour
Uranium Metal Criticality	$10^{-2} – 10^{-4}$	See Table D.9.3-2 and Table D.9.3-4	$1.0×10^{18}$ fissions
Earthquake	$10^{-2} – 10^{-4}$	Bounded by large fire	
High wind/tornado	$10^{-2} – 10^{-4}$	Bounded by large fire	
Rain/Snow	$10^{-2} – 10^{-4}$	Bounded by large fire	

Table D.9.3-2. Source Term (Ci) released to the environment following a Uranium Metal Criticality (1.0×10^{18} fissions).

Radionuclide	Half Life	Curies released
Kr-83m	1.8 hr	8.00E+00
Kr-85m	4.5 yr	7.50E+00
Kr-84	1.7 yr	8.00E-05
Kr-87	76.3 min	4.95E+01
Kr-88	2.8 hr	3.25E+01
Kr-89	3.2 min	2.10E+03
Xe-131m	11.9 day	4.10E-03
Xe-133m	2.0 day	9.00E-02
Xe-133	5.2 day	1.35E+00
Xe-135m	15.6 min	1.10E+02
Xe-135	9.1 hr	1.80E+01
Xe-137	3.8 min	2.45E+03
Xe-138	14.2 min	6.50E+02
I-131	8.1 day	4.35E-02
I-132	2.3 hr	5.50E+00
I-133	0.8 hr	8.00E-01
I-134	52.6 min	2.25E+01
I-135	6.6 hr	2.35E+00

Table D.9.3-3. Source Term (Ci) released to the environment following a Uranium Solution Criticality (3.28×10^{18} fissions).

Radionuclide	Half Life	Curies released
Kr-83m	1.8 hr	5.25E+01
Kr-85m	4.5 yr	4.92E+01
Kr-84	1.7 yr	5.25E-04
Kr-87	76.3 min	3.25E+02
Kr-88	2.8 hr	2.13E+02
Kr-89	3.2 min	1.38E+04
Xe-131m	11.9 day	2.69E-02
Xe-133m	2.0 day	5.90E-01
Xe-133	5.2 day	8.86E+00
Xe-135m	15.6 min	7.22E+02
Xe-135	9.1 hr	1.18E+02
Xe-137	3.8 min	1.61E+04
Xe-138	14.2 min	4.26E+03
I-131	8.1 day	7.13E-01
I-132	2.3 hr	9.02E+01
I-133	0.8 hr	1.31E+01
I-134	52.6 min	3.69E+02
I-135	6.6 hr	3.85E+01

Table D.9.3-4. Estimated Direct Radiation Dose from an Unshielded Criticality Accident.

Downwind Distance (m)	Direct Radiation Dose (rem)	
	Uranium metal criticality	Uranium solution criticality
100	5.7	18.6
200	0.88	2.9
300	0.25	0.81
350	0.14	0.47
400	0.088	0.29
450	0.056	0.18
500	0.036	0.12
550	0.024	0.079
600	0.016	0.053
650	0.011	0.036
700	0.0077	0.025
750	0.0054	0.018
800	0.0039	0.013
850	0.0028	0.0091
900	0.0020	0.0066
950	0.0015	0.0048
1000	0.0011	0.0036

D.9.4 Estimated Health Effects

Tables D.9.4-1 and D.9.4-2 show the frequencies and consequences of the postulated set of accidents for a noninvolved worker and the public (maximally exposed offsite individual and the general population living within 50 miles of Y-12).

Table D.9.4-1. Radiological Accident Frequency and Consequences: All Alternatives.

		Maximally Exposed Individual [a]		Offsite Population [b]		Noninvolved Worker [c]	
Accident	**Frequency (per year)**	**Dose (rem)**	**Latent Cancer Fatalities**	**Dose (Person-rem)**	**Latent Cancer Fatalities**	**Dose (rem)**	**Latent Cancer Fatalities**
Major fire	$10^{-4} – 10^{-6}$	0.59	0.00036	520	0.31	16.3	0.0098
Explosion	$10^{-4} – 10^{-6}$	0.058	0.000035	51.2	0.031	1.18	0.00071
Fire in UPF Warehouse	$10^{-4} – 10^{-6}$	0.69	0.00041	608	0.36	17.4	0.010
Design-basis fires for HEU Storage	$10^{-2} – 10^{-4}$	0.073	0.000044	66.1	0.04	1.08	0.00065
Aircraft crash	$10^{-4} – 10^{-6}$	0.3	0.0002	665	0.4	0.388	0.00023

Source: Tetra Tech 2008.
[a] At site boundary, approximately 1.3 miles from release.
[b] Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.
[c] At 1000 meters from release.

Table D.9.4-2. Annual Cancer Risks: All Alternatives.

Accident	Maximally Exposed Individual [a]	Offsite Population[b]	Noninvolved Worker [c]
Major fire	3.6×10^{-8}	3.1×10^{-5}	9.8×10^{-7}
Explosion	3.5×10^{-9}	3.1×10^{-6}	7.1×10^{-8}
Fire in UPF Warehouse	4.1×10^{-8}	3.6×10^{-5}	1.0×10^{-6}
Design-basis fires for HEU Storage	4.4×10^{-7}	4.0×10^{-4}	6.5×10^{-6}
Aircraft crash	2.0×10^{-8}	4.0×10^{-5}	2.3×10^{-8}

Source: Tetra Tech 2008.
[a] At site boundary, approximately 1.3 miles from release.
[b] Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.
[c] At 1000 meters from release.

The accident with the highest potential consequences to the offsite population (see Table 5.14.1-1) is the aircraft crash into the EU facilities. Approximately 0.4 LCFs in the offsite population could result from such an accident in the absence of mitigation. An offsite MEI would receive a maximum dose of 0.3 rem. Statistically, this MEI would have a $2x10^{-4}$ chance of developing a LCF, or about 1 in 5,000. This accident has a probability of occurring approximately once every 100,000 years. When probabilities are taken into account (see Table 5.14.1-2), the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be $4.4x10^{-7}$, or about 1 in 2 million. For the population, the LCF risk would be $4x10^{-4}$, or about 1 in 2,500.

D.9.5 Involved Worker Impacts

Workers in the facility where the accident occurs would be particularly vulnerable to the effects of the accident because of their location. For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. However, prediction of latent potential health effects becomes increasingly difficult to quantify for facility workers as the distance between the accident location and the worker decreases. This is because the individual worker exposure cannot be precisely defined with respect to the presence of shielding and other protective features. The worker also may be injured or killed by physical effects of the accident itself.

The facility ventilation system would control dispersal of the airborne radiological debris from the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological injury.

The bounding case radiological accident for involved workers is a uranium solution criticality in EU Building. Severe worker exposures could occur inside the facility as a result of a criticality, due primarily to the effects of prompt neutrons and gammas. A criticality would be detected by the criticality alarm system, and an evacuation alarm would be sounded. All personnel would immediately evacuate the building.

Personnel close to the criticality event (within the building) may incur prompt external exposures. Depending on distance and the amount of intervening shielding material, lethal doses composed of neutron and gamma radiation could be delivered. The dose due to prompt gamma and neutron radiation at a distance can be evaluated by the following formulas:

$$\text{Prompt gamma dose: } D_g = 2.1 \times 10^{-20}\, N\, d^{-2}\, \exp^{-3.4d}$$

$$\text{Prompt neutron dose: } D_n = 7.0 \times 10^{-20}\, N\, d^{-2}\, \exp^{-5.2d}$$

Where:

D_g = gamma dose (rem)

D_n = neutron dose (rem) (neutron quality factor = 20)

N = number of fissions

d = distance from source (km)

At a distance of 10 meters, the combined prompt gamma and neutron radiation dose to personnel from a criticality in a powder, solution, or slurry of uranium or plutonium (3.28×10^{18} fissions) would be 2,845 rem (Dg = 665 rem plus Dn = 2,180 rem), which is greater than the average lethal radiation dose to humans of approximately 450 rem. Thus, the potential for lethal exposure exists. On average, there could be two workers in a room who could be exposed to this radiation.

In EU Building, the laboratory interior concrete walls would provide substantial shielding, except through the doors. In the event of a criticality, this shielding and rapid evacuation from the laboratories would reduce doses to personnel not in the immediate vicinity of the criticality excursion.

Direct exposure to airborne fission products produced during the criticality event would contribute only a small fraction to the total dose to a worker. Because of ventilation system operation, other personnel inside the building would not likely incur radiation dose resulting from the inhalation of airborne radioactive materials or immersion in the plume. If the ventilation system were unavailable, this dose would be small in comparison to the direct dose received at the time of the burst. The worker immediately involved would act appropriately according to training and emergency procedures.

D.9.6 Secondary Impacts

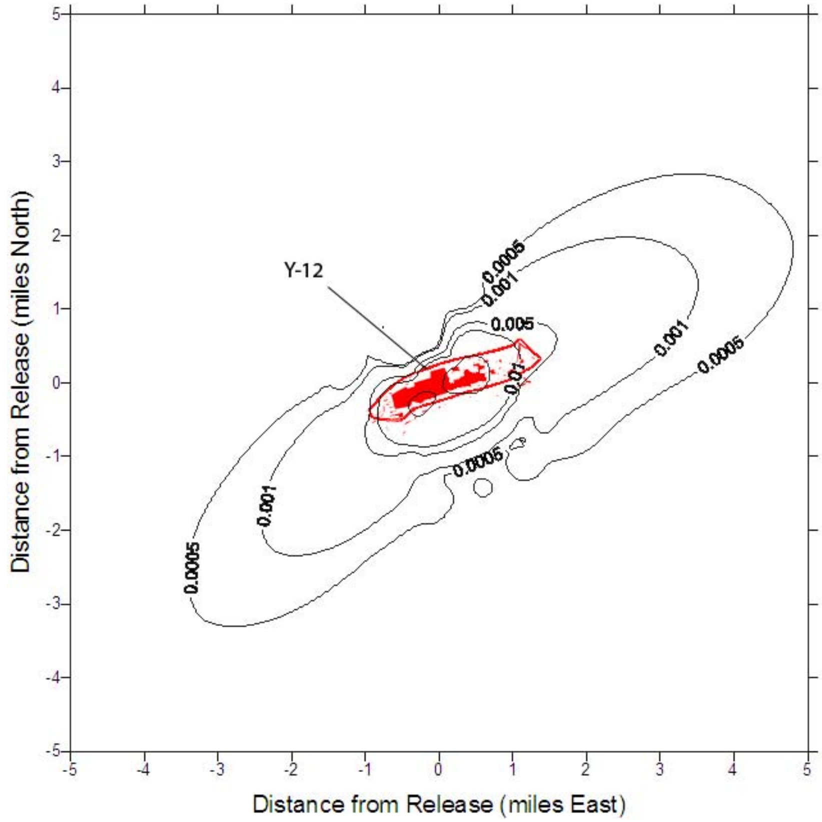
The main focus of the accident analysis has been to determine the impacts to public and worker health and safety. However, NNSA recognizes that accidents involving releases of radioactivity and chemical substances can also adversely affect the surrounding environment. For the purposes of this analysis, postulated impacts upon the environment from potential accident scenarios are referred to as "secondary impacts."

To determine the greatest impact that could occur to the environment from the postulated accidents considered in the appendix, each accident scenario was evaluated to determine potential secondary impacts. Since the main pathway for contamination from the accidents discussed above is via airborne released, NNSA expects only limited contamination of surface water or groundwater on or off site. Therefore, adverse impacts on water quality and aquatic biota from the postulation accident scenarios considered in this EIS would not be expected.

It is expected that contamination of the environment from most of the accidents postulated in this EIS would be limited to the immediate area surrounding the facility where the accident occurs. However, for some of the accident scenarios, contamination could extend off of the Y-12 site. For the accident with the largest offsite radiological consequences (aircraft crash into the EU Operations Complex), Figures D.9.6-1, D.9.6-2 and D.9.6-3 depict the dispersion plume from this accident and give an indication of the area of radiological contamination, both on and off of the Y-12 site. Figures D.9.6-1, D.9.6-2 and D.9.6-3 show mean deposition isopleths that would result if the maximum risk accident were to occur. The isopleths are presented for three scales: 0-5 miles, 0-10 miles, and 0-50 miles from the release. The depositions are compared with EPA soil Preliminary Remediation Goals (PRGs) for perspective. These PRGs are typically used as site screening tools to help determine whether CERCLA (i.e., Superfund) sites require soil remediation actions.

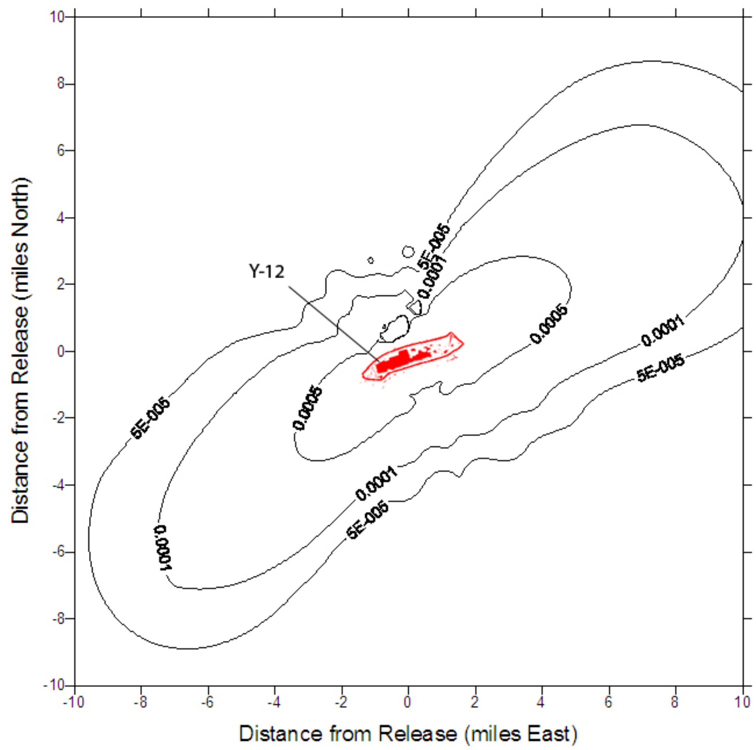
The soil screening level PRGs for each nuclide were combined into a single PRG for agricultural land usage (0.21 pCi per gram) and residential land usage (4.8 pCi per gram). These concentrations were converted to equivalent agriculture and residential deposition levels, 0.008 μCi per square meter and 0.18 μCi per square meter, respectively, assuming a typical soil density (1.5 grams per cubic centimeter) and mixing of deposited material in the upper inch of soil.

These screening levels are limited to the area close to the release, as seen in Figure D.9.6-1 (0-5 mile scale). The agriculture (ingestion of fruit and vegetables grown at this location) screening level is exceeded only within approximately one-third of a mile from the release. The residential (inhalation of suspended material, soil ingestion, external exposure) screening level is exceeded only within approximately 1.5 miles from the release.



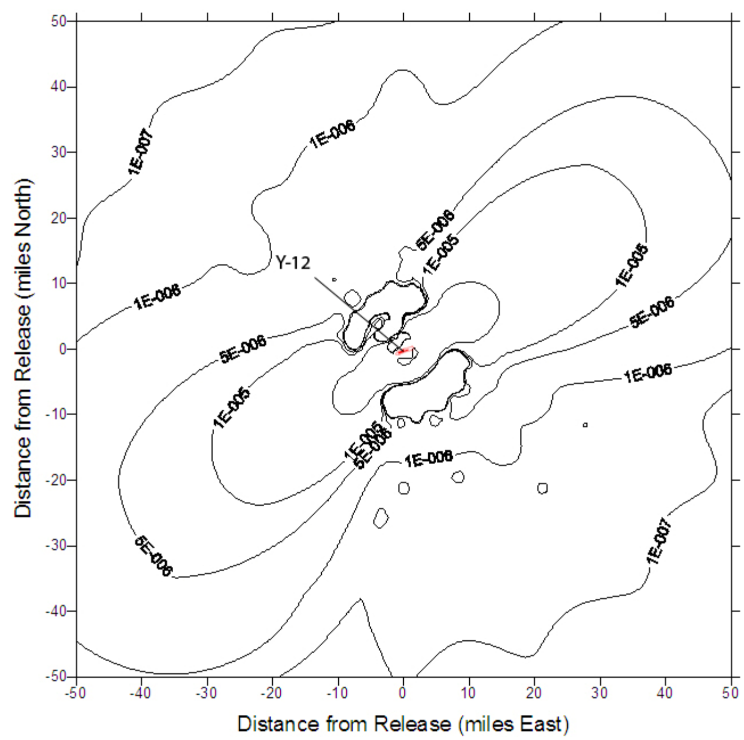
Note: units of measure for the isopleth lines are micro-curies/square meter.

Figure D.9.6-1. Dispersion Plume: 0 – 5 Mile Scale.



Note: units of measure for the isopleth lines are micro-curies/square meter.

Figure D.9.6-2. Dispersion Plume: 0 – 10 Mile Scale.



Note: units of measure for the isopleth lines are micro-curies/square meter.

Figure D.9.6-3. Dispersion Plume: 0 – 50 Mile Scale.

D.9.7 Chemical Accidents

Under all alternatives, Y-12 would store and use a variety of hazardous chemicals. The quantities of chemicals vary, ranging from small amounts in individual laboratories to bulk amounts in processes and specially designed storage areas. In addition, the effects of chemical exposure on personnel would depend upon its characteristics and could range from minor to fatal. Minor accidents within a laboratory room, such as a spill, could result in injury to workers in the immediate vicinity. A catastrophic accident such as a large uncontrolled fire, explosion, earthquake, or aircraft crash could have the potential for more serious impacts to workers and the public.

The adverse effects of exposure vary greatly among chemicals. They range from physical discomfort and skin irritation to respiratory tract tissue damage and, at the extreme, death. For this reason, allowable exposure levels differ from substance to substance. For this analysis, ERPG values are used to develop hazard indices for chemical exposures. Emergency Response Planning Guide (ERPG) definitions are provided below.

EPRG DEFINITIONS

ERPG-1 *is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.*

ERPG-2 *is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.*

ERPG-3 *is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.*

NNSA estimated the impacts of the potential release of the most hazardous chemicals used at Y-12. Potential chemical accidents were obtained from review of the Y-12 chemical accident scenarios reported in previous NEPA documents. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release were factors used to rank a chemical's hazard. Determination of a chemical's hazardous ranking takes into account quantities available for release, protective concentration limits (ERPG-2) and evaporation rate. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. The chemical analyzed for release was nitric acid.

Table D.9.7-1 show the impact of an accidental release of nitric acid as measured in terms of ERPG-2 protective concentration limits given in parts per million. The distance at which the limit is reached is also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite.

Both Gaussian Plume and ALOHA methodologies were used to evaluate the potential consequences associated with a release of each chemical in an accident situation. The impacts of a nitric acid release are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations.

Table D.9.7-1. Chemical Accident Frequency and Consequences: All Alternatives.

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) [a]	
Nitric acid	10,500	6	0.28	0.5	0.01	10^{-4}

Source: Tetra Tech 2008.

[a] Site boundary is at a distance of approximately 1.3 miles.

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APPENDIX E: IMPACT METHODOLOGY

APPENDIX E: IMPACT METHODOLOGY

This appendix briefly describes the methods used to assess the potential direct, indirect, and cumulative effects of the alternatives in the Y-12 Site-Wide Environmental Impact Statement (SWEIS). Included are impact assessment methods for land use, visual resources, site infrastructure, traffic and transportation, geology and soils, water resources, ecological resources, cultural resources, socioeconomics, environmental justice, human health and safety, waste management, and malevolent, terrorist, or intentional destructive acts.

E.1 IMPACT METHODOLOGY

The following paragraphs are brief descriptions of the impact assessment approaches used in the Y-12 SWEIS for the Y-12 National Security Complex (Y-12), for addressing potential impacts of Y-12 operations under the No Action Alternative, Uranium Processing Facility (UPF) Alternative, Upgrade in-Place Alternative, Capability-sized UPF Alternative, and No Net Production/ Capability-sized UPF Alternative. Methodologies used for each resource area are discussed below to identify and, if possible, measure potential impacts.

E.2.1 Land Resources

To estimate possible impacts of the alternatives, the land resources analysis relied on information for current and planned land use on Y-12. A comparative methodology was used to determine land use impacts from the project alternatives in terms of function and acreage. Acreage disturbed were assessed for each project alternative. Facility operations and particularly any facility construction activities were examined and compared to existing land use conditions. Impacts, if any, were identified as they relate to changes in land use classifications as well as conflicting uses.

E.2.2 Visual Resources

The visual resources analysis looked at the impacts of the alternatives on the visual quality at Y-12 and the area surrounding Y-12. The analysis of visual impacts included a qualitative examination of potential changes to the viewsheds and viewpoints. Construction of new facilities, modification of existing facilities, and demolition of existing facilities associated with each alternative were examined, and any resulting changes were analyzed for potential impact to the existing visual environment. Analysis focused on site development or modification activities that would alter the visibility of Y-12 structures, obscure views of the surrounding landscape, or conflict with visual resources in the surrounding area.

E.2.3 Site Infrastructure

Incremental changes to utilities and energy use at Y-12 were assessed by comparing the support requirements of the alternatives to current site utility demands. The assessment focuses on the basic resource requirements of electrical power, fuel requirements, and water usage. These three resource requirements were judged to be the most effective measures of potential infrastructure impacts resulting from implementation of any of the alternatives.

E.2.4 Traffic and Transportation

National Nuclear Security Administration (NNSA) selected traffic congestion and collective radiation dose and latent cancer fatalities (LCFs) to the general population as analytical endpoints for the transportation analysis. Traffic congestion was determined by qualitatively comparing current traffic levels with projected employment changes for the various alternatives. Radiological doses from transport of radioactive materials and wastes were calculated by computer modeling. The radiological transportation analysis methodology is summarized below.

All transportation of radioactive materials was assumed to take place by truck. Y-12 identified origin-destination pairs for each shipment campaign. NNSA then used the Transportation Routing Analysis Geographic Information System (TRAGIS) computer code to determine the most suitable routing. TRAGIS was constrained to only provide routes consistent with the U.S. Department of Transportation’s highway route-controlled quantity regulations. Besides identifying the route, TRAGIS provided useful inputs to the remainder of the modeling such as miles per population density category and population within 800 meters of the route for each state and population density category.

NNSA then used the U.S. Department of Energy (DOE) code, RADTRAN 4, to calculate incident-free radiological impacts (normal transport without any accident releasing radioactive materials) to a member of the public. RADTRAN 4 is a routinely used DOE computer model for calculating radiological exposures related to transportation issues. Members of the public are those residing within 800 meters of the route, those sharing the route in other vehicles, and those near the shipment at rest stops. Besides route length and demographics, the radiation dose 1 meter from the truck was the most important parameter. NNSA used a dose rate of 1 millirem per hour for shipments of special nuclear material and low-level waste (LLW) and 4 millirem per hour for transuranic (TRU) waste. RADTRAN 4 was used to calculate the collective dose for each type of material shipped between the various origin-destination pairs. The results were then multiplied by the numbers of shipments for each campaign.

For accidents, NNSA used RADTRAN 4 to calculate the collective dose should an accident occur. NNSA conservatively selected the highest consequence accident in the most populated area to report. Collective doses from incident-free and accident analyses were multiplied by the conversion factor for converting collective dose to numbers of LCFs. This factor is 6×10^{-4} LCFs per person-rem (DOE 2002a).

E.2.5 Geology and Soils

The geology and soils analysis looked at the effects of the construction and operation of facilities and of activities described for the alternatives. The analyses evaluated the amount of disturbance that might affect the geology and/or soils of areas at Y-12. Impacts could include erosion and effects to potential geologic economic resources, such as mineral and construction material resources and fossil locations. Impacts to soils were quantified as the amount of area disturbed by construction activities. The seismicity of the region was evaluated to provide perspective on the probability and severity of future earthquakes in the area. This information was used to provide input to the evaluation of accidents due to natural phenomena.

E.2.6 Air Quality and Noise

E.2.6.1 *Nonradiological Air Quality*

The primary activities that emit air pollutants, associated with current and continued laboratory operations, include fuel combustion, vehicular activity particularly with employees commuting to and from the site, and construction and maintenance activities. Air pollutant emission rates and potential impacts of these activities were assessed using standard methods endorsed by the U.S. Environmental Protection Agency (EPA) and local air pollution control agencies. As available, site-specific parameters developed by local air quality regulatory agencies were incorporated and conservative assumptions were used so as not to underestimate the potential impact.

Total emissions from project operations were compared to significance and conformity levels using the EPA-approved ISC3 model (EPA 1995b, DOE 2001a). Greenhouse gas emissions were also considered by assessing the amounts of carbon dioxide that would be emitted by each alternative. In addition to operational emissions, construction activities were considered, by comparing the emissions to past construction projects of similar magnitude. Experience has shown that there are a number of feasible control measures that can be reasonably implemented to significantly reduce particulate matter emissions from construction. The approach to analyses of construction impacts relative to significance levels is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions.

E.2.6.2 *Radiological Air Quality*

Routine radiological emissions from Y-12 facility operations were evaluated on the basis of dose to the site-wide maximally exposed individual (MEI) and collective dose to the general population within 50 miles of the site (population dose). The MEI evaluation was compared to the National Emissions Standards for Hazardous Air Pollutants (NESHAP) (40 CFR Part 61). NESHAP limits the radiation dose that a member of the public may receive from radiological material released to the atmosphere from normal operations to 10 millirems per year. Although there is no standard that governs population dose, it is compared with the population dose received from naturally occurring radiation.

The baseline year for radiological emissions was taken as 2004. The changes due to new facilities, upgraded facilities, or changes in releases on MEI dose and location was calculated using the EPA-approved *Clean Air Assessment Package* (CAP 88-PC 2000) *Version 3* computer model. CAP88-PC, used also in the NESHAP annual report, conservatively calculates radiological impacts extending up to 50 miles. Doses from both internal (e.g., inhalation, ingestion of foodstuffs) and external exposure (e.g., standing on ground contaminated with radioactive material) were considered. Spatial population distributions at each site were based on 2000 census data, which represents the best available data. Agricultural data used were for the State of Tennessee, as contained in the CAP88-PC database. It was assumed that the entire source of ingested vegetables and meat is grown within the affected area. No milk production was found in the area; all milk was assumed imported from outside the area.

The MEI is a hypothetical member of the public assumed to be located outdoors in a public area where the radiation dose from a particular source is highest. This individual is assumed to be exposed to the entire plume in an unshielded condition. The impacts on the MEI are therefore greater than the impacts that any member of the public can be expected to receive. The site-wide MEI is located where the composite dose from all site sources is greatest.

E.2.6.3 *Noise*

Various activities at Y-12 result in noise that may be heard in surrounding offsite locations. To understand the potential impact of planned or proposed activities, noise levels attributed to activities such as construction, demolition, and operating equipment were characterized in terms of decibel level and described in relation to comparative noise levels of activities commonly encountered in community settings and land use compatibility guidelines. For non-continuous sources, such as construction, demolition, and the unique impulse noise associated with explosives firings, activity levels were provided to give a sense of the amount of time that intermittent sources would be operated and contribute to ambient noise levels. Source location is also discussed where proximity to community receptors would result in a higher likelihood that a source would be heard in offsite areas.

E.2.7 Water

E.2.7.1 *Surface Water*

The affected environment discussion includes a description of local surface water resources at Y-12, flow characteristics and relationships, and existing water quality. Data used for impact assessments included rates of water consumption and wastewater discharge. The existing water supply was evaluated to determine if sufficient quantities were available to support an increased demand by comparing projected increases with the capacity of the supplier.

The water quality of potentially affected receiving waters was determined by reviewing current monitoring data for contaminants of concern. Monitoring reports for discharges permitted under the National Pollutant Discharge Elimination System (NPDES) were examined for compliance with permit limits and requirements. The assessment of water quality impacts from wastewater (sanitary and process) and stormwater runoff addressed potential impacts to the receiving waters' average flow during construction and operation. Suitable mitigation measures for potential impacts such as stream channel erosion, sedimentation, and stream bank flooding were identified. Floodplains were identified to determine whether any of the proposed facilities would be located within the 100-year and 500-year floodplains.

E.2.7.2 *Groundwater*

Groundwater resources were analyzed for effects on aquifers, groundwater use and storage, and groundwater quality within the regions. Groundwater resources were defined as the aquifers underlying the site and their extensions downgradient, including discharge points. The affected environment discussion included a description of the local hydrogeology, occurrence, flow, and quality. Groundwater usage was described and projections of future usage were made based on changing patterns of usage and anticipated growth patterns.

Available data on existing groundwater quality were compared to Federal and state groundwater quality standards, effluent limitations, and safe drinking water standards. Additionally, Federal and state permitting requirements for groundwater withdrawal and discharge were identified. Impacts of groundwater withdrawals on existing contaminant plumes due to construction and facility operations were assessed to determine the potential for changes in their rates of migration and the effects of any changes in the plumes on groundwater users. Impacts were assessed by evaluating local hydrogeology, groundwater quality, and groundwater availability.

E.2.8 Ecological Resources

A qualitative analysis addresses the impacts of the activities under each alternative to biological resources. The methodology focused on those biological resources with the potential to be appreciably affected, and for which analyses assessing alternative impacts were possible. Biological resources include vegetation, wildlife, protected and sensitive species, and wetlands that are present or use the Y-12 and contiguous areas. The potential sources of impacts from normal operations and security measures to biological resources that were considered include noise, outdoor tests, erosion, construction, demolition, and prescribed burns.

The biological data from earlier projects, wetlands surveys, and plant and animal inventories of portions of the Y-12 were reviewed to identify the locations of plant and animal species and wetlands. Lists of sensitive species potentially present on the Y-12 and areas designated as critical habitat were obtained from the U.S. Fish and Wildlife Service (USFWS). A similar request was made to the Tennessee Department of Wildlife.

Activities and potential releases identified under the alternatives were reviewed for their potential to affect plants, animals, and the sensitive species under Federal and state laws and regulations. Potential beneficial and negative impacts to plants and animals were evaluated for gain, loss, disturbance, or displacement. Impacts to wetlands were evaluated to determine if their areal extent would change. Monitoring data on sensitive plants and animals were reviewed for impact to these resources.

E.2.9 Cultural Resources

Section 106 of the *National Historic Preservation Act* (NHPA) and its implementing regulations (36 *Code of Federal Regulations* [CFR] Part 800) state that an undertaking has an effect on a historic property when that undertaking may alter those characteristics of the property that qualify it for inclusion in the National Register of Historic Places (NRHP). An undertaking is considered to have an adverse effect on a historic property when it diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

Adverse effects include, but are not limited to:

- Physical destruction, damage, or alteration of all or part of the property;

- Isolation of the property or alteration of the character of the property's setting when that character contributes to the property's qualifications for the NRHP;
- Introduction of visual, audible, or atmospheric elements that are out of character with the property, or changes that alter its setting;
- Neglect of a property resulting in its deterioration or destruction;
- Transfer, lease, or sale of a property, without adequate provision to protect the property's historic integrity.

The analysis addressed potential impacts or effects to NRHP-eligible resources located within the boundaries of Y-12. Activities under the alternatives were reviewed to identify those that would cause ground disturbance, introduce visual or audible changes, or make changes to existing buildings and structures. The proposed activities were then analyzed to determine if they would cause adverse effects to NRHP-eligible resources.

The *Sitewide Programmatic Agreement Among the Department of Energy Oak Ridge Operations Office,* the *National Nuclear Security Administration, the Tennessee State Historic Preservation Office,* and the *Advisory Council on Historic Preservation Concerning the Management of Historical and Cultural Properties at the Y-12 Complex* provides implementing procedures to ensure the protection of the remaining 77 historic properties and structures at the Y-12 Complex. The Programmatic Agreement is a guideline for NNSA to comply with Section 106 for all present and future actions. In addition, the *National Historical Preservation Act* Historic Preservation Plan (Y/TS 2003) provides an effective approach to preserving the historically significant features of Y-12's historic buildings and structures. Both the plan and the Programmatic Agreement were reviewed by NNSA, DOE Oak Ridge Office (ORO), the Tennessee State Historic Preservation Officer (SHPO), and the advisory council in August 2003 and were approved in November 2003 (DOE 2004e). Provisions of the Programmatic Agreement would serve as components of mitigation measures.

E.2.10 Socioeconomics

The socioeconomic analysis measured the incremental effects from changes in employment and income associated with the alternatives at Y-12, as well as their overall effect on the region of influence (ROI). The ROI, as described in Chapter 4 of this Y-12 SWEIS, is a four-county area surrounding Y-12 where more than 90 percent of Y-12 employees and their families live, spend their wages and salaries, and use their benefits.

Spending by Y-12 directly affects the ROI in terms of dollars of expenditures gained or lost for individuals and businesses, dollars of income gained or lost to households, and the number of jobs created or lost. Changes in employment at Y-12 directly affect the overall economic and social activities of the communities and people living in the ROI. These changes directly affect the amount of income received by individuals and businesses. Businesses and households in the ROI re-spend Y-12 money, which creates indirect socioeconomic effects from Y-12 operations. Every subsequent re-spending of money by businesses and households in the ROI is another tier of indirect and induced socioeconomic effects originating from Y-12 operations.

The analysis compared the magnitude of Y-12 employment changes to the future employment, population, and housing levels. Determination of impacts was based on the percentage of these future levels that are attributable to Y-12's influence. For construction activities, the analysis focuses on the peak year of construction, as this year would have the greatest impact.

Estimates of the geographic distribution of residences of potential new hires associated with the alternatives were based on the existing distribution of the workforce residences. This demographic pattern could change over the project period due to various economic and quality of life factors, as employees balance factors such as housing costs, commute times, and quality of schools. For purposes of this analysis, no change in the distribution was assumed. The community services analysis measured effects on local government support services: fire protection and emergency services, police protection and security services, and school services. The analysis evaluated the burden placed on each of these support services by changes in Y-12 demands under the various alternatives. For insignificant changes, no detailed analyses were required.

E.2.11 Environmental Justice

The potential for disproportionately high and adverse human health or environmental impacts from the alternatives on minority and low-income populations was examined in accordance with Executive Order (EO) 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629). Both the *Environmental Justice Guidance Under the National Environmental Policy Act* (CEQ 1997) and the *Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses* (EPA 1998) provide guidance for identifying minority and low-income populations and determining whether the human health and environmental effects on these populations are disproportionately high and adverse.

Demographic information from the U.S. Census Bureau was used to identify minority and low-income populations in the ROI. Information on locations and numbers of minority and low-income populations was obtained from the 2000 U.S. Census. Census data is reported on the level of census tracts.

Arc View Geographic Information Systems (GIS) layers were produced by identifying polygons from the 2000 census data which met the following criteria:

- Any block group with a minority population greater than 50 percent
- Had a median household income in 1999 less than 65 percent of the statewide median household
- Had an English proficiency of less than or equal to 75 percent
- Any block group with a foreign-born value of 25 percent or more

Areas meeting these criteria that fell within a 50-mile radius of Y-12 were identified as low-income or minority populations.

E.2.12 Human Health and Safety

Y-12 operations that could potentially impact human health and safety include radiological and nonradiological exposures and occupational injuries, illnesses, and fatalities resulting from normal, accident-free operations on site facilities. Impacts are given in LCFs, emergency response planning guideline (ERPG) values, injury and illness recordable cases, and lost/restricted workday cases. The following paragraphs discuss how each of these human health and safety issues is estimated. Impacts are estimated for involved workers, noninvolved workers, and the public.

E.2.12.1 *Nonradiological Health Impacts*

Occupational Safety. Occupational injuries and illnesses are those incidents that result during the performance of an individual's work assignment. Occupational injury, illness, and fatality estimates were evaluated using site-specific occupational incidence rates. Occupational injury, illness, and fatality categories used in this analysis were in accordance with Occupational Safety and Health Administration (OSHA) definitions.

Hazardous Air Pollutants. Health risks from hazardous chemical releases during normal operation will be assessed by evaluating facility chemical source term inventories and engineered facility safety features used to mitigate personnel exposures during normal (accident-free) operations. If required, site boundary concentrations, derived through modeling (i.e., ISCST or equivalent) will be used to develop hazard quotients for noncancer risks for comparison to reference concentration values, such as the EPA Integrated Risk Information System.

E.2.12.2 *Radiological Health Impacts*

Radiological health impacts from normal operations were evaluated in terms of the probability of a premature fatality. Such impacts were quantified by noting the probability that a given radiation exposure would result in an LCF to an individual. When evaluated over a population, the individual probabilities can be generalized to make a statement as to how many people (but not which people) in the population would be affected.

The DOE recommends a risk estimator of 6×10^{-4} excess (above those naturally occurring) fatal cancers per person-rem of dose in order to assess health effects to the public and to workers (DOE 2002a). Worker health effects from occupational exposure to radiation are projected based on recent experience with continuing operations and projections of specific additional operation impacts on involved workers. Radiological health impacts to the general population were calculated from radiation exposure to the site-wide MEI and the population as a whole. A similar calculation was performed for the noninvolved worker population dose. These doses were converted to health impacts using the dose to risk estimators. The air transport pathway currently results in almost all of the doses to the public from Y-12, either directly or through deposition and subsequent inhalation and ingestion.

The methodology for the accident analysis is presented in Appendix D.

E.2.13 Waste Management

The waste management analysis examines potential impacts associated with waste generation activities at Y-12, including LLW, mixed low-level waste (MLLW), hazardous waste, *Resource Conservation and Recovery Act* (RCRA) construction waste, decontamination and decommissioning (D&D) waste, municipal solid waste, and process (including domestic) wastewater. The ongoing waste management practices relating to generating, handling, treating, permits modifications, and storing wastes are described. The analysis also presents a summary of the regulatory framework as it applies to waste management and a summary of current and projected waste generation activities. Selected facilities or activities that generate waste were evaluated for changes in the existing or No Action Alternative quantity of waste generated as a result of the alternatives. Y-12 treatment and storage facilities were evaluated for any impacts on their capabilities to manage wastes before transportation to offsite disposal. The analysis of potential impacts considered physical safety, regulatory requirements, and security measures associated with storage capacity, personnel safety, and treatment capacity.

For each alternative, the waste projected represents the maximum possible waste generation level, and thus the bounding level of operation. This applies to all waste types including LLW, MLLW, and hazardous waste and all material types including radioactive, explosive, and chemical.

E.2.14 Malevolent, Terrorist, or Intentional Destructive Acts

Analyses of the potential impacts of terrorist attacks are in a classified appendix to this SWEIS. The impacts of some terrorist attacks would be similar to the accident impacts described earlier in this section, while others would have more severe impacts. This section describes the methodology NNSA uses to assess the vulnerability of its sites to terrorist attacks and then designs its systems to prevent and deter those threats.

E.2.14.1 *Assessment of Vulnerability to Terrorist Threats*

In accordance with DOE Order 470.3A, Design Basis Threat Policy, and DOE Order 470.4, Safeguards and Security Program, NNSA conducts vulnerability assessments and risk analyses of its facilities and sites to determine the physical protection elements, technologies, and administrative controls NNSA should use to protect its assets, its workers, and the public. DOE Order 470.4 establishes the roles and responsibilities for the conduct of DOE's Safeguards and Security Program. DOE Order 470.3A establishes requirements designed to prevent unauthorized access, theft, diversion, or sabotage of nuclear weapons, components, and special nuclear material controlled by NNSA.

Among other things, DOE Order 470.3A: 1) Specifies those national security assets that require protection; 2) Outlines threat considerations for safeguards and security programs to provide a basis for planning, designing, and constructing new facilities; and 3) Requires the development of credible scenarios of threats that are used to design and test safeguards and security systems.

NNSA must also protect against espionage, sabotage, and theft of materials, classified matter, and critical technologies.

NNSA's safeguards and security programs and systems employ state-of-the-art technologies to:

- Deny adversaries access to nuclear weapons, nuclear test devices, and completed nuclear assemblies;
- Deny adversaries the opportunity to steal special nuclear materials (SNM), sabotage weapons or facilities, or produce an unauthorized nuclear yield (criticality) of SNM;
- Protect the public and employees from harm resulting from an adversary's use of radiological, chemical, or biological materials; and
- Protect classified information, classified matter, and designated critical facilities or activities from sabotage, espionage, and theft.

NNSA's vulnerability assessments employ a rigorous methodology based on guidance from the DOE Vulnerability Assessment Process Guide (September 2004), and the Vulnerability Assessment Certification course. Typically, a vulnerability assessment involves analyses by subject matter experts to determine the effectiveness of a safeguard and security system used to protect against an adversary with certain capabilities. Vulnerability assessments generally include the following activities:

Characterizing the threat. Threat characterization provides a detailed description of a physical threat by a malevolent adversary to a site's physical protection systems. Usually the description includes information about the types of potential adversaries, their motivations, objectives, actions, capabilities, and site-specific tactical considerations. Much of the information required to develop a threat characterization is described in DOE Order 470.3A and the Adversary Capabilities List. The Department also issues site-specific guidance, to assist in this process.

Determining the target. Target determination involves identifying, describing, and prioritizing potential targets among NNSA's security interests. Results of target determinations are used to help characterize potential threats and objectives, as well as, protective force and neutralization requirements.

Defining the scope. The scope of a vulnerability assessment is determined by subject matter experts and depends on the site vulnerabilities. In addition to defining the threat and possible terrorist objectives, the scope establishes the key assumptions and interpretations that will guide the analyses, as well as the objectives, methods, and format for documenting the results of the vulnerability assessment.

Characterizing the facility or site. This activity requires defining and documenting every aspect of the facility or site to be assessed, particularly existing security programs (personnel security, information security, physical security, material control and accountability, etc.), to assist in identifying strengths and weaknesses. Results are used as inputs to the pathway analyses, which DOE uses to develop representative scenarios for evaluating the security system. Facility and site characterization modeling tools include Analytical System and Software for Evaluating Safeguards and Security (ASSESS), Adversary Time-Line Analysis System (ATLAS), VISA, tabletop analysis, and others.

Characterizing the protective force. To assess a facility or site's vulnerability, analysts must accurately characterize protective force's capabilities against a defined threat and objective, particularly its ability to detect, assess, interrupt, and neutralize an adversary. Specific data used for this activity include special nuclear materials categorization; configuration, flow, and movement of special nuclear materials within or from a facility or site; defined threats; detection and assessment times; and adversary delay and task time. The protective force's equipment, weapons, size, and posts also are considered in the characterization. The characterization information is validated and verified via observation, alarm response assessments, performance tests, force-on-force exercises, joint conflict and tactical simulation (JCATS), and tabletop analyses. The JCATS software tool is used for training, analysis, planning, and mission rehearsal, as well as characterization of the protective force. It employs detailed graphics and models of buildings, natural terrain features, and roads to simulate realistic operations in urban and rural environments.

Analyzing adversary pathways. This activity identifies and analyzes adversary pathways based on the results of threat, target, facility, and protective force characterization, as well as ancillary analyses such as explosives analysis. ASSESS and ATLAS are two primary tools that are used in this analysis. Analysts also conduct insider analysis as part of this activity.

Developing credible scenarios. Credible scenarios are developed for use in performance testing and to determine the effectiveness of the security system in place against a potential adversary's objectives. As part of this activity, data from the adversary pathways analyses are used to identify applicable threats, threat strategies, and objectives, and combined with protective force strategies and capabilities to develop scenarios that include specific adversary resources, capabilities, and projected task times to successfully achieve their objectives. Specialists also work with the vulnerability assessment team to develop realistic scenarios that provide a structured and informal analysis of the strengths and weaknesses of potential adversaries.

Determining the probability of neutralization. The probability of neutralization is the probability that a protective force can prevent an adversary from achieving its objectives. The probability is derived from more than one source, one of which must be based on Joint Tactical Simulation, JCATS analysis, or force-on-force exercises.

Determining system effectiveness. System effectiveness is determined by applying an equation that reflects the capabilities of a multi-layered protection system. Analysis data derived from the various vulnerability assessment activities are used to calculate this equation, which reflects the security system's effectiveness against each of the scenarios developed for the vulnerability assessment. If system effectiveness is unacceptable for a scenario, the root cause of the weakness must be analyzed and security upgrades must be identified. The scenarios are reanalyzed with the upgrades, and effective upgrades are documented in the vulnerability analysis report.

Implementation. The culmination of the vulnerability assessment is development of a report documenting the analyses and results and a plan for implementing any necessary changes to security systems. NNSA verifies the results of the vulnerability assessment report and the conclusions of the implementation plan. NNSA also oversees the implementation of security system upgrades.

E.2.14.2 *Terrorist Impacts Analysis*

Substantive details of the credible scenarios for terrorist attacks NNSA's countermeasures, and potential impacts of attacks are not released to the public because disclosure of this information could be exploited by terrorists and assist them in the planning of attacks. Depending on the intentionally destructive acts, impacts may be similar to or would exceed those of bounding accidents analyzed elsewhere in this SWEIS. A separate classified appendix to this SWEIS evaluates the impacts of an adversary achieving its objectives in one or more of the credible scenarios.

The classified appendix evaluates the potential impacts of the successful execution of credible scenarios for Y-12 and calculates consequences to a noninvolved worker, maximally exposed individual, and population in terms of direct effects, radiation dose, and LCFs. Risks are not calculated because the probability that an adversary could successfully execute the attack in a scenario cannot be quantified. The MACCS2 and RISKIND computer codes are used along with other manual methods to calculate human health effects of each credible scenario. The same site-specific meteorology and population distribution that is used in the accident analyses in this SWEIS are used in analyses of the impacts of an adversary achieving its objectives in the credible attack scenario.

E.2.14.3 *Mitigation of Impacts from Potential Terrorist Attacks*

The DOE strategy for the mitigation of environmental impacts resulting from a terrorist attack has three distinct components: 1) Prevent and deter terrorists form executing successful attacks; 2) Plan and provide timely and adequate response to emergency situations; and 3) Progressive recovery through long-term response in the form of monitoring, remediation, and support for affected communities and their environment.

E.2.14.4 *Actions to Prevent or Reduce the Probability of Successful Attacks*

NNSA employs a well-established system of engineered and administrative controls to prevent or reduce the probability of occurrence of extreme events and to limit their potential impacts on the environment. This system has evolved over time and will continue to evolve as new security requirements are identified, as new become available, and as new engineering standards or best practices are developed. The directing requirements and the framework for implementing this system of controls are embodied in the Code of Federal Regulations and in DOE Orders. These are imposed as contractual requirements for DOE management and operating (M&O) contractors. The NNSA system of safety requirements and quality assurance guidelines and controls covers all aspects of key nuclear and non-nuclear facilities including design requirements, construction practices, start-up and operational readiness reviews, and routine operations and maintenance. The contractor and federal staff at these facilities are evaluated for trustworthiness and reliability.

E.2.14.5 *Plan for and Respond to Emergency Situations*

While NNSA has comprehensive security measures to prevent terrorist attacks, it is also necessary to have the capability for timely and adequate response to emergency situations. Therefore, in addition to the systems of workplace hazard controls and safeguards and security measures, the NNSA emergency management system imposes additional protections over operations involving dispersible hazardous materials in quantities that could harm people outside the immediate workplace. NNSA's comprehensive all-hazards approach to emergency management is established in DOE Order 151.1C, Comprehensive Emergency Management System. This Order provides a general structure and framework for responding to any emergency at an NNSA facility or for an NNSA activity and specific requirements to address protection of workers, the public, and the environment from the release of hazardous materials.

NNSA's comprehensive emergency management system is based on a three-tiered structure consisting of facility, site, or activity management; the Cognizant Field Element; and Headquarters, with each tier having specific roles and responsibilities during an emergency. Each organizational tier provides management, direction, and support of emergency response activities. Management personnel of a facility, site, or activity manage the tactical response to the emergency by directing the mitigative actions necessary to resolve the problem, protect the workforce, the public, and the environment; and return the facility, site, or activity to a safe condition. The Cognizant Field Element oversees the facility/site response and provides local assistance, guidance, and operational direction to the facility/site management. The Cognizant Field Element also coordinates the tactical response to the event with tribal, state, and local governments. NNSA Headquarters provides strategic direction to the response, provides assistance and guidance to the Cognizant Field Element, and evaluates the broad impacts of the emergency on the NNSA complex. Headquarters also coordinates with other Federal agencies on a national level, provides information to representatives of the executive and legislative branches of the Federal government, and responds to inquiries from the national media.

Each NNSA facility, site, or activity is required by DOE Order 151.1C to have an Operational Emergency Base Program, which provides the framework for responding to serious events or conditions that involve the health and safety of the workforce and the public, the environment, and safeguards and security. The objective of the Operational Emergency Base Program is to achieve an effective integration of emergency planning and preparedness requirements into an emergency management program that provides capabilities for all emergency responses through communication, coordination, and an efficient and effective use of resources, that is commensurate with the hazards present at that facility, site, or activity.

DOE Order 151.C requires that a Hazards Survey be prepared, maintained, and used for emergency planning purposes. The Order requires that emergency management efforts begin with the identification and qualitative assessment of the facility- or site-specific hazards and the associated emergency conditions that may require response, and that the scope and extent of emergency planning and preparedness reflect these facility-specific hazards. Hazards Surveys are used to:

- identify the generic emergency conditions that apply to each facility;
- qualitatively describe the potential health, safety, or environmental impacts of the applicable emergencies;
- identify the applicable planning and preparedness requirements; and
- indicate the need for further evaluation of hazardous materials in an Emergency Planning Hazards Assessment (EPHA).

Some facilities have been analyzed as stand-alone facilities; however, several structures or component units with common or related purposes have been combined into a facility- or complex-wide hazards survey. Each facility- or complex-specific hazards survey clearly identifies the facility and describes the facility's mission, operations, and physical characteristics.

Using the knowledge and insights gained through the Hazards Survey and EPHA processes, the emergency management organization at each NNSA site or facility develops detailed plans and procedures and trains the staff to carry out response actions to reduce the severity of hazardous material release events and to minimize health impacts.

The Response Activities of the Emergency Management Program that would come into play should an operational emergency occur would include many of the following elements, depending on the specific circumstances:

Emergency Response Organization (ERO). The ERO is structured to enable it to assume overall responsibility for initial and ongoing site actions associated with the emergency response and mitigation. The ERO establishes effective control at the event/incident scene and integrates local agencies and organizations providing onsite response services.

Offsite response interfaces. DOE Order 151.1C requires coordination with tribal, state, and local agencies and organizations responsible for offsite emergency response. Interrelationships and interfaces for fire, hazardous materials expert, medical, and law enforcement and mutual assistance and support are pre-arranged and documented in various formal plans, agreements, and memoranda of understanding.

Emergency facilities and equipment. The EPHA is used to assist in determining the types and amounts of personal protective equipment, radiation monitoring, communications, and other equipment and supplies required to be maintained and operable for immediate use in responding to an operational emergency. Facilities established for either dedicated permanent use or on an ad hoc basis depending on the specific type and location of the operational emergency can include Emergency Operations Centers (EOCs), Command Centers, and Joint Information Centers. Departmental assets that may be required in the event of an operational emergency involving nuclear weapons, weapons components, or the dispersal of special nuclear materials include the Accident Response Group, Nuclear Emergency Search Team, Federal Radiological Monitoring and Assessment Center, Aerial Measuring System, Atmospheric Advisory Capability, Radiological Emergency Assistance Center/Training Site, and the Radiological Assistance Program.

Emergency categorization and classification. DOE Order 151.1C and the associated Emergency Management Guide (DOE G 151.1-1A) require a DOE site or facility to declare an operational emergency when unplanned or abnormal events or conditions require time-urgent response from outside the immediate affected site, facility, or area of the incident. Events or conditions meeting the criteria for categorization as operational emergencies are those events or conditions that have the potential to cause: serious health or safety impacts to workers or the public; serious detrimental effects on the environment; direct harm to people or the environment as a result of degradation of security or safeguards conditions; direct harm to people or the environment as a result of a major degradation of safety systems, protocols, or practices involving hazardous biological agents or toxins; or loss of control over hazardous materials (for example, toxic chemicals or radioactive materials). NNSA sites or facilities are also required to classify an operational emergency that involves the loss of control over hazardous materials resulting in an actual or potential airborne release to the environment (outside a structure or enclosure on an NNSA facility or site) as either an Alert, Site Area Emergency, or General Emergency, in order of increasing severity.

Notifications and communications. The accurate, timely, and useful exchange of information during an emergency response is a key factor in understanding the scope of an emergency and providing proper response to limit its impacts. Emergency reporting includes initial notifications to onsite personnel, emergency response personnel, and offsite authorities including applicable NNSA elements; other Federal Agencies; and local, state, and tribal government organizations, and follow-on emergency status updates.

Consequent assessment. Consequence assessment includes all processes utilized to perform data collection and analysis necessary to support critical initial assessments and the continuing processes of refining the assessments as more information and additional resources become available. These can involve monitoring for specific indicators or field measurements and the integration of monitoring data with calculations and modeling capabilities. Consequence assessment is integrated with both event classification and protective action decision making and can include coordination with offsite entities including federal, state, local, and tribal organizations.

Protective actions and re-entry. Protective actions can be implemented either individually or in combination to reduce exposure of the workforce and the public to special nuclear materials or other hazardous materials. These can include:

- Controlling, monitoring, and maintaining records of personnel exposure to radiological and nonradiological hazardous materials;
- Sheltering or evaluation;
- Turning off heating, ventilation, and air conditioning systems during sheltering;
- Controlling access to contaminated areas and decontaminating personnel or equipment exiting the area;
- Controlling foodstuffs and water, or changing livestock and agricultural practices; and
- Developing and deploying for use in protective action decision making prepared Protective Action Guides and ERPG using DOE-approved guidance applicable to the actual or potential release of hazardous materials.

Planning and executing re-entry activities must include establishing adequate measures for the protection of response personnel from unnecessary exposure to hazardous materials or conditions either known or suspected to exist at the site of the accident or incident.

Emergency medical support. Emergency medical support includes providing various levels of treatment to those who may become injured or contaminated and arranging with offsite medical facilities to transport, accept, and treat contaminated, injured personnel. DOE Order 440.1A establishes requirements for facility and site medical programs required to meet the provisions of 10 CFR 851.210, *Occupational Medicine*, and addresses the medical organization, facilities and equipment, communications planning, and preparedness activities considered necessary for providing the medical treatment and access to medical services for mass casualty situations and medical response to an operational emergency involving contamination.

Emergency public information. The Emergency Public Information program plays a critical role in establishing and maintaining coordination with tribal, state, and local governments and the public. The program is expected to provide timely, candid, and accurate information to the workforce, the news media, and the public during an operational emergency. Providing accurate and factual health and safety information and security information helps to avoid and discourage speculation. The elements of an effective program can be pre-established by developing appropriate broadcast and print media interfaces, establishing a system for assembling and releasing emergency information that may include set-up of a Joint Information Center with representatives of offsite organizations, and conducting various drills and exercises that include exercising various Emergency Public Information program systems to educate the press and the public.

Termination and recovery. An operational emergency is terminated only after a predetermined set of criteria is met and in many scenarios, termination must be coordinated with various offsite agencies. The various pathways and timelines for recovery and resumption of normal operations must be developed to ensure the health and safety of the work force and the public. Actions may include the creation of a recovery organization to manage the conduct of recovery operations and to maintain communication and coordination with local, state, and tribal organizations, and other federal agencies providing support at the site. Specific recovery procedures may include dissemination of information to federal, state, tribal, and local organizations regarding the emergency and conditions required for the relaxation of public protection measures; planning and conducting decontamination actions; development and compliance with reporting requirements; and the creation of processes and procedures to guide the resumption of normal operations. Recovery also specifically includes the evaluation of the accident or incident and the response to identify lessons learned and develop potential means to mitigate the effects of future operational emergencies.

E.2.14.6 *Progressive Recovery Through Long Term Response*

The recovery phase of an operational emergency in which radioactive materials are dispersed over a wide area could require years to complete and might require an extended response by NNSA. The specific requirements for an extended response would be dictated by the circumstances. Requirements may include a continuing coordination with local authorities and various government agencies to continue protective actions and controls; long-term monitoring of the affected environment, population, or both for effects attributable to the operational emergency; providing medical support for affected individuals; maintaining public information and various technical and other response interfaces; and performing periodic reassessments and evaluations of progress in the recovery and return to more normal conditions.

APPENDIX F: NEPA DISCLOSURE STATEMENT FOR PREPARATION OF THE *SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT FOR THE Y-12 NATIONAL SECURITY COMPLEX*

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NEPA DISCLOSURE STATEMENT FOR PREPARATION OF THE *SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT FOR THE Y-12 NATIONAL SECURITY COMPLEX*

CEQ Regulations at 40 CFR 1506.5(c), which have been adopted by the DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981 guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 8026-18038 at Question 17a and b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)." 46 FR 18026-18038 at 18031.

In accordance with these requirements, the offeror and any proposed subcontractors hereby certify as follows: (check either (a) or (b) to assure consideration of your proposal).

(a) __X__ Offeror and any proposed subcontractor have no financial or other interest in the outcome of the project.

(b) _____ Offeror and any proposed subcontractor have the following financial or other interest in the outcome of the project and hereby agree to divest themselves of such interest prior to award of this contract.

<u>Financial or Other Interests</u>

1.

2.

3.

Certified by

____
Signature

Mark E. Smith, Vice President
Printed Name and Title

Tetra Tech, Inc.
Company

June 22, 2006
Date