DOE/EA-1593

Final Environmental Assessment for the Y-12 Steam Plant Life Extension Project - Steam Plant Replacement Subproject

U.S. Department of Energy
National Nuclear Security Administration

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LIST OF ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing materials
AHP	Analytical Hierarchy Process
ALARA	As Low As Reasonably Achievable
AQRs	Air Quality Regions
BEA	Bureau of Economic Analysis
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practices
CDL VII	Construction Demolition Landfill VII
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFR	Code of Federal Regulation
CY	calendar year
DOE	U.S. Department of Energy
DNL	Day-Night Average Sound Level
DSWM	Division of Solid Waste Management
EA	environmental assessment
EDE	effective dose equivalent
EFPC	East Fork Poplar Creek
EM	Environmental Management
EMWMF	Environmental Management Waste Management Facility
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
FD	Forced Draft
FFA	Federal Facilities Agreement
FFCA	Federal Facility Compliance Agreement
FFC Act	*Federal Facility Compliance Act*
FY	fiscal year
HEPA	High Efficiency Particulate Air
ICRP	International Commission on Radiological Protection
ID	Induced Draft

ILFV	Industrial Landfill V
IR	Infrastructure Reduction
LDRs	Land Disposal Restrictions
LLW	low level waste
LLRW	low-level radioactive waste
LOS	level-of-service
MEI	maximally exposed individual
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NEPA	*National Environmental Policy Act*
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	*National Historic Preservation Act*
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
ORR	Oak Ridge Reservation
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit
R&D	Research and Development
RCRA	Resource Conservation and Recovery Act
ROI	Region of Influence
SE	System Engineering
SPCC	Spill Prevention Control and Countermeasure
SPLE	Steam Plant Life Extension
SWEIS	Site-Wide Environmental Impact Statement
SWPP	Stormwater Pollution Prevention Plan
SWMU	Solid Waste Management Unit
SR	state route
T&E	threatened and endangered
TCPs	traditional cultural properties
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
TSCA	Toxic Substances Control Act

TVA	Tennessee Valley Authority
UEFPC	Upper East Fork Poplar Creek
USCB	U.S. Census Bureau
USFWS	U.S. Fish and Wildlife Service
VRM	Visual Resource Management
WETF	West End Treatment Facility
Y-12 Complex	Y-12 National Security Complex
Y-12 SWEIS	Y-12 Site Wide Environmental Impact Statement

CHEMICALS AND UNITS OF MEASURE

µg/m3	microgram per cubic meter
°C	degree Celsius
cfs	cubic feet per second
cm	centimeter
CO	carbon monoxide
dB	decibel
dB(A)	decibel A weighted
DCE	1,1-dichloroethane
ft	feet
°F	degree Fahrenheit
ha	hectares
HF	hydrogen fluoride
hr	hours
in	inches
km	kilometer
m^3/s	cubic meters per second
m	meter
mi	mile
MGD	million gallons per day
MGY	million gallons per year
MLD	million liters per day
MLY	million liters per year
mph	miles per hour
mrem	millirem
NO2	nitrogen dioxide
NOx	oxides of nitrogen
O^3	ozone
Pb	lead
PCBs	polychlorinated biphenyls
PCE	tetrachloroethylene
pCi	picocurie
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 microns

PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 microns
ppb	parts per billion
ppm	parts per million
psig	pounds per square inch gauge
SO^2	sulfur dioxide
SO_x	sulfur oxides
Tc	Technetium
TCE	trichloroethylene
VOCs	volatile organic compounds
yd^3	cubic yard
yr	year

CHEMICALS AND UNITS OF MEASURE

µg/m3	microgram per cubic meter
°C	degree Celsius
cfs	cubic feet per second
cm	centimeter
CO	carbon monoxide
dB	decibel
dB(A)	decibel A weighted
DCE	1,1-dichloroethane
ft	feet
°F	degree Fahrenheit
ha	hectares
HF	hydrogen fluoride
hr	hours
in	inches
km	kilometer
m^3/s	cubic meters per second
m	meter
mi	mile
MGD	million gallons per day
MGY	million gallons per year
MLD	million liters per day
MLY	million liters per year
mph	miles per hour
mrem	millirem
NO2	nitrogen dioxide
NOx	oxides of nitrogen
O^3	ozone
Pb	lead
PCBs	polychlorinated biphenyls
PCE	tetrachloroethylene
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VOCs	volatile organic compounds
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yr	year

METRIC PREFIXES

Prefix	Symbol	Multiplication Factor		
exa-	E	1 000 000 000 000 000 000	=	10^{18}
peta-	P	1 000 000 000 000 000	=	10^{15}
tera-	T	1 000 000 000 000	=	10^{12}
giga-	G	1 000 000 000	=	10^{9}
mega-	M	1 000 000	=	10^{6}
kilo-	k	1 000	=	10^{3}
hecto-	h	100	=	10^{2}
deka-	da	10	=	10^{1}
deci-	d	0.1	=	10^{-1}
centi-	c	0.01	=	10^{-2}
milli-	m	0.001	=	10^{-3}
micro-	µ	0.000 001	=	10^{-6}
nano-	n	0.000 000 001	=	10^{-9}
pico-	p	0.000 000 000 001	=	10^{-12}
femto-	f	0.000 000 000 000 001	=	10^{-15}
atto-	a	0.000 000 000 000 000 001	=	10^{-18}

1.0 INTRODUCTION

The National Nuclear Security Administration (NNSA) Y-12 Site Office proposes to replace the existing coal fired boiler steam plant at the Y-12 National Security Complex (Y-12 Complex) with a new centralized steam plant using natural gas fired, packaged boiler systems as part of the Steam Plant Life Extension (SPLE) Project - Steam Plant Replacement (SPR) Subproject. The NNSA is preparing this environmental assessment (EA) as part of the decision-making process to assess potential environmental impacts of the project in accordance with the *National Environmental Policy Act* (NEPA) of 1969 and the U.S. Department of Energy (DOE) NEPA Implementing Procedures (10 Code of Federal Regulations [CFR] Part 1021).

1.1 Purpose and Need for Action

Purpose of the Action. The purpose of the proposed action is to ensure a long term source of steam production at the Y-12 Complex. NNSA proposes to utilize skid mounted gas fired boilers as an alternative to extending the life of the existing Y-12 Steam Plant. This action would require a new building, several package boilers, water treatment units, and a minimum of two fuel oil storage tanks. The skid mounted package boiler concept would be a long term solution, scalable to the Y-12 Complex existing and future energy requirements.

Need for the Action. The existing Y-12 Steam Plant has been operating continuously since its construction in 1954. A service life extension upgrade completed in the mid-1980s was projected to extend the life of three of the four boilers (boilers 1, 2, and 4) and supporting auxiliaries to approximately 2010. Boiler 3 was not upgraded, and the existing Y-12 Steam Plant has undergone no significant modifications or upgrades since the previous life extension program. For the Y-12 Complex to continue to meet its mission, the existing steam-generating capability must be replaced or restored to a condition that will provide a reliable, cost-effective source of steam to the Y-12 Complex.

The purpose of the SPLE Project – SPR Subproject 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. Selection of the long-term source for steam production at the Y-12 Complex is necessary in order to continue reliable operations and directly support the recommendation of the December 2001 Nuclear Posture Review to revitalize the defense infrastructure, increase

confidence in the deployed forces, eliminate unneeded weapons, and mitigate the risks of technological surprise. The SPLE Project – SPR Subproject directly contributes to the DOE Strategic Plan's Defense Strategic Goal: To protect our national security by applying advanced science and nuclear technology to the Nation's defense. It also supports achievement of DOE General Goal 1 of Nuclear Weapons Stewardship: Ensure 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. The SPLE Project – SPR Subproject will directly contribute to the safety and reliability of one of the nation's most sensitive nuclear weapons sites.

Reliable and cost-effective steam generation is vital to the operation of the Y-12 Complex. It is the primary source of building heat for personal 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 the wet chemistry operations of Enriched Uranium Operations. The existing Y-12 Steam Plant also provides steam condensate and treated water as feed water for the demineralized water plant.

1.2 Background

The existing Y-12 Steam Plant has been operating continuously since its construction in 1954. Service life extension upgrades were completed in the mid-1980s to extend the life of three of the four boilers and supporting auxiliaries to approximately 2010. In its current condition, the plant is approaching the end of its useful life. An inspection in fiscal year (FY) 2003 found boiler 4 to be in good condition. Boilers 1 and 2 have a history similar to that of boiler 4 and are judged to be in reasonable condition. Boiler 3 was permanently retired on June 12, 2006, and will not be restarted. Some components of the auxiliary equipment including the coal-handling system, feedwater system, forced-draft system, induced-draft system, ash-handling systems, and the plant control and electrical systems are in various states of deterioration and are deemed to be unreliable, technologically obsolete, and inefficient. Spare parts for many systems are not readily available.

The existing Y-12 Steam Plant consists of four Wickes boilers, each rated at a maximum steam output of 250,000 pounds/hour at 235 pounds per square inch gauge (psig). Pulverized coal,

natural gas, or a combination of these two fuels may be fired simultaneously in each boiler. Each boiler is equipped with a reverse air baghouse. Flue gas is exhausted from each boiler through a dedicated baghouse by an induced draft fan that discharges the flue gas to a stack. There are two stacks; one serves Boilers 1 and 2, and the other stack services Boilers 3 and 4.

Steam is distributed at 235 psig to the numerous demand points through the main headers. Steam condensate amounting to approximately 25 percent (in the summer) and 35 percent (in the winter) of the plant boiler feedwater is returned for reuse through a condensate return piping network. Most of the heating steam condensate return is used to supply the plant's demineralized water system located in Building 9404-18.

Boiler feedwater consists of treated water from the Oak Ridge Water Treatment Facility and condensate return from the steam distribution system. The water is processed through chemical softeners, degassifiers, deaerators, and other chemicals that are added as required to maintain proper pH and water chemistry.

Waste streams from the water softener beds regeneration, feedwater heat exchangers, and the steam plant's floor drains are pumped to the north partitioned section of the coal yard run off holding basin, which has a 124,000 gallon capacity. Waste streams from the boiler blowdown and ash hoppers are pumped into the concrete channel that surrounds the coal pile. The waste streams in this channel flow into the south section of the 373,000-gallon capacity holding basin. Waste water collected in the partitioned basin along with stormwater runoff from the coal pile is pumped to the Steam Plant Wastewater Treatment Facility for treatment. Existing Y-12 Steam Plant operating procedures require the treatment of the liquid waste at the Steam Plant Wastewater Treatment Facility to satisfy the City of Oak Ridge Industrial and Commercial User Waste Water Discharge Permit, 1-91, for direct discharge to the Y-12 Complex's sanitary sewer system.

1.3 Scope of EA Analysis

This EA conforms to the requirement of the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508) implementing the NEPA and DOE Implementing Procedures (10 CFR 1021).

This EA is tiered from the Final Site-Wide Environmental Impact Statement (SWEIS) for the Y-12 National Security Complex (Y-12 SWEIS), DOE/EIS-0309. The No Action Alternative of the Y-12 SWEIS includes the continued implementation of planned modernization actions announced in the 2002 Record of Decision (ROD) as modified by subsequent actions, as well as new actions subsequent to the 2002 ROD that have undergone separate NEPA review. 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. The environmental conditions described in the Y-12 SWEIS reflect the baseline operational impacts of these missions for the foreseeable future. The Y-12 SWEIS also discusses operational impacts under the No Action Alternative, Proposed Action Alternative, and the Reduced Operations Alternative.

1.4 Public Involvement

No public meetings have been conducted for this EA. However, NNSA will provide the public an opportunity to review and comment on the EA, prior to the issuance of the Final EA. However, NNSA provided the public a public notice announcing the availability of the Draft EA, the length of the comment period, and where copies of the draft could be obtained was placed in local newspapers.

2.0 DESCRIPTION OF ALTERNATIVES

An alternative study using the System Engineering (SE) approach was performed to identify the best alternative(s) for replacing and/or restoring the steam production capability at the Y-12 Complex (DOE 2004a). The alternative study first identified a problem statement, "provide steam to meet Y-12 demands through the year 2030." The study then established requirements that must be met by every viable alternative. These requirements include:

1. The peak steam flow rate shall meet Y-12 Complex requirements.
2. Steam supply must be continuous and uninterruptible including during the transition period (i.e., between the current state and any alternative selected).
3. Environmental regulations and national codes and standards compliance must be ensured.

The following goals were then identified:

1. Maximize reliability, availability, and maintainability of steam supply.
2. Maximize security of steam-generating facility and required energy sources.
3. Minimize impact on health and safety of workers and the public.
4. Maximize compliance with laws, regulations, DOE Orders, etc.
5. Minimize time of implementation.
6. Maximize reduction of deferred maintenance backlog/plant footprint.
7. Maximize ability to respond to reduced demand (i.e., modernization evolution and mission changes).
8. Maximize ability to respond to changes in imposed requirements.
9. Minimize lowest net present value.
10. Minimize unit steam cost to end user.
11. Minimize near-term appropriations for capital projects (2005-2010).
12. Maximize conformity with available funding and associated profiles.
13. Optimize load profile.
14. Minimize steam supply infrastructure.

Goals are different from the requirements in that they are desirable, but not mandatory. In some cases, the goals listed above represent capabilities or attributes that exceed the minimum requirements.

In addition, the alternative study also considered the following assumptions in the selection of the alternatives:

- The information used in the study is based on the FY2007 version of the *Ten-Year Comprehensive Site Plan* and on a Draft Modernization Plan.
- The use of the year 2035 is based on a 25-year life for a new facility coming on-line in 2010.
- Any life extension of the existing Y-12 Steam Plant should have a useful life only through the year 2025, after which a new steam supply will have to be provided.
- The available NNSA funding for the project will not exceed $50 million, based on the Integrated Construction Project Plan.

Alternatives that can potentially perform the function and meet the requirements were identified. The SE approach was used in the evaluation of alternatives; and the alternatives were ranked using the Analytical Hierarchy Process (AHP) method. The AHP method was used to determine the relative importance, or weight for the following five criteria: (1) maximize reliability, availability, and maintainability of steam supply; (2) minimize time of implementation; (3) maximize lowest net present value; (4) maximize reduction of deferred maintenance backlog/ plant footprint; (5) minimize unit steam cost to end user.

Ten viable alternatives were initially identified by NNSA. After each alternative was evaluated using the five criteria listed above, three alternatives were rated to be the most viable. The top three alternatives identified by NNSA:

- Life Extension (Alternative 2 – Life Extension of Existing Steam Plant)
- Three Small Plants
- New Gas Fired Plant

Alternative 1 (discussed below) is a variation of Three Small Plants and the New Gas Fired Plant Alternatives.

2.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Under the Proposed Action, the boiler house for the packaged boiler system technologies that use natural gas as the primary fuel source and oil as the secondary source would be constructed on the site that is currently occupied by office buildings (Figure 2.1-1). These buildings are slated for demolition and removal in FY 2007. The Infrastructure Reduction (IR) program will remove the existing structures to grade (which will be financed by the SPLE Project – SPR Subproject); however, IR demolition does not include concrete slab-on-grade or foundations for each building. Soil characterization sampling has been completed and results provided in the BWXT Y-12 Complex report, *Steam Package Plant and Oil Tank Farm Report on Site Characteristics and Sample Locations* (RP-PJ-940107-A002).

The packaged boiler system would include four 80,000 pound/hour water tube packaged boilers with low NOx burners, a flue gas recirculation system, forced draft fans, economizers, stacks, and local controls for natural gas primary fuel and No. 2 fuel oil as a secondary fuel source. The storage site for fuel would be located at the vacant area east of the proposed location for the boiler house (Figure 2.1-1) and the oil would consist of 200,000 gallon diked maximum storage (no less than two 100,000 gallon steel above ground storage tanks).

Water-Tube Packaged Boiler

This packaged boiler alternative would allow for a 40 year steam plant operational life and would accommodate modernization, changes in the production activities, and infrastructure reduction activities that are part of the modernization vision in the *Y-12 National Security Complex Strategic Plan* and the *Ten Year Comprehensive Site Plan for the Y-12 National Security Complex*.

The use of the secondary oil fuel would allow for continuous steam production during curtailment periods of natural gas and other upset conditions when steam demand exceeds the

available production capacity using the primary, natural gas, fuel source. Economizers and heat exchangers would be incorporated to maximize boiler efficiency and extend equipment process life. The new package boilers will be designed with a heat input capacity less than 100 million Btu/hr. The packaged boiler system would include sufficient capacity and redundant equipment and components to ensure reliability. The packaged boiler system would tie into existing potable water, electrical, natural gas, steam distribution systems and other utilities. Figure 2.1-2 displays the location of the proposed natural gas line replacement. Fuel oil storage tanks and transfer of fuel oil from delivery trucks to the tanks will be located within a concrete secondary containment and transfer station structure that will conform to the Y-12 Complex standard, Y/TS-104, Standards for Primary and Secondary Containment Systems and transfer stations. The secondary containment structure will be sized to contain the volume of one tank, plus the volume of rainwater from 100-year, 24-hour storm events, plus the appropriate fire water volume. Waste streams from the packaged boiler systems will not be treated using existing waste water treatment systems. New waste streams will discharge directly to the Y-12 sanitary sewer system with pH adjustment and cooling if necessary.

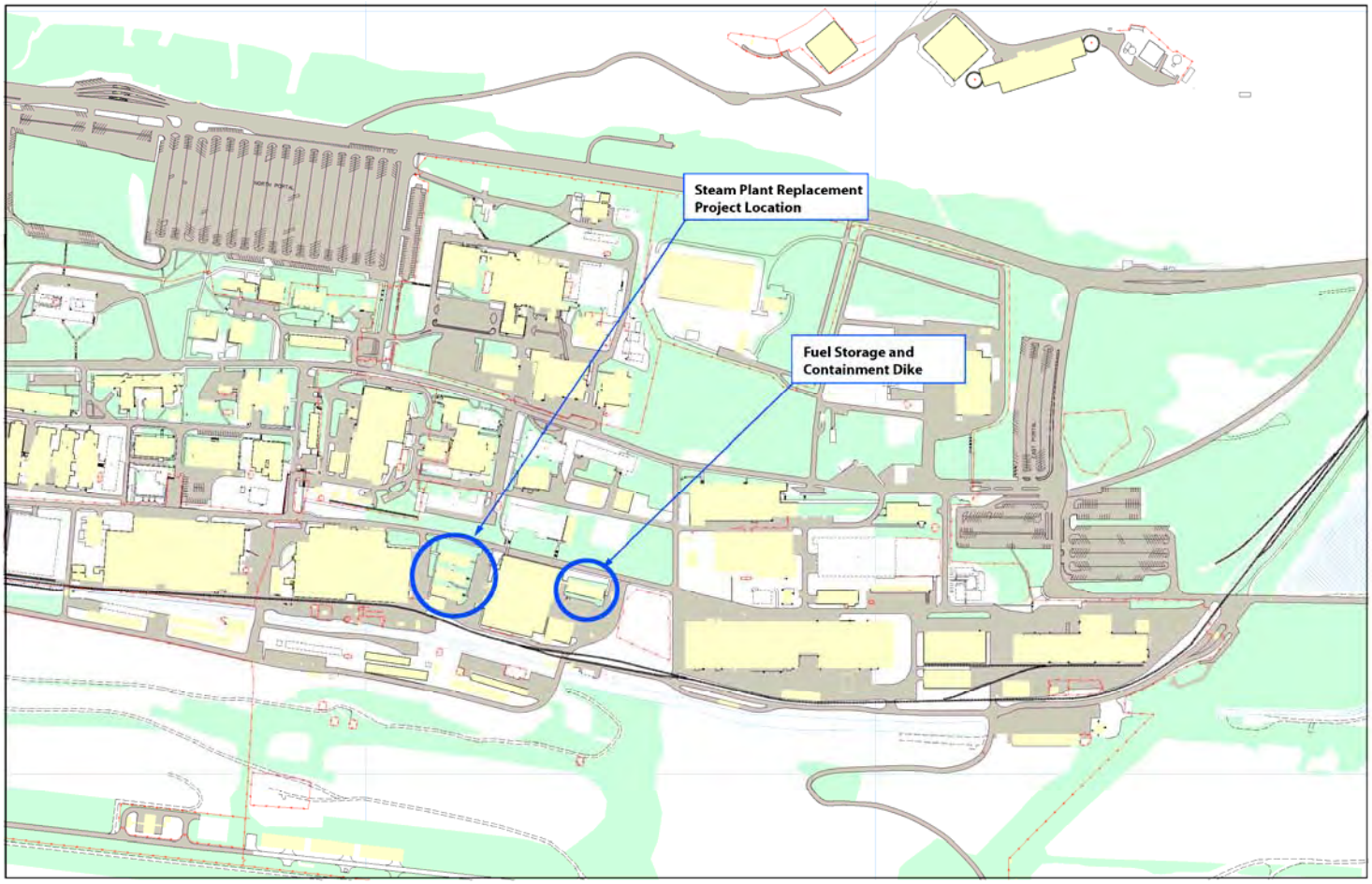

Figure 2.1-1. Project Location.

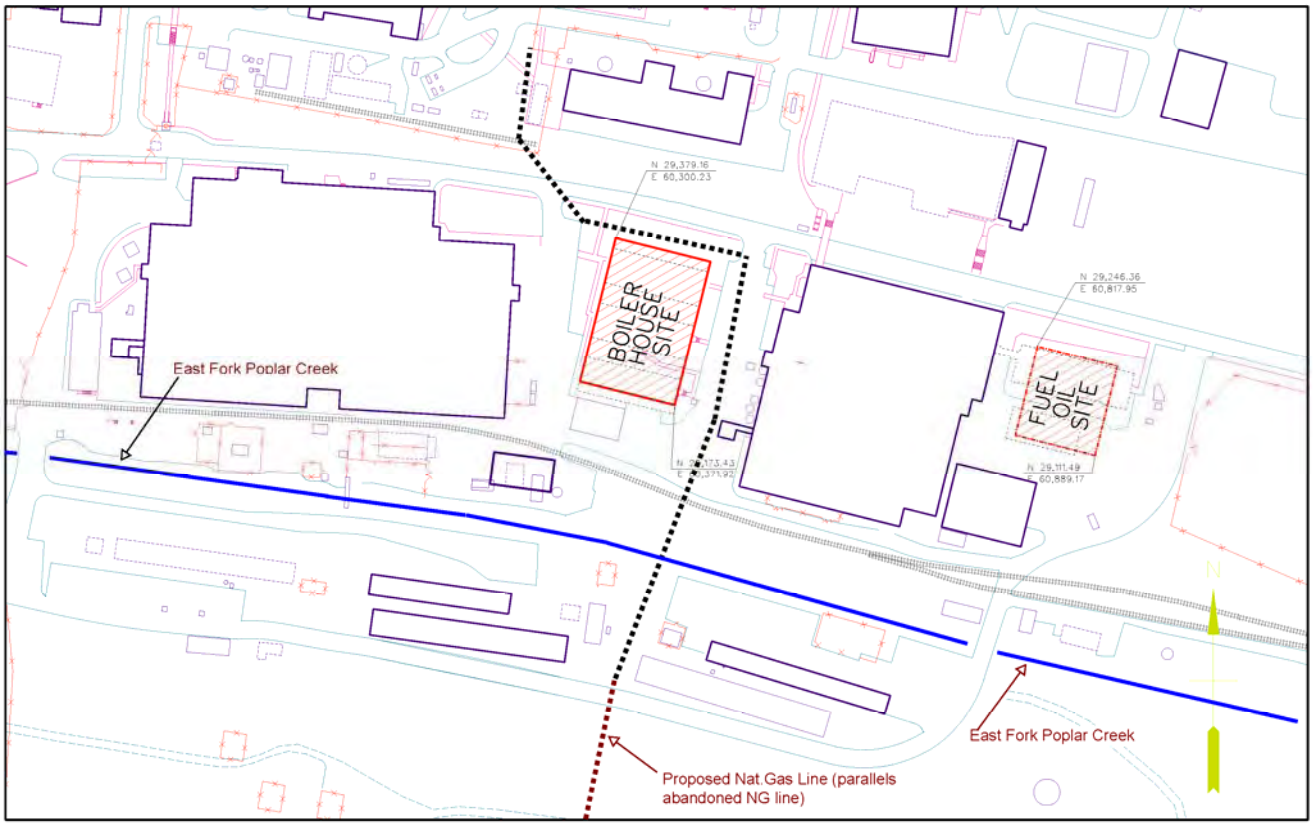

Figure 2.1-2. Location of the Natural Gas Line Replacement.

The packaged boiler system would be housed in a new pre-engineered steel building (boiler house would be constructed on a new concrete foundation).

Pre-engineered Steel Buildings

Operations at the existing Y-12 Steam Plant would cease as activities are transferred to the packaged boiler system. The existing Y-12 Steam Plant facility and coal yard will remain unused and will require remediation or general surveillance and maintenance until existing structures are removed and will be investigated and remediated under CERCLA.

Site Development. The following site development actions would prepare the project site for construction. Temporary utility services such as electricity, telephone service, and potable water would be provided to the project site from existing Y-12 infrastructure utilities. The top five feet of soil may require removal or replacement with engineered fill after the removal of the existing concrete slab. New foundation and concrete slab will be placed to support the boiler house and the packaged boilers. During construction sanitary service would be provided by collection tanks or portable toilets which would be pumped as needed. Existing roads would support all construction needs.

Erosion and sediment control would be provided prior to any land disturbance to prevent both erosion and transport of sediment beyond the limits of the site. The project site would be graded and topsoil removed and stockpiled according to the *Soil Management Plan for the Oak Ridge Y-12 National Security Complex* (Y/SUB/92-28B99923C-Y05, Rev. 1) with appropriate run-on/run-off protection. Site development activities would be conducted to minimize environmental impacts and to be in compliance with applicable laws and regulations.

Temporary construction fencing, signs and flagging would surround the construction work area to warn and restrict access.

Construction Laydown Area. The construction staging and laydown area will most likely be located on and/or near the construction site. The staging area would be sufficiently graded to accommodate a number of temporary construction trailers, storage buildings, and material storage yards.

2.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Under the Life Extension of the Existing Plant Alternative, replacement and/or repairs to three boilers and the associated auxiliary systems of the existing Y-12 Steam Plant would occur to extend the useful life 10 to 15 years. It would include the repair or replacement of boilers, coal handlers, forced draft system, induced draft system, feed water system, wet ash system, dryash system, wastewater system basin, control room, and electrical systems.

Excavation and backfill activities would be needed under the Life Extension of the Existing Plant Alternative. Excavation and backfill would be required for replacing the existing blowdown drain line along the south side of the existing Y-12 Steam Plant building. There would also be some earthwork associated with storm drain modifications to improve runoff drainage. Upgrades to the Steam Plant Wastewater Treatment Facility would also include excavation and backfill activities relating to foundations for the building extension for the clarifier as well as a foundation for the new sulfuric acid tank.

To restore the condition of the existing steam-generating capability, this alternative would include replacement/renovation of the following items (DOE 2005):

- Boiler systems
- Coal receiving and handling system
- Forced Draft (FD) system
- Induced Draft (ID) system
- Feed water system
- Ash handling system
- Wastewater system
- Control system
- Electrical system
- Structural system
- Security fence

2.3 Alternative 3 – No Action Alternative

Under the No Action Alternative, the existing Y-12 Steam Plant would not be replaced or renovated. The Y-12 Complex would have to spend additional operating funds to maintain the existing Y-12 Steam Plant or continue to operate with a system only marginally capable of meeting operational needs. Parts would be replaced, as required, during routine maintenance activities. As a result, there would be a greater risk of system failure.

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3.0 AFFECTED ENVIRONMENT

3.1 Land Use

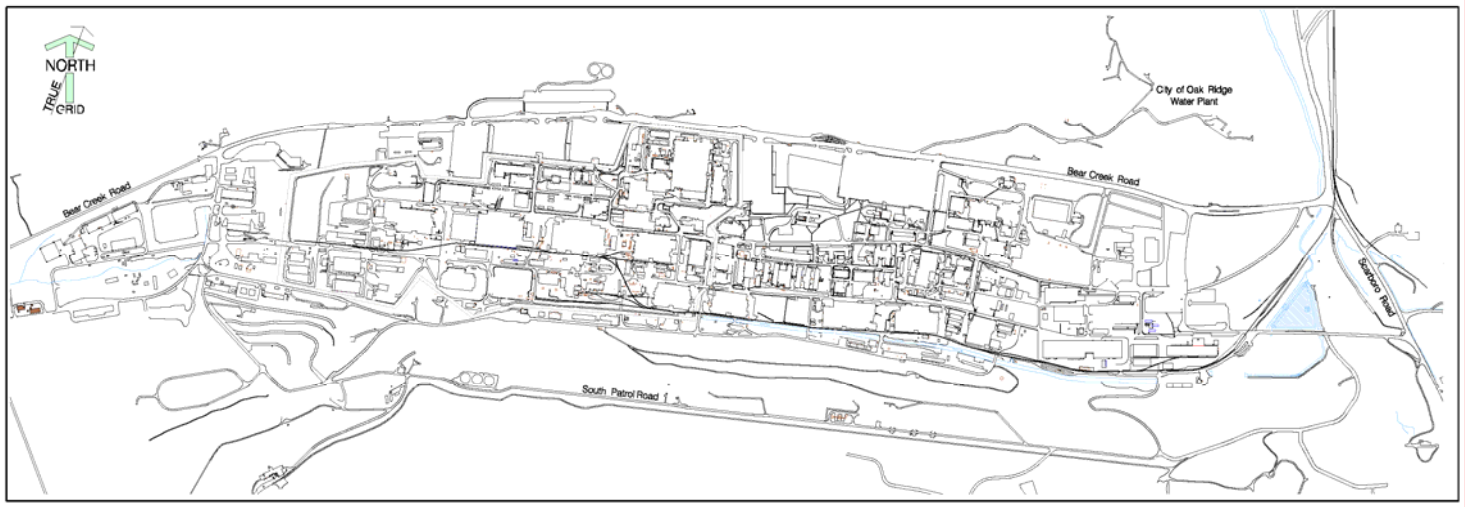
3.1.1 Land Use Designation

Oak Ridge Reservation. The Oak Ridge Reservation (ORR) consists of approximately 13,943 hectares (ha) (34,453 acres) and is located mostly within the corporate limits of the City of Oak Ridge, approximately 24 kilometers (km) (15 miles [mi]) west of the City of Knoxville. Approximately one-third of the ORR is occupied by the facilities of the Y-12 Complex, Oak Ridge National Laboratory (ORNL), and East Tennessee Technology Park (ETTP). All of this land is titled to the United States of America and under the jurisdictional control of DOE for administration and management with the exception of alternatively financed facilities at Y-12 and ORNL.

DOE classifies land use on the ORR into five categories: Institutional/Research, Industrial, Mixed Industrial, Institutional/Environmental Laboratory, and Mixed Research/Future Initiatives. Development on the ORR accounts for about 35 percent of the total acreage, leaving approximately 65 percent of the ORR undeveloped. Land bordering the ORR is predominately rural, with agricultural and forest land being predominant.

Y-12. Figure 3.1-1 shows the boundary of the Y-12 Complex. The main industrialized area of the Y-12 Complex encompasses 324 ha (800 acres). At the end of January 2007, real property on the Y-12 Complex includes over 440 buildings with a floor area of approximately 659,612 square meters (m^2) (7.1 million square feet [ft^2]) (DOE 2007). Land use at the Y-12 Complex is classified as Industrial.

The eastern portion of the Y-12 Complex is occupied by Lake Reality, and the former New Hope Pond (now closed), New Hope Building, maintenance facilities, office space and training facilities, change houses, and former ORNL Biology Division facilities. The far western portion of the Y-12 Complex consists primarily of waste management facilities and construction contractor support areas.



Source: DOE 2006.

Figure 3.1–1. Y-12 Site Boundary Map.

The central and west-central portions of the Y-12 Complex encompass the high-security portion, which supports core NNSA missions (DOE 2001a).

3.1.2 Future Land Use and Leasing Agreements

Future land use at the ORR will continue to incorporate the principles associated with ecosystem management. For the most part, the land uses will expand and build on current uses, not replace them.

3.2 Geology and Soils

3.2.1 Physiography

The ORR lies in the Valley and Ridge Physiographic Province of eastern Tennessee, which has developed on thick, folded beds of sedimentary rock deposited during the Paleozoic era. The topography consists of alternating valleys and ridges that have a northeast-southwest trend, with most of the ORR facilities occupying the valleys. In general, the ridges consist of resistant siltstone, sandstone, and dolomite units, and the valleys consist of the less-resistant shales and shale-rich carbonates.

The topography within the ORR ranges from a low of 229 meters (m) (751 feet [ft]) above mean sea level (MSL) along the Clinch River to a high of 384 m (1,260 ft) above MSL along Pine Ridge.

3.2.2 Geology

The Y-12 Complex is located within Bear Creek Valley, which is underlain by middle to late Cambrian strata of the Conasauga Group. The Conasauga Group consists primarily of high 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 of mostly shale. This group is divided into six discrete formations, which are, in ascending order, the Pumpkin Valley Shale, the Rutledge Limestone, the Rogerville Shale, the Maryville Limestone, the Nolichucky Shale, and the Maynardville Limestone. The thickness of each formation varies throughout the Conasauga Group. The bedrock at the Y-12 Complex is adequate to support structures using standard construction techniques.

The Y-12 Complex 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 Complex area is typically less than 12 m (40 ft). In the undeveloped areas of the Y-12 Complex, the saprolite retains primary texture features of the unweathered bedrock including fractures.

The Y-12 Complex 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 33 m (100 ft) (DOE 2001a).

3.2.3 Soils

The Y-12 Complex lies on soils of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskinghum associations. Due to extensive cut-and-fill grading during the construction of the Y-12 Complex, 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. The soils at the Y-12 Complex are generally stable and acceptable for standard construction techniques.

Soil characterization sampling has been completed and results provided in the BWXT Y-12 Complex report, *Steam Package Plant and Oil Tank Farm Report on Site Characteristics and Sample Locations* (RP-PJ-940107-A002).

3.2.4 Seismicity

The Oak Ridge area lies in seismic Zone 2A of the Uniform Building Code, indicating that minor to moderate damage could typically be expected from an earthquake. The Y-12 Complex is cut by many inactive faults formed during the late Paleozoic Era but there is no evidence of capable faults in the immediate area of Oak Ridge. The nearest capable faults are approximately 480 km (300 mi) west of the ORR in the New Madrid Fault zone.

3.3 Climate and Air Quality

3.3.1 Climate

The Y-12 Complex 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 16 km (10 mi) to the northwest; and the Great Smoky Mountains are 51 km (32 mi) to the southeast (DOE 2005d). The Region of Influence (ROI) specific to air quality is primarily the Bear Creek Valley for the Y-12 Complex. 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 continental. Local terrain often exhibits significant influences on the local climate resulting in seasonal changes to cloud cover, precipitation, air masses, and wind flow regimes which vary with season. Local winters consist of migratory cyclones that produce significant precipitation events every 3 to 5 days. Snow and ice are infrequently associated with these events, but snowfall does occur with some regularity each winter. Severe thunderstorms are most frequent during spring; however tornadoes are relatively rare. Summers are characterized by warm, humid conditions. The occurrence of precipitation during the fall tends to be less cyclic than during other seasons; and October tends to be the driest month of the year (DOE 2005d).

The mean annual temperature for the Oak Ridge area is 14.2 Celsius (°C) (57.6 Fahrenheit [°F]). The coldest month is usually January with an average temperature of about 2.6 °C (36.7°F) and low temperatures that occasionally drop as low as –31 °C (–23.8 °F). July is typically the hottest month of the year with an average temperature of about 25.2 °C (77.4 °F) and high temperatures that occasionally exceed 37.8 °C (100 °F). In the course of a year, the average difference between the maximum and minimum daily temperatures is 12.6 °C (22.7 °F). Average temperature in 2004 was 15.4 °C (59.7 °F) (DOE 2005d).

Winds in the Oak Ridge area are controlled in large part by the valley-and-ridge topography. Prevailing winds are either up-valley (northeasterly) daytime winds or down-valley (southwesterly) nighttime winds. Wind speeds are less than 11.9 kilometers per hour (km/hr) (7.4 miles per hour [mph]) 75 percent of the time. Tornadoes and winds that exceed 30 km/hr (18.7 mph) are rare in the Oak Ridge area. However, in February 1993 a tornado struck the east end of the Y-12 Complex and uprooted trees and downed some primary electrical powerlines but caused minimal damage to buildings and equipment (DOE 2001a).

The 30-year annual average precipitation is 139.8 centimeters (cm) (55.0 inches [in]) which includes about 24.4 cm (9.6 in) of snowfall. Precipitation in 2004, measured at the Oak Ridge meteorological tower on Laboratory Road, was 170.8 cm (67.24 in) (DOE 2005d). Precipitation in the region is greatest in the winter months (December through February). Precipitation in the spring exceeds the summer rainfall, but the summer rainfall may be locally heavy because of thunderstorm activity. The driest periods generally occur during the fall months when high-pressure systems are most frequent (DOE 2001a).

3.3.2 Air Quality

Regional Air Quality. As directed by the *Clean Air Act* of 1970 (42 U.S.C. §7401), the U.S. EPA has set the National Ambient Air Quality Standards (NAAQS) for several criteria pollutants to protect human health and welfare (40 CFR 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 (O_3). 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.

The ORR is located in Anderson and Roane Counties in the Eastern Tennessee-Southwestern Virginia AQCR 207 and the Y-12 Complex is completely within Anderson County. The EPA has designated Anderson County as a basic non-attainment area for the 8-hour O_3 standard, as part of the larger Knoxville basic 8-hour O_3 non-attainment area that encompasses several counties; and for $PM_{2.5}$ based on a revision to the standards (EPA 2007a). 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, and 3 hours). The averaging times shown in the tables in this section correspond to the regulatory averaging times for the individual pollutants. Table 3.3–1 presents the NAAQS and Tennessee State ambient air quality standards.

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. The Y-12 Complex 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 the ORR include exhaust gas scrubbers, baghouses, and High Efficiency Particulate Air (HEPA) 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 in regulation of emissions (DOE 2005d).

Table 3.3–1. National and Tennessee Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS (:g/m^3)	Tennessee Standard (:g/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)
	3-Hour[2]	1,300 (0.5 ppm)[a]	1,300 (0.5 ppm)
PM_{10}	Annual[1]	50	50
	24-Hour[2]	150[b]	150
$PM_{2.5}$	Annual[1]	15[c]	15
	24-Hour[2]	35[d]	35
CO	8- Hour[2]	10,000 (9 ppm)[a]	10,000 (9 ppm)
	1- Hour[2]	40,000 (35 ppm)[a]	40,000 (35 ppm)
Ozone	8- Hour[3]	157 (0.08 ppm)[e]	157 (0.08 ppm)
	1- Hour[2]	235 (0.12 ppm)[f]	235 (0.12 ppm)
NO_2	Annual[1]	100 (0.05 ppm)	100 (0.05 ppm)
Lead	Quarter[1]	1.5	1.5

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 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).
[e] 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.
[f] (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
.Source: EPA 2007c and DOE 2001a.

Both effluent and ambient air are sampled on the ORR. Effluent air flows into the environment from a source, such as an exhaust stack, and ambient air is the air that exists in the surrounding

area. Both radiological and nonradiological air emissions are monitored. Sample results show that ORR operations have an insignificant effect on local air quality (DOE 2005d).

The release of nonradiological contaminants into the atmosphere at the Y-12 Complex occurs 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. The multiple air permits issued by TDEC for the Y-12 Complex emission sources were combined into two site-wide operations permits, 554701 and 554594, issued in October 2004. The allowable level of air pollutant emissions from emission sources in 2005 was approximately 9,100 metric tons per year (10,033 tons per year) of regulated pollutants. Actual emissions are much lower than the allowable emissions (DOE 2005d). See Table 3.3-2.

The primary source of criteria pollutants at the Y-12 Complex is the steam plant, where coal and natural gas are burned. Actual and allowable emissions from the existing Y-12 Steam Plant are illustrated in Table 3.3-2.

Table 3.3–2. Actual vs. Allowable Air Emissions from the Oak Ridge Y-12 Complex, 2005

Pollutant	Emissions (tons/year)		Percentage of allowable
	Actual	Allowable	
Particulate	33	945	3.5
Sulfur dioxide	2,313	20,803	11.1
Nitrogen oxides[a]	707	5,905	12.0
Nitrogen oxides (ozone season only)	215.4	232	92.8
Volatile organic compounds[a]	2.3	41	5.6
Carbon monoxide[a]	21	543	3.9

[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 8760 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 1995 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.)

Source: 2006 ORNL ASER

Radiological and Hazardous Air Emissions. The release of radiological contaminants, primarily uranium, into the atmosphere at the Y-12 Complex occurs as a result of plant production, maintenance, and waste management activities. Atmospheric emissions of radionuclides from DOE facilities are limited by EPA regulations found under National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations (40 CFR 61, Subpart H), which

have been delegated to TDEC for implementation. All three ORR facilities are operated in accordance with the Tennessee regulatory dose limits for Hazardous Air Pollutants for Radionuclides and have met all emission and test procedures. The NESHAP establishes a dose limit of 10 millirem (mrem) per year for any member of the public. The total 2004 dose to the maximally exposed individual (MEI) from the Y-12 Complex activities was 0.4 mrem (DOE 2006). Details on the annual radionuclide compliance modeling and other NESHAP that cover asbestos and specific source categories on the ORR are reported in the 2005 *Oak Ridge Reservation Annual Site Environmental Report* (DOE 2006). No releases of reportable quantities of asbestos were reported at the Y-12 Complex in 2005.

Ambient air monitoring of mercury concentrations has been conducted at the Y-12 Complex since 1986 as a best management practice. Two atmospheric mercury monitoring stations located near the east and west boundaries of the Y-12 Complex are currently in operation. These stations have monitored mercury in ambient air continuously since 1986, except for short periods of downtime due to electrical or equipment outages. Average mercury vapor concentrations at the Y-12 Complex monitoring stations have declined significantly since monitoring began. Annual average mercury concentrations during 2005 at the Y-12 Complex east and west boundary monitoring stations are comparable to reference levels measured on Chestnut Ridge in 1988 and 1989 and only slightly elevated above values reported for continental background. These concentrations are well below current environmental and occupational health standards for inhalation exposure to mercury vapor (DOE 2006).

The ORR maintains a perimeter air monitoring network of eight stations at the reservation perimeter and one at an offsite reference location. Surveillance of airborne radionuclides includes measurement of ambient levels of alpha-, beta-, and gamma-emitting radionuclides and tritium. Additional information on monitoring locations and activities is provided in the Y-12 SWEIS (DOE 2001a).

3.4 Noise

The acoustic environment along the Y-12 Complex 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 decibel (dBA). Areas near the Y-12 Complex site within Oak Ridge are typical of a suburban area, with a DNL in the range of 53 to 62 dBA. The

primary source of noise at the Y-12 Complex site boundary and at residences located near roads is traffic. During peak hours, the Y-12 Complex worker traffic is a major contributor to traffic noise levels in the area.

Major noise emission sources within the Y-12 Complex 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 of the Y-12 Complex 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 Complex site boundary, noise levels from Y-12 Complex mission operations range between 50 and 70 dBA which is typical for industrial facilities.

The State of Tennessee has not established specific community noise standards applicable to the Y-12 Complex; however, Anderson County has quantitative noise-limit regulations as shown in Table 3.4–1 (DOE 2004b).

Table 3.4–1. 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 2004b.

3.5 Water Resources

3.5.1 Groundwater

The Y-12 Complex, bound on the north by Pine Ridge and on the south by Chestnut Ridge, is located near the boundary between the Knox Aquifer and the ORR aquitards. The ORR aquitards underlie Pine Ridge and Bear Creek Valley, which includes the main plant area of the

Y-12 Complex and the disposal facilities of western Bear Creek Valley. The Knox Aquifer underlies Chestnut Ridge and the stream channels of Bear Creek and UEFPC. Bedrock formations comprising the aquitards are hydraulically upgradient of the aquifer, which functions as a hydrologic drain in Bear Creek Valley. Fractures provide the principal groundwater flowpaths in both the aquifer and aquitards. Dissolution of carbonates in the aquifer has enlarged fractures and produced solution cavities and conduits that greatly enhance its hydraulic conductivity relative to the aquitards.

Groundwater at the Y-12 Complex 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. For more details on these hydrogeologic regimes, refer to Section 4.5 of the Y-12 SWEIS (DOE 2001a).

Recharge occurs over most of the area but is most effective where overburden soils are thin or permeable. Groundwater flow in the aquitard and the aquifer is primarily parallel to bedding planes. There are no Class I sole-source aquifers that lie beneath the ORR. All aquifers are considered Class II aquifers (current potential sources of drinking water). Because of the abundance of surface water and its proximity to the points of use, very little groundwater is used at the ORR. Only one water supply well exists on the ORR and it serves as a supplemental water supply to an aquatics laboratory during extended droughts.

Groundwater Quality. Groundwater samples are collected semiannually and annually from a representative number of monitoring wells throughout the ORR. Historical monitoring efforts have shown that four types of contaminants have affected groundwater quality at the Y-12 Complex: nitrates, volatile organic compounds (VOCs), metals, and radionuclides. Of these, nitrates and VOCs are the most widespread. Some radionuclides, particularly uranium and technetium (^{99}Tc), are found principally in the Bear Creek regime and the western and central portions of the UEFPC regime.

Groundwater in Bear Creek Valley west of the Y-12 Complex has been contaminated by hazardous chemicals and radionuclides from past weapons production waste disposal activities. The primary groundwater contaminants in the Bear Creek Regime are nitrates, trace metals,

VOCs, and radionuclides. The contaminant sources include past waste disposal facilities sited on aquitard bedrock north of Bear Creek. Former disposal facilities and Solid Waste Management Units (SWMUs) in the Bear Creek Valley include the S-3 Ponds, Oil Landfarm, Boneyard/Burnyard site, New Hope Pond, and the Bear Creek Burial Grounds, all closed in 1988 (DOE 2001a, DOE 2006).

Among the three hydrogeologic regimes at the Y-12 Complex, the UEFPC regime encompasses most of the known and potential sources of groundwater contamination. The groundwater contamination is the result of a co-mingling of releases from multiple sources within the Y-12 Complex. Nitrates and ^{99}Tc from the S-3 Site are the primary groundwater contaminants in the western portion of the UEFPC regime, while groundwater in the eastern portion including Union Valley is predominantly contaminated with VOCs, such as tetrachloroethylene (PCE), trichloroethylene (TCE), 1, 1-dichloroethane (DCE), carbon tetrachloride, and chloroform; and fuel components such as benzene, toluene, ethylbenzene and xylene (BTEX). The most frequently detected metals are boron, beryllium, cobalt, copper, chromium, lead, lithium, mercury, manganese, nickel, and total uranium (DOE 2001a, DOE 2006).

The Chestnut Ridge hydrogeologic area is dominated by several closed and operating disposal facilities, including the closed Chestnut Ridge Security Pits, Chestnut Ridge Sediment Disposal Basin, United Nuclear Corporation Site, and five nonhazardous waste landfills. Groundwater monitoring data collected since the mid-1980s indicate a definable VOC contaminant plume in groundwater that is associated with the Chestnut Ridge Security Pits and extends approximately 792 m (2,600 ft) east of that facility.

In addition, shallow groundwater within the water table interval near New Hope Pond (closed SWMU), Lake Reality, and UEFPC is monitored. Historically, VOCs have been detected near Lake Reality from wells, a dewatering sump, and the New Hope Pond distribution channel underdrain. In this area, shallow groundwater flows north-northeast through the water table interval east of New Hope Pond and Lake Reality, following the path of the distribution channel for UEFPC. During calendar year (CY) 2005, the observed concentrations of VOCs at the New Hope Pond distribution channel continue to remain low (DOE 2006).

3.5.2 Surface Water

Waters drained from the ORR eventually reach the Tennessee River via the Clinch River, which forms the southern and western boundaries of the ORR. Within the Y-12 Complex, the two major surface water drainage basins are those of Bear Creek and East Fork Poplar Creek (EFPC). The upper reaches of the EFPC drains the majority of the industrial facilities at the Y-12 Complex. The reach of EFPC upstream of Bear Creek Road has been designated as the UEFPC. EFPC, which discharges into Poplar Creek east of the ETTP, flows northeast along the south side of the Y-12 Complex. Various Y-12 Complex wastewater discharges to the UEFPC from the late 1940s to the early 1980s left a legacy of contamination, such as mercury, polychlorinated biphenyls (PCBs), and uranium that has been the subject of water quality improvement initiatives over the past 22 years.

The natural drainage pattern of UEFPC was altered during the construction of the Y-12 Complex in the 1940's. The creek flows in a modified and straightened channel lined with riprap and concrete. Flow in UEFPC is derived partially from groundwater captured by the buried channels and funneled to the creek. In addition, outfalls into UEFPC add a combination of groundwater, storm water, and effluents generated by plant operations. As a result of reduced operations and elimination of direct discharges to UEFPC, flow in UEFPC decreased from 38 to 57 million liters per day (MLD) (15 to 23 cubic feet per second [cfs]) in the mid-1980s to about 9 MLD (3.7 cfs) in the mid-1990s. To improve downstream water quality, the Y-12 Complex's 1995 National Pollutant Discharge Elimination System (NPDES) permit required supplementing flow in UEFPC by the addition of raw water from the Clinch River. Since mid-1996, water has been added to the western portion of the open channel in order to maintain flow of 26 MLD (10.8 cfs) at Station 17, downstream of Lake Reality just before the creek exits the Y-12 Complex boundary on the east end.

Bear Creek Valley west of the Y-12 Complex is drained by Bear Creek. Bear Creek begins near the westernmost portion of the Y-12 Complex and flows west for approximately 8.3 km (5.2 mi). At the location where Bear Creek reaches U.S. Highway 95, it turns north and flows through a gap in Pine Ridge to its confluence with EFPC, just above its confluence with Poplar Creek. Bear Creek flow is maintained by inputs from tributary streams flowing in from the north from Pine Ridge. Flow in Bear Creek is further supplemented by discharges from several springs at

the base of Chestnut Ridge and underdrains from the Environmental Management Waste Management Facility (EMWMF).

The Clinch River is the source of potable water for the City of Oak Ridge which provides potable water for the Y-12 Complex and ORNL. The Clinch River has an average flow of 132,000 liters per second (L/s) (4,656 cfs) as measured at the downstream side of Melton Hill Dam at mile 23.1. The average flow of Bear Creek near the Y-12 Complex is 110 L/s (3.9 cfs). Base flow without augmentation in UEFPC, measured downstream of the Y-12 Complex averages 1,300 L/s (46 cfs). The Y-12 Complex uses approximately 7,530 million liters per year (MLY) (2,000 MGY) of water while the ORR uses approximately twice as much. The City of Oak Ridge, which has a capacity of 44,347 MLY (11,715 MGY), supplies water to the Y-12 Complex and ORNL as well as Oak Ridge residents.

Clinch River water levels in the vicinity of the ORR are regulated by a system of dams operated by the Tennessee Valley Authority (TVA). Melton Hill Dam controls the flow of the Clinch River along the northeast and southeast sides of the ORR. Watts Bar Dam, located on the Tennessee River downstream of the lower end of the Clinch River, affects the flow of the Clinch River along the southeast side of the ORR.

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 the ORR classified for domestic water supply. Most of the streams at the 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. Portions of Poplar Creek and Melton Branch are not classified for recreation.

There are six wastewater treatment facilities which operate under NPDES permits at the Y-12 Complex. Another facility known as Big Spring Water Treatment Facility began operation in 2005 as an interim remedial action to remove mercury under a *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) ROD. This facility diverts flow from outfall 051 and discharges through a CERCLA outfall into the UEFPC. 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 the Y-12 Complex 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 the Y-12 Complex.

Among the three hydrogeologic regimes at the Y-12 Complex, the UEFPC regime 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). Water quality in Bear Creek is influenced significantly by a groundwater hydraulic connection either directly to Bear Creek or to tributaries to Bear Creek. Contaminants in Bear Creek, from multiple formerly used waste burial trenches and pits, include nitrates, metals (e.g., uranium), radionuclides (e.g., uranium isotopes, ^{99}Tc), and chlorinated organics (DOE 2001a, DOE 2005d).

Routine surface water surveillance monitoring, above and beyond that required by the NPDES permit, is performed as a best management practice. The Y-12 Complex monitors the surface water as it exits each of the three hydrogeologic regimes that serve as an exit pathway for surface water. Monitoring is conducted at Station 17, near the junction of Scarboro and Bear Creek roads. More than 4,000 surface water samples were collected in 2005. Comparisons with the Tennessee water quality criteria indicate that only mercury, chromium, zinc, and copper from samples collected at Station 17 were detected above the criteria maximum (DOE 2006).

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 usages of a water body 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 and TVA permits to construct intake structures.

3.6 Ecological Resources

This section describes the ecological resources at the ORR, including threatened and endangered (T&E) species, and floodplains and wetlands. The proposed project site is located inside the ORR, within the boundaries of the Y-12 Complex.

The ORR is mostly contiguous native eastern deciduous forest. Forested (hardwood and pine) areas are found throughout the reservation. Less than 2 percent of the ORR remains as open agricultural fields. The forests are mostly oak-hickory, pine-hardwood, or pine. Minor areas of other hardwood forest cover types are found throughout the ORR, including northern hardwoods, a few small natural stands of hemlock or white pine, and floodplain forests (ORNL Plant communities are 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 the ORR (DOE 2001a). Over 1,100 vascular plant species are found on the ORR (ORNL 2002). Animal species found on the ORR include approximately 63 species of fish; 59 species of amphibians and reptiles; up to 260 species of migratory, transient, and resident birds; and 38 species of mammals (DOE 2001a).

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

Under the Proposed Action, a pre-engineered steel building and a packaged boiler system would be constructed in the south east portion of the Y-12 Complex. The proposed project site is located in an industrialized and developed area of the Y-12 Complex, is currently occupied by office buildings and provides little habitat for terrestrial resources. Additional information and listing of species found at the ORR can be found in the Section 4.6 of the Y-12 SWEIS (DOE 2001a).

3.6.1 Threatened and Endangered Species

Forty-five Federal- and state-listed threatened, endangered, and other special status species have been identified on the ORR. Among these, 20 Federal- or state-protected vertebrate

species have been confirmed in recent surveys (Table 3.6-1) (ORNL 2002, DOE 2001a). The only federally threatened or endangered species that has been recently observed at the Y-12 Complex is a gray bat (*Myotis grisescens*), which has been recorded over water bordering the ORR (the Clinch River) in 2003 and over a pond on the ORR in 2004. It was mist-netted outside a cave on the ORR in 2006 (DOE 2006). The U.S. Fish and Wildlife Service (USFWS) records indicate that the federally endangered Indiana Bat (*Myotis sodalis*) may also be present in the vicinity of the Y-12 Complex, however, this bat has not been observed at the Y-12 Complex or other parts of the ORR (DOE 2001a). The federally threatened bald eagle is increasingly observed in winter. The Federal and state threatened species; the spotfin chub (*Cyprinella monnacha*) has been sighted and collected in the City of Oak Ridge and is possible present on the ORR (DOE 2006).

Table 3.6–1. Federal or State–Listed Threatened and Endangered Species Reported on the Oak Ridge Reservation

	Common Name	Scientific Name	Status[a]	
			Federal	State
Mammals				
	Gray bat	*Myotis grisescens*	E	E
	Indiana bat	*Myotis sodalis*	E	E
Birds				
	Bald eagle	*Haliaetus leucocephalus*	T(DL)	T
	Peregrine falcon	*Falco peregrinus*	NL	E
Plants				
	American ginseng	*Panax quinquefolius*	NL	S-CE
	Appalachian bugbane	*Cimicfuga rubifolia*	SC	T
	Branching whitlow-grass	*Draba ramosissima*	SC	T
	Butternut	*Juglans cinera*	NL	T
	Canada lily	*Lilium canadense*	NL	T
	Fen orchid	*Liparis loeselii*	NL	E
	Golden seal	*Hydrastis Canadensis*	NL	S-CE
	Hairy sharp-scaled sedge[b]	*Carex oxylepis var. pubescens*	NL	S
	Heavy sedge	*Carex gravida*	NL	S
	Large-tooth aspen	*Populus grandidentata*	NL	S
	Michigan lily[c]	*Lilium michiganense*	NL	T
	Mountain witch alder	*Fothergilla major*	NL	T
	Northern bush honeysuckle	*Diervilla lonicera*	NL	T
	Northern white cedar	*Thuja occidentalis*	NL	S
	Nuttall waterweed	*Elodea nuttallii*	NL	S
	Pink lady's-slipper	*Cypripedium acaule*	NL	E-CE
	Pursh's wild-petunia	*Ruellia purshiana*	NL	S
	River bulrush	*Scirpus fluviatilis*	NL	S
	Shining ladies-tresses	*Spiranthes lucida*	NL	T
	Small-head rush	*Juncus brachycephalus*	NL	S
	Spreading false foxglove	*Aureolaria patula*	SC	T
	Tall larkspur	*Delphinium exaltatum*	SC	E
	Three-parted violet	*Viola tripartite var. tripartite*	NL	S
	Tuberculed rein-orchid	*Platanthera flava var. herbiola*	NL	T

[a]Status codes: CE-candidate endangered; DL-proposed for delisting; E-endangered; NL-not listed; P-possibly extirpated; S-special concern in Tennessee; SC-Federal species of concern; T-threatened.
[b] *Carex oxylepis var. pubescens* has not been observed during recent surveys.
[c] *Lilium michiganense* is believed to have been extirpated from the ORR by the impoundment at Melton Hill.
Sources: DOE 2001a, DOE 2006.

There are no federally listed threatened or endangered plant species on the ORR. State threatened and endangered species observed on the ORR include 22 plants, 1 mammal, and 2 raptor species (DOE 2001a, DOE 2006). A number of rare or state-listed animals and plants are present in the vicinity of the Y-12 Complex. No critical habitat for threatened or endangered species, as defined in the *Endangered Species Act*, exists on the ORR (DOE 2001a).

3.6.2 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 has conducted floodplain studies along the Clinch River, Bear Creek, and EFPC (DOE 2001a). Portions of the Y-12 Complex lie within the 100- and 500-year floodplains of EFPC.

Wetlands. Approximately 235 ha (581 acres) of wetlands have been identified on the ORR, with most classified as forested palustrine, scrub/shrub, and emergent wetlands (DOE 2001a). Wetlands occur across the ORR at low elevation, 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 10 ha (24.7 acres) at White Oak Lake (ORNL 2002).

A wetlands survey of the Y-12 Complex area found palustrine, scrub/shrub, and emergent wetlands. An emergent wetland was found at the eastern end of the Y-12 Complex, 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. For additional discussion of wetlands, refer to Section 4.6.2 of the Y-12 SWEIS (DOE 2001a).

3.7 Cultural Resources

3.7.1 Introduction

Cultural resources are those aspects of the physical environment that relate to human culture, society, and cultural institutions that hold communities together and link them to their surroundings. Cultural resources have been organized into three categories for this EA:

prehistoric resources, historic resources, and traditional cultural properties and practices. These types are not exclusive and a single resource may fall within more than one category due to the presence of multiple components. Prehistoric cultural resources refer to any material remains, structures, and items used or modified by Native American people before the establishment of a Euro-American presence in the region. Historic cultural resources include material remains and landscape alterations that have occurred since the arrival of Euro-Americans in the region. These resources can be associated with either Euro-American or Native American people. Traditional cultural properties (TCPs) refer to sites, locations, natural resources, or manmade objects that are important to a particular living community, and this importance is "derived from the role the TCP plays in the community's historically rooted beliefs, customs, and practices" (Parker and King 1990). TCPs and beliefs that are based in a community's history are important for maintaining the cultural identity of the community, and are essential to the preservation and viability of a culture.

3.7.2 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 United States Code [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 its resources, and consultation to avoid, reduce, or mitigate adverse effects. The NHPA does require Federal agencies to ensure that decisions concerning the treatment of these cultural resources result from meaningful consideration of cultural and historic values, and identification of options available to protect these 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 determined as 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. Resources that are determined to be eligible 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.

3.7.3 Cultural Resources at the Y-12 Complex

Architectural and archaeological surveys have been conducted for the Y-12 Complex (Thomason and Associates 2003). In 1995 (final version 1999), Thomason and Associates completed a comprehensive architectural and historical evaluation of the Y-12 Complex. A total of 248 properties were individually recorded and evaluated. The remaining 325 facilities were identified and categorized by design and use. At least 10 major archaeological reconnaissance-level surveys have been conducted on the ORR. The Y-12 Complex contains only one known archaeological site.

A survey conducted of the Y-12 Complex in the early 1990s identified one archeological site (40AN68) which is located on a flat rise overlooking the EFPC within the boundaries of the Y-12 Complex. This site is of the ephemeral nature and is not eligible for inclusion in the NRHP pursuant to 36 CFR 60.4 (DuVall and Associates 1999). It was concluded that the potential is low for identifying significant archeological sites within the Y-12 Complex.

No cultural resources at the Y-12 Complex are currently listed on the NRHP. The Y-12 Complex has a historic district that has been determined eligible for listing and the Tennessee State Historic Preservation Officer has concurred with this determination (Thomason and Associates 2003). The district currently includes 77 contributing buildings and structures. The district is 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 development activities. It is also eligible under Criterion C for the engineering merits of many of the properties and their contributions to science. Figure 3.7-1 shows the location of the historic district at the Y-12 Complex in relation to the proposed site.

Two of the 77 contributing buildings and structures within the historic district have been determined as eligible for National Historic Landmark status. Building 9731 is the oldest process facility at the Y-12 Complex and played a major part in the Manhattan Project (DOE 2001a). Building 9204-3 (Beta-3) functioned as a uranium enrichment facility during World War II and is significant for its pioneering role in nuclear research for enriched uranium and the separation of stable isotopes (DOE 2001a).

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 Complex. Procedures for consulting with the Cherokee regarding TCPs are in place. No Native American traditional use areas or religious sites are known to be present on the Y-12 Complex. Also, no artifacts of Native American religious significance are known to exist or to have been removed from the Y-12 Complex (DOE 2001a).

There are at least 68 cemeteries on the ORR, 7 of which are located on the Y-12 Complex. These cemeteries are associated with Euro-American use of the area prior to World War II (DOE 2001a) and are likely to have religious or cultural importance to descendants and the local community. All are currently maintained and protected.

3.7.4 Cultural Resources at Proposed Site

The historic district includes much of the Y-12 Complex. The proposed project location is adjacent to Category 1 and 4 facilities (Figure 3.7-1); however the proposed action would not adversely affect any of these properties or any properties eligible for listing in the NRHP.

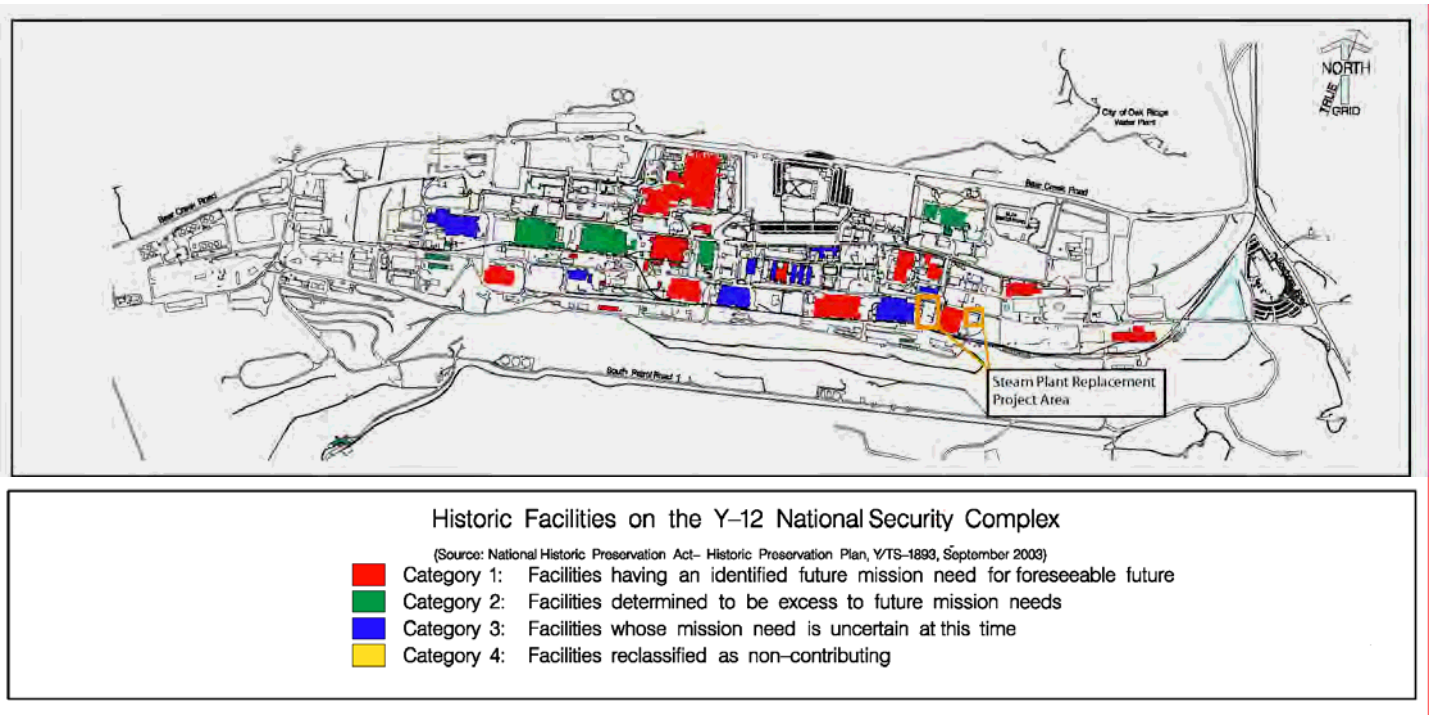


Figure 3.7–1. Location of the Historic District at the Y-12 Complex in Relation to the Proposed Site.

3.8 Socioeconomics

This section describes current socioeconomic conditions within a ROI where more than 90 percent of the ORR workforce resides. The ROI is a four-county area in Tennessee comprised of Anderson, Knox, Loudon, and Roane Counties. Figure 3.8–1 shows the surrounding counties influenced by ORR. Approximately 40 percent of the current ORR workforce resides in Knox County, 29 percent in Anderson County, 16 percent in Roane County, and 6 percent in Loudon County.

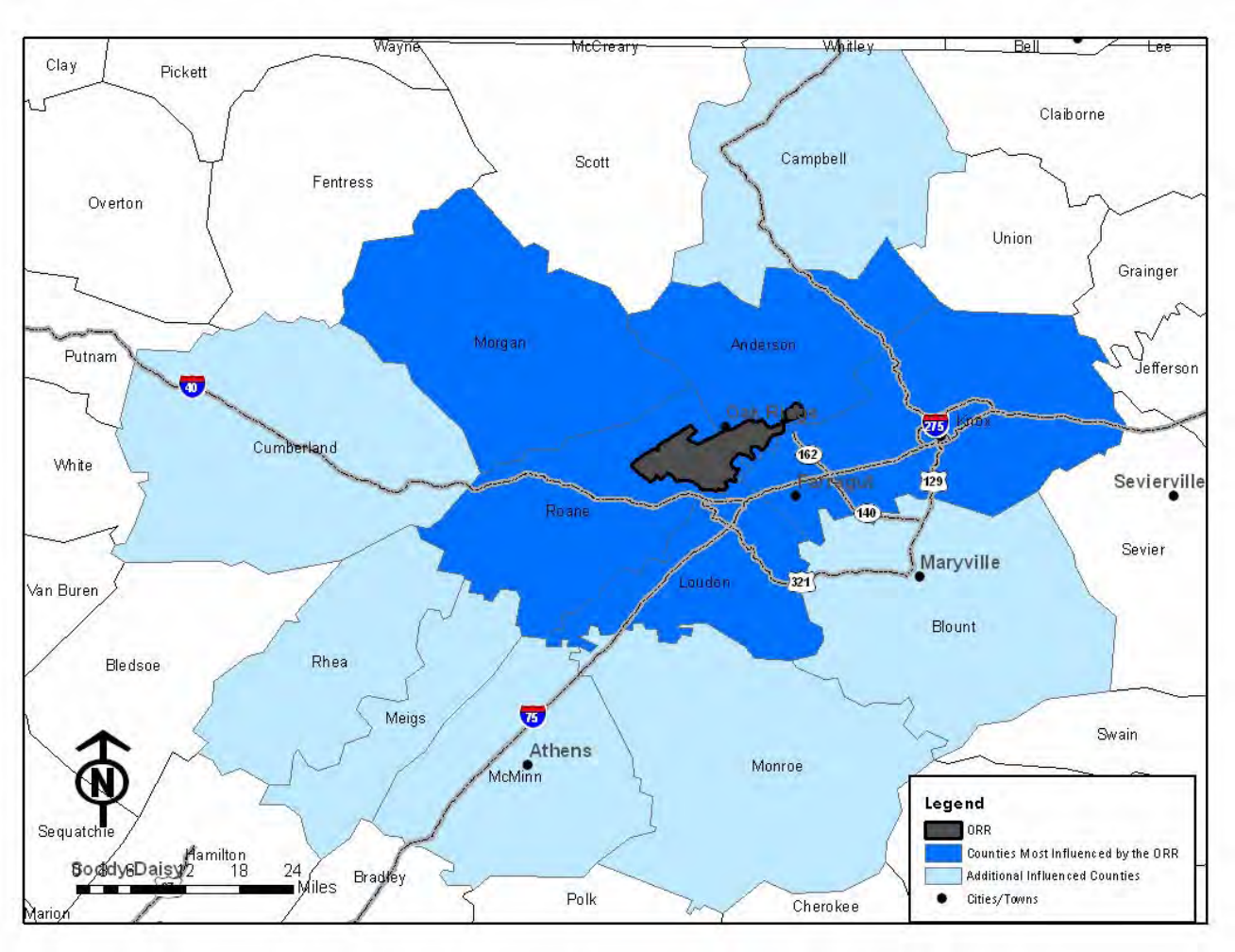


Figure 3.8–1. Location of Oak Ridge Reservation and Surrounding Counties.

The remaining 9 percent of the workforce resides in other counties across Tennessee, none of which are home to more than 3 percent of the workforce (DOE 2001b).

3.8.1 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 3.8–1 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 4.7 percent from 280,982 in 1995 to 294,937 in 2004. Overall, ROI employment grew from 270,151 in 1995 to 282,500 in 2004 and continued to grow despite the fluctuations in the labor force (BLS 2005).

Table 3.8–1. Employment by Sector (%)

Sector	1980	1990	2000
Services	19.1	27.3[a]	32.2
Wholesale	5.5	5.5	5.0
Retail	15.6	19.3[a]	18.3
Government (including Federal, State, local, and military)	20.3	15.4	13.7
Manufacturing	21.9	15.8	10.7
Farm	2.0	1.5	1.2
Construction	4.9	5.4	6.3
Finance, Insurance, and Real Estate	6.0	5.1	6.3
Transportation and Public Utilities	3.7	4.0	5.1
Agricultural Service, Forestry, and Other	0.3	0.6	1.1[b]
Mining	0.7	0.4	0.2[b]

[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.
Source: BEA 2003.

In 2006, unemployment rates within the ROI ranged from a low of 3.9 percent in Knox County to a high of 5.4 percent in Roane County (Table 3.8-2). The 2006 unemployment rate in Tennessee was 5.2 percent (BLS 2007).

Table 3.8–2. Region of Influence Unemployment Rates (%)

Area/Region	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Anderson County	5.5	3.9	3.7	4.2	4.8	4.8	5.3	4.9	5.1	4.7
Knox County	3.6	3.3	2.6	3.2	3.4	3.7	4	4	4.2	3.9
Loudon County	4.4	3.4	3.1	3.6	4.3	4.9	4.9	4.6	4.7	4.4
Roane County	7.2	5.4	4.7	4.4	4.8	5.5	5.5	5.8	5.8	5.4
Tennessee	5.3	4.5	4.1	4	4.7	5.3	5.7	5.5	5.6	5.2

Source: BLS 2007.

The average per capita income in the ROI was $29,986 in 2005, an 8 percent increase from the 2003 level of $27,854. Per capita income in 2005 in the ROI ranged from a low of $27,584 in

Roane County to a high of $32,815 in Knox County. The per capita income in Tennessee was $30,969 in 2005 (BEA 2007a).

The Y-12 Complex employs approximately 5,400 workers, including DOE employees and multiple contractors. This represents approximately 3.1 percent of area employment. DOE has a significant impact on the economy of the ROI and Tennessee. As a whole, DOE employees and contractors number more than 13,700 individuals in Tennessee, primarily in the ROI. These jobs have an average salary of $40,000 in comparison to the statewide average of $35,241 (BEA 2007b). 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.

Current projections of the future plant population indicate that, in the long term, the population necessary for the Y-12 Complex's mission will decrease 20 percent. However, within the next 5 years, nearly half of the current workforce will be eligible for full, unreduced retirement. To combat a possible shortage of critical skills, a robust recruiting effort has been put in place. Therefore, in the short term, the Y-12 Complex will experience a brief peak in its employee population as the transition is made from one generation to another.

3.8.2 Population and Housing

Between 1960 and 1990, population growth in the ROI was slightly slower than population growth in the State of Tennessee. The ROI population increased at an average annual rate of 1 percent while the state population increased 1.2 percent annually. Between 1990 and 2002, ROI population growth increased 1.2 percent annually while the state population increased 1.6 percent annually. Loudon County experienced the fastest rate of population growth, averaging 2.5 percent annually between 1990 and 2002, while Anderson County population has increased an average of only 0.4 percent annually (DOE 2001b, USCB 2005). 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 3.8–3.

Table 3.8–3. Historic and Projected Population Levels in the Region of Influence

County	1960	1970	1980	1990	2000	2002	2010	2020
Anderson	60,032	60,300	67,346	68,250	71,330	71,627	75,163	77,226
Knox	250,523	276,293	319,694	335,749	382,032	389,327	427,593	481,842
Loudon	23,757	24,266	28,553	31,255	39,086	40,631	48,362	58,729
Roane	39,133	38,88	48,425	47,227	51,910	52,316	57,042	61,836
ROI	373,445	399,740	464,018	482,481	544,358	553,901	608,160	679,633
Tennessee	3,567,089	3,923,687	4,591,120	4,877,203	5,689,283	5,797,289	6,425,969	7,195,375

Source: DOE 2001b, USCB 2005.

Knox County is the largest county in the ROI with a 2003 population of 392,995. 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 41,624. The City of Oak Ridge and the ORR are located in both Roane and Anderson Counties which had 2003 populations of 52,424 and 71,904, respectively (USCB 2005).

There were a total of 244,536 housing units in the ROI in 2000. A summary of ROI housing characteristics is shown in Table 3.8–4. Approximately 8 percent of the housing units were vacant, although some vacant units were used for seasonal, recreational, or other occasional purposes. Rental vacancy rates ranged from 9.0 percent in Loudon County to 13.1 percent in Roane County, while homeowner vacancy rates ranged from 1.7 percent in Roane County, to 2.5 percent in Knox County. Owner-occupied housing units accounted for 64 percent of the total housing units while renter-occupied units accounted for approximately 28 percent (USCB 2000a). In 2000, the median value of owner-occupied housing units ranged from $86,500 in Roane County to $98,500 in Knox County, while the median contract rent ranged from $398 in Roane County to $493 in Knox County.

Table 3.8–4. Region of Influence Housing Characteristics (2000)

County	Total Number of Housing Units	Number of Owner-Occupied Units	Homeowner Vacancy Rates (percent)	Median Value	Number of Occupied Rental Units	Rental Vacancy Rates (percent)	Median Monthly Contract Rent
Anderson	32,451	21,592	1.9	$87,500	8,188	12.8	$450
Knox	171,439	105,562	2.5	$98,500	52,310	10.0	$493
Loudon	17,277	12,612	1.9	$97,300	3,332	9.0	$462
Roane	23,369	16,453	1.7	$86,500	4,747	13.1	$398
ROI	244,536	156,219	NA	NA	68,577	NA	NA

Note: NA - Not applicable.
Source: USCB 2000a.

3.8.3 Community Services

Community services in the ROI include public schools, law enforcement, and medical services. Eight public school districts (DOE 2001b), with approximately 130 K-12 schools, provide educational services for approximately 72,000 students in the ROI (TDE 2007). Higher education opportunities in the ROI include the University of Tennessee as well as several private colleges and two community colleges (DOE 2001b).

Law enforcement is provided by 20 municipal, county, and local police departments that employ over 1,500 officers and civilians. Security at the Y-12 Complex is provided by a government contractor (DOE 2001b).

There are 13 hospitals in the ROI with a total of 2,833 beds. These hospitals operate at an average of 67 percent occupancy. There are 1,525 doctors in the ROI with the majority (1,279) in Knox County (DOE 2001b).

3.9 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 2007b). 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 Executive Order (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 its technical analyses and its public involvement program in accordance with EPA and the CEQ regulations (CEQ 1997).

Demographic information from the U.S. Census Bureau was used to identify minority and low-income populations in the area of influence. 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 (low-population density census tracts generally cover 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 (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 geographic area of comparison for this analysis is the State of Tennessee.

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 the Y-12 Complex are assessed for the census tract which contains the site, the area for which health effects are assessed. Health effects resulting from discharge to water pathways would also be assessed for this area.

Figure 3.9-1 shows the census tracts containing the ORR. Minority populations for these tracts are shown in Table 3.9-1 and low-income populations are shown in Table 3.9-2. Socioeconomic impacts associated with environmental justice concerns are assessed for the four-county ROI described in Section 3.8, Socioeconomics.

Approximately 12,726 people live within the 3 census tracts containing the ORR. Minorities comprise 15.8 percent of this population. In 2000, minorities comprised 24.9 percent of the population nationally and 19.8 percent of the population in Tennessee. There are no federally-recognized Native American groups within 80 km (50 mi) of the Y-12 Complex. For census tract

020100 in Anderson County, the Aggregate of All Minorities category represents 42 percent of the total population. This meets one of the criteria for determining the existence of sensitive populations within the area (i.e., more than 20 percentage points greater than the average for a geographic area of comparison; in this case, the State of Tennessee). None of the census tracts met the "greater than 50 percent" criterion. The percentage of persons below the poverty level is 7.3 percent, which is significantly lower than the 2000 national average of 12.4 percent and the statewide figure of 13.5 percent (USCB 2000d). The Scarboro community is predominately a minority community located approximately 1 km (0.6 mi) north of the Y-12 Complex.

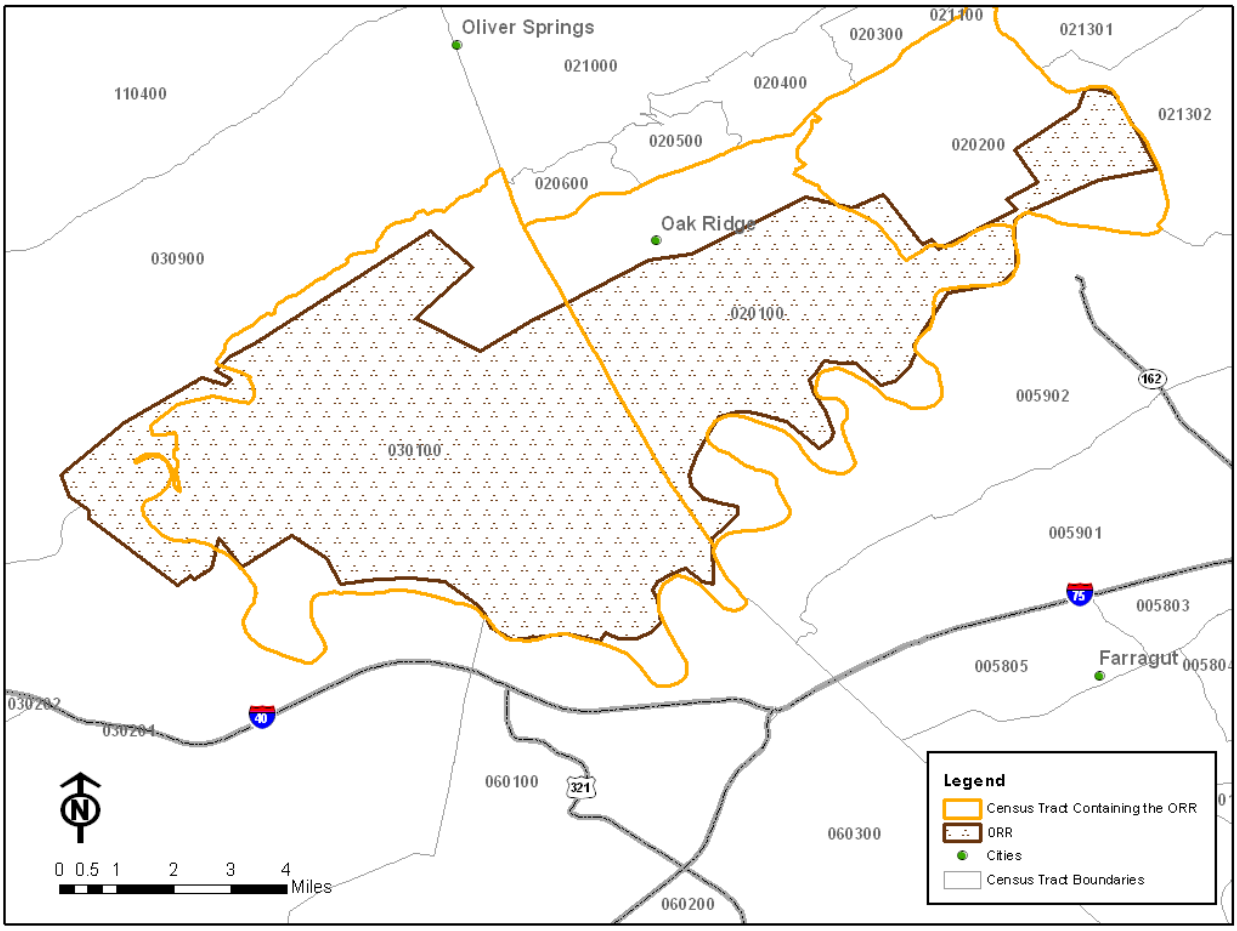


Figure 3.9–1. City of Oak Ridge Census Tracts.

Table 3.9–1. Population Distribution by Race in Census Tracts Containing the ORR

		White		Black		Aggregate: Non-White		Hispanic[a]	
Census Tract	**Total Population**	**Total**	**%**	**Total**	**%**	**Total**	**%**	**Total**	**%**
020100	2,471	1,433	58.0	831	33.6	1038	42.0	92	3.7
020200	7,227	6,458	89.4	343	4.7	769	10.6	125	1.7
030100	3,028	2,826	93.3	68	2.2	202	6.7	48	1.6
Total	**12,726**	**10,717**	**84.2**	**1,242**	**9.8**	**2009**	**15.8**	**265**	**2.1**
Tennessee	5,689,283	4,563,310	80.2	932,809	16.4	1,125,973	19.8	123,838	2.8

[a] Hispanic of any race or origin and is included in other totals.
Shaded box represents a 20 percentage point exceedance of State of Tennessee percentage.
Source: USCB 2000b, 2000c.

Table 3.9–2. Individuals Living Below Poverty Level in Census Tracts Containing the ORR

Census Tract	**Total Population[a]**	**Number of Individuals Below Poverty Level**	**Percentage of Total Individuals in Census Tract Below Poverty Level**
020100	2,363	374	15.8
020200	6,961	471	6.8
030100	3,028	58	1.9
Total	**12,352**	**903**	**7.3**
Tennessee	5,539,896	746,789	13.5

[a]Population for whom poverty status is determined. Assuming less than 100 percent response.
Source: USCB 2000d.

3.10 Traffic and Transportation Safety

3.10.1 On-site Traffic

The Y-12 Complex is located within 80 km (50 mi) of three interstate highways: I-40, I-75, and I-81. Primary roads on the ORR serving the Y-12 Complex include Tennessee State Routes (TSRs) 58, 62, 95, and 170 (Bethel Valley Road) and Bear Creek Road. The daily traffic numbers for various roads at the ORR are provided in Table 3.10–1.

Table 3.10–1. Existing Average Daily Traffic Counts on the ORR Serving Y-12 National Security Complex

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	–	31,620
Bethel Valley Road	TSR 62	–	9,350

Source: TDOT 2005.

3.10.2 Off-site Traffic

The Y-12 Complex is located within 80 km (50 mi) 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, State Route (SR) 61, SR 162, and US 25W at Clinton also serve the Y-12 Complex transportation needs off site (DOE 2001a).

3.11 Occupational and Public Health and Safety

Current activities associated with routine operations at the Y-12 Complex have the potential to affect worker and public health. Air emissions at the Y-12 Complex can expose both groups to radioactive and non-radioactive materials. Liquid effluents discharged to near waterbodies may affect downstream populations using the water for drinking water purposes or recreation. Additionally, workers are exposed to occupational hazards similar to those experienced at most industrial work sites.

3.11.1 Worker Health

Hazardous materials used at the Y-12 Complex that are of particular concern, due to their historical or current uses in plant operations or due to their potential adverse health effects from exposure, include: radionuclides, mercury, beryllium, PCBs, polycyclic aromatic hydrocarbons, and VOCs. In addition to the risks from these chemicals, workers at the Y-12 Complex are at risk from potential standard industrial hazards that if not controlled can lead to accidents, injuries and illnesses due to everyday operations.

Work control processes are implemented utilizing Integrated Safety Management systems (ISMS) in accordance with DOE Policy 450.4, Safety Management System Policy. The core functions of ISMS include defining the scope of work, analyzing the hazards and risks, developing and implementing hazard controls, performing work within controls and providing feedback and continuous improvement.

Worker Safety and Health Program, 10 CFR Part 851, regulates the health and safety of workers at all DOE sites. This comprehensive standard directs DOE contractor's to establish the framework for an effective worker protection program that will reduce or prevent injuries, illnesses, and accidental losses by providing DOE Federal and 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 1910 and 29 CFR 1926, *Occupational Safety and Health Standards*, including the permissible exposure limits (PELs) set by the Occupational Safety and Health Administration (OSHA). DOE requires that all sites comply with the PELs unless a lower limit (more protective) exists in the American Conference of Governmental Industrial Hygienists Threshold Limit Values. In addition, potential beryllium exposure is regulated by 10 CFR Part 850, Chronic Beryllium Disease Prevention Program.

The Y-12 Complex 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*.

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. The average annual dose to an involved worker at the Y-12 Complex during 2000 was 20.1 mrem. The dose to the involved workforce of 3,264 radiation workers was estimated to be 65.7 person-rem (DOE 2001a). The Y-12 Complex worker doses have typically been well below DOE worker exposure limits.

3.11.2 Public Health

In 2004, the total effective dose equivalent (EDE) to the MEI from Y-12 Complex operations was 0.4 mrem. The MEI for the Y-12 Complex was located approximately 2,306 m (1.4 mi) east-northwest of the main Y-12 Complex release point. Inhalation and ingestion of uranium isotopes accounted for more than 99 percent of the dose to the MEI (DOE 2005d). The NESHAP standard for airborne releases is 10 mrem per year and applies to the sum of doses from all airborne pathways (inhalation, submersion in a plume, exposure to radionuclides

deposited on the ground, and consumption of foods contaminated as a result of deposition of radionuclides). The DOE Order 5400.5 MEI dose standard for all pathways is 100 mrem per year.

Waterborne releases using the worst case EDE for all pathways in a water-body segment resulted in an MEI dose of 0.4 mrem in 2004 (DOE 2005d). The DOE standard is 4 mrem per year to the MEI from the drinking water pathway.

The population within an 80 km (50 mi) radius of ORR was 1,040,041 in 2004. In 2004, based on the 2000 census data, the 50-year committed collective EDE to the population within 80 km (50 mi) of the ORR was 12 person-rem for all pathways, 5.8 person-rem from atmospheric releases at the Y-12 Complex and as high as 0.7 person-rem from waterborne releases (DOE 2005d). Based on a dose to risk conversion factor of 5.0×10^{-4} fatal cancers per person-rem (ICRP 1991), the collective EDE of 12 person-rem would statistically result in less than one additional latent cancer death within the population.

Several epidemiological studies have been completed on the Y-12 Complex workers to evaluate the potential health effects from radiation and chemical exposures. The Y-12 Complex workers have also been included in many site-wide health studies. In addition to these reviews, community-wide health patterns have been studied in Anderson and Roane counties. There are several ongoing occupational health studies dealing with the Y-12 Complex, including an ongoing study of the public health impact from releases of hazardous materials from the DOE operations at Oak Ridge. This assessment will help identify and characterize both the current and past exposures of offsite populations to radiological and chemical contaminants. For additional information on worker and surrounding public health, refer to the Y-12 SWEIS (DOE 2001a), Section 4.12.2 and Appendix D, Human Health and Worker Safety.

3.12 Waste Management

The Federal Facility Compliance Act and CERCLA are two laws passed by Congress to address hazardous and radioactive waste. The Federal Facility Compliance Agreement, made in accordance with the Federal Facility Compliance Act, requires that all DOE facilities manage and dispose of waste in accordance with their respective site treatment plans. The Waste Disposition and Waste Operations projects address waste stored, treated, disposed of, or

recycled on the ORR in accordance with the Site Treatment Plan. The DOE Environmental Management (EM) program also operates and maintains waste treatment, storage, disposal, and recycling facilities at each of the three Oak Ridge sites (ETTP, ORNL, and the Y-12 Complex). The TDEC regulates the management of hazardous and non-hazardous waste streams under the *Resource Conservation and Recovery Act* (RCRA) and TDEC Chapter 1200-1-7 Solid Waste Regulations. CERCLA demolition waste is disposed of at the EMWMF.

Waste management services at the Y-12 Complex include a pollution prevention program, sanitary waste; recycle waste, legacy waste disposition and a hazardous waste management program. In addition, the Y-12 Complex houses several on-site waste management facilities including the west end treatment facility, tank farms, and tanker terminal.

3.12.1 Waste Generation from Routine Operations

The major waste types generated at the Y-12 Complex from routine operations include low level waste (LLW), mixed-LLW, hazardous waste, and nonhazardous waste. Table 3.12–1 presents a summary of waste generation totals for routine operations at Y-12 for FY2003. Other waste includes sanitary and industrial wastewater, construction debris, general refuse, and medical wastes. Y-12 does not generate or manage high-level radiological waste or transuranic waste.

Table 3.12–1. Summary of Waste Generation Totals by Waste Type for Routine Operations at Y-12 National Security Complex

Waste Type	Waste Volume (FY 2006)
Low-Level Waste (Liquid)	3.68 m^3 (4.81 yd^3)
Low-Level Waste (Solid)	3,998.36 m^3 (5,229.66 yd^3)
Mixed Low Level Waste (Liquid)	3.95 m^3 (5.17 yd^3)
Mixed Low Level Waste (Solid)	126.75 m^3 (165.78 yd^3)
RCRA Waste	12.85 metric tons (14.16 short tons)
TSCA Waste	0.06 metric tons (0.066 short tons)
Mixed TSCA	0.74 metric tons (0.82 short tons)
Sanitary Waste	14,203.81 metric tons (15,657.02 short tons)

Source: Gilbert 2007.

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 the Y-12 Complex. In Fiscal Year (FY) 2003, the Y-12 Complex generated approximately 5,960 cubic meters (m^3) (7,797 cubic yards [yd^3]) of LLW. Liquid LLW is treated in several facilities, including the West End Treatment Facility (WETF). The Y-12 Complex is

the largest generator of routine LLW at Oak Ridge. In FY2003, the Y-12 Complex generated 13.32 m^3 (17.42 yd^3) of liquid LLW.

Mixed Low-Level Waste. Mixed waste and LLW subject to treatment requirements to meet Land Disposal Restrictions (LDRs) under RCRA are generated and stored at the Y-12 Complex. 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. *Toxic Substance Control Act* (TSCA)-regulated waste (containing PCBs) that is also radioactive waste is managed under a separate Federal Facilities Compliance Agreement (FFCA), effective February 20, 1992.

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 2003, the Y-12 Complex generated 13 metric tons (14.3 short tons) of RCRA waste. The hazardous waste is shipped offsite for treatment and disposal at either DOE or commercially-permitted facilities (Gilbert 2003).

Other Waste Types. Treated industrial wastewater is discharged to the UEFPC under a NPDES permit issued by the State of Tennessee. Sanitary wastewater is discharged to the City of Oak Ridge publicly-owned treatment works. PCBs are transported to permitted facilities for treatment and disposal. Medical wastes are autoclaved to render them noninfectious and are then sent to the Y-12 Complex 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 the Y-12 Complex.

Capacities. Excess treatment and disposal capacity exists both onsite and offsite for hazardous waste at the Y-12 Complex. Storage capacities at the Y-12 Complex are currently adequate for hazardous, mixed, and low-level waste.

3.12.2 Waste Generation from Environmental Restoration Activities

Environmental Restoration Waste. EPA placed the ORR on the National Priority List on November 21, 1989. DOE, EPA Region IV, and TDEC entered into a Federal Facilities

Agreement (FFA) effective January 1, 1992. This agreement coordinated the ORR inactive site assessment and remedial action. Groundwater, surface water, and soil contamination will be remediated to a level consistent with future use of these sites as identified in the CERCLA and RCRA processes. CERCLA demolition waste is disposed of at the EMWMF.

3.13 Visual Resources

The ORR landscape 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. Much of the ORR's open fields (about 2,020 ha [4,991 acres]) have been planted in shortleaf and loblolly pine. Smaller areas have been planted with a variety of deciduous and coniferous trees.

For the purpose of rating the scenic quality of the Y-12 Complex 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 the Y-12 Complex however; the level of development at the Y-12 Complex is consistent with VRM Class IV which is used to describe a highly developed area. Most of the land surrounding the Y-12 Complex site would be consistent with VRM Class II and III (i.e., left to its natural state with little to moderate changes).

The viewshed, which is the extent of the area that may be viewed from the 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 on Pine Ridge at the Y-12 Complex, can be seen from the urban areas of the City of Oak Ridge.

The Y-12 Complex is situated in Bear Creek Valley at the eastern boundary of the ORR. It is bounded by Pine Ridge to the north and Chestnut Ridge to the south. The area surrounding the Y-12 Complex consists of a mixture of wooded and undeveloped areas. Facilities at Y-12 are

brightly lit at night, making them especially visible. There are no visible daytime plumes over Y-12.

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 at the west end of Y-12 located on a slight rise across from the intersection of Old Bear Creek Road and Bear Creek Road.

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

4.0 Environmental Consequences

4.1 Land Use

4.1.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. The main area of the Y-12 Complex is largely developed and because of the Site's defense support, manufacturing, and storage facilities, the land is classified in DOE's industrial use category. The Proposed Action, to construct a long term source of steam production for the Y-12 Complex would be consistent with the current land use patterns at the Y-12 Complex. The Proposed Action would use commercially available packaged boiler systems technology and would be constructed on the site that is currently occupied by office buildings. Fuel oil storage would be diked and located on a vacant area near the proposed location for the new boiler house. There would be no alterations of current land use patterns or planning resulting from the Proposed Action.

Operation. Operation of the Skid Mounted Gas Fired Boilers would be consistent with the current land use patterns at the Y-12 Complex. There would be no alteration of current land use patterns or planning resulting from the Proposed Action.

4.1.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. In general, construction activities under this alternative would consist mostly of internal building modifications and renovation at the existing Y-12 Steam Plant. Land uses at the Y-12 Complex would be compatible with surrounding areas and with land use plans. If external building modifications and renovation occur land use impacts would include disturbance to areas surrounding the existing building for construction laydown areas; however areas surrounding the existing Y-12 Steam Plant have been previously disturbed; therefore, there would be no alteration to the current land use patterns or planning.

Operation. Under this alternative, operations would not impact land use resources because activities would be substantially identical to existing operations and would be located in previously disturbed or heavily industrialized portions of the Y-12 Complex.

4.1.3 Alternative 3 – No Action Alternative

Under the No Action Alternative, impacts would be similar to those discussed above for Alternative 2. Under this alternative there is a potential for external building modifications and renovations and would occur as necessary; however areas surrounding the existing Y-12 Steam Plant have been previously disturbed; therefore, there would be no alternation to the current land use patterns or planning.

4.2 Geology and Soils

4.2.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. Construction of the new boiler house and fuel oil storage facility may require the top five feet of soils to be removed and replaced with engineered fill after the removal of the existing concrete slabs. New concrete foundation and slabs will be constructed to support the boiler house and the packaged boilers. Any additional impacts on geological resources, and the hazards posed by geological conditions are expected to be minor. The bedrock at the Y-12 Complex is adequate to support structures using standard construction techniques.

The construction of the new boiler house and fuel oil storage facility would require grading and excavation of soil for a new building foundation and placement of tanks, secondary containment dike, and new natural gas line extension. The boiler house and fuel oil storage project area will be located on currently occupied sites. Soil characterization sampling has been completed and results provided in the BWXT Y-12 Complex report, *Steam Package Plant and Oil Tank Farm Report on Site Characteristics and Sample Locations* (RP-PJ-940107-A002).

Based on the seismic history of the area, a moderate seismic risk exists at the Y-12 Complex. The boiler house and fuel oil storage facility would be designed and constructed to meet all regulatory requirements.

There is a potential for soil disturbance as a result of the excavation, backfilling, and placement of a new concrete foundations and slabs. Excavation of approximately 900 linear feet of soil trenching will be required to tie a natural gas line extension in to the existing natural gas line. The potential for soil contamination from project activities would be minimized by complying with

DOE waste management procedures and existing the Y-12 Complex administrative controls. Disturbance of the EFPC will be avoided by use of an elevated pipe bridge.

Operation. No impacts to geology and soils are anticipated from the operation of the Proposed Action. The new facilities would have no added impact on geology or soils during operation because of site design and engineered control measures. Runoff control ditches would be utilized to minimize impacts if any should occur. The Y-12 Complex Spill Prevention Control and Countermeasures (SPCC) plan would also minimize potential impacts.

4.2.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. Under this alternative, construction activities would consist mostly of internal building modifications and renovation at the existing Y-12 Steam Plant, therefore there would be no disturbance to the geology of the site. There is a potential for soil disturbance as a result of the excavation, backfilling, and placement of foundations and slabs.

Operation. No impacts to geology and soils are anticipated from the operation of the Proposed Action. Control measures currently in place, such as the Y-12 SPCC plan would help to minimize potential impacts.

4.2.3 Alternative 3 – No Action Alternative

Under the No Action alternative, no new construction or land disturbing activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur. The No Action alternative would not result in any immediate changes to the current geology and soils at the Y-12 Complex. However, continued maintenance requirements would result in General Plant Projects spread over the useful life of the existing Y-12 Steam Plant.

4.3 Climate and Air Quality

4.3.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. Under the Proposed Action, construction of the new boiler house and fuel oil storage facility would affect air quality temporarily.

During preparation and construction, the use of heavy equipment would generate combustion engine exhaust that contains air pollutants associated with diesel combustion (NO_x, CO, SO_x [sulfur oxides], PM_{10} and VOCs). Similar air emissions would be generated from delivery vehicles that bring supplies and equipment to the construction site and from construction workers that commute to work in their personal vehicles. There would be a relatively limited amount of construction equipment and small number of construction workers. The quantities of air pollutants produced by vehicles and equipment associated with construction would not be a substantial contribution to the total emissions from mobile sources that already operate in the area and would not be expected to significantly change air quality at the Y-12 Complex.

In addition, construction activities could generate an increase in fugitive dust (i.e., airborne particulate matter that escapes from a construction site) from earthmoving and other construction vehicle movement. Air emissions generated during construction would not be subject to additional permitting requirements, but would be subject to state regulations that limit fugitive emissions (TDEC Rules Chapter 1200-3-8). Appropriate mitigation measures would be implemented in accordance with TDEC Rules for Fugitive Dust. These measures include, but are not limited to the following:

- Use, where possible, of water or chemicals for control of dust associated with land clearing and construction operations.
- Application of asphalt, water, or suitable chemicals on dirt roads, material stock piles, and other surfaces which can create airborne dusts.
- Installation and use of hoods, fans, and fabric filters to enclose and mitigate release of dusty materials. Adequate containment methods shall be employed during sandblasting or other similar operations.

The potential effect on ambient air quality from construction activities would be temporary and localized and would not affect the overall air quality of the region. The Proposed Action would not have a net effect on regional climatic conditions.

Operation. Under this alternative, the addition and operation of four 80,000 lb/hour water tube packaged boilers with low NOx burners would have an overall positive impact on the air quality. Currently at the Y-12 Complex there are three operating Wickes boilers each rated at a maximum steam output of 250,000 lb/hour a combined 750,000 lb/hour. These existing boilers can burn coal and natural gas. Combined steam output for the proposed boiler system would be 320,000 lb/hr. The new boilers would burn natural gas with fuel oil back-up. During natural gas curtailment operation (expected to be less than 50 days per year) one boiler of the proposed system would operate on Number 2 fuel oil. State issued clean air construction and operating permits would be obtained prior to construction and operating the proposed boiler system. The new permit limits for pollutant emissions (all pollutants) from the new boilers would be significantly less than the current permit limits for pollutant emissions from the old boilers. The new Y-12 Steam Plant would be designed to meet the new lower limits.

Table 4.3-1 displays a comparison of existing Y-12 Steam Plant emissions, current emission limits, and estimated emissions from the Proposed Action. Actual emissions are expected to be significantly lower under the Proposed Action versus current operations 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 would be eliminated. Actual emissions under worst case fuel conditions are expected to be slightly higher, by 2-5 tons per year, for $PM_{2.5}$, PM_{10}, and Volatile Organic Carbons (VOCs). Carbon monoxide emissions are expected to be 82 tons higher under the Proposed Action versus current conditions. Increased carbon monoxide emissions under the Proposed Action are due to the large amount of natural gas burned along with No. 2 fuel oil during natural gas curtailment and does 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.

Once installed, the proposed system upgrades would not require additional workers, and therefore, no associated increase in emissions from private motor vehicles as workers commute to and from the site are expected.

Table 4.3–1. Air Emissions of Existing Y-12 Steam Plant and Packaged Boilers

	Existing Y-12 Steam Plant (Boilers)			Proposed Alternative Package Boilers	
	CY 2006 Emissions (tons/yr)		Concentration Allowable (permit)	Worst Case Fuel Scenario Emissions (tons/yr)	
Pollutant	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

[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 8760 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 1995 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 proposed emissions are calculated based on a maximum heat input of 99 millions Btu/hr, and the projected actual emissions are based on a projected heat input of 75 millions Btu/hr.

4.3.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. Under this alternative, construction activities would consist mostly of internal building modifications and renovation at the existing Y-12 Steam Plant, therefore air quality and climate would not be impacted.

Operation. Operation of replaced/repaired boilers and associated auxiliary systems of the existing Y-12 Steam Plant would cause similar emissions as the current operations. As with the proposed action, a state issued clean air construction permit would be obtained prior to conducting the life extension project. Permit conditions would be incorporated into a revised operating permit for the existing boiler system. The new permit limits for pollutant emissions (all pollutants) from the boilers (post-life extension) would be significantly less than the current permit limits for pollutant emissions from the existing boilers (pre-life extension). Also, similar to the Proposed Alternative, some actual emission increases may be experienced due to normal operating fluctuations, however, none of the projected emission increases would be considered significant for the purposes of non-attainment New Source Review or Prevention of Significant Deterioration permitting.

4.3.3 Alternative 3 – No Action Alternative

Construction. Under the No Action Alternative, the Y-12 Steam Plant would continue to be a primary source of criteria pollutants. All criteria pollutant concentration expected would remain below national and TDEC standards, except for 8-hour ozone and $PM_{2.5}$, which currently exceeds standards throughout the region. No new construction or land disturbing activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur, therefore there would be no additional impact on the air quality and climate.

Operation. During current operations at the Y-12 Steam Plant emissions would stay the same, and may even increase due to a decrease in performance of aging equipment.

4.4 Noise

4.4.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. The onsite and offsite acoustical environments would be impacted during construction of the proposed boiler house and fuel oil storage facility. Construction activities would generate noise produced by heavy construction equipment, trucks and power tools. In addition, traffic noise would be 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 a medium-scale construction site. Table 4.4–1 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, site preparation, heavy equipment noise would become more sporadic and brief in duration. The noise from trucks, power tools, and percussion equipment would be sustained through most of the construction and equipment installation activities on the proposed facility site.

Construction activities normally would be limited to daytime hours and thus would not impact existing background noise levels at night. As construction activities reach their conclusion,

sound levels on the proposed 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 (DOE 2001a).

Table 4.4–1. 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.

Peak attenuated noise levels at offsite locations within the City of Oak Ridge from construction activities would be similar to background noise levels (53 to 62 dBA) as shown in Table 4.4–1.

The *Noise Control Act* of 1972 (42 U.S.C. §4901), and *Occupational Noise Exposure* (29 CFR 1910.95) include noise reduction and mitigation measures. For sound levels that exceed those listed in Table 4.4–2, feasible administrative or engineered controls would be used. If such controls fail to reduce sound levels to within the levels shown in Table 4.4–2, personal protective equipment (e.g., ear plugs) would be provided and used to reduce sound levels within acceptable levels. Continued compliance measures would be taken to ensure personnel do not experience hearing damage or loss.

Operation. Operation of the new packaged boiler system and associated systems would generate noise that is consistent with existing conditions. Operation under the Proposed Action would therefore have a negligible effect on ambient noise levels, and the facility would satisfy the noise regulations established by Anderson County (Table 3.4–1). Operation under this

alternative would not require the addition of workers and would therefore, not produce an increase in noise from private motor vehicles used by workers to commute to and from work.

Table 4.4–2. Permissible Noise Exposure

Duration Per Day, hours	Sound Level dBA Slow Response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	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.

Source: DOE 2001a.

4.4.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. The onsite and offsite acoustical environments would be impacted during construction of the proposed replacements/repairs to the three boilers and associated auxiliary systems of the existing Y-12 Steam Plant. Alternative 2, construction activities would consist mostly of internal building modifications and renovation. The level of noise would be representative of levels at a small-scale construction site. Table 4.4-1 describes peak attenuated noise levels expected from operation of construction equipment. Noise impacts from the use of heavy equipment would be the same as that of the Proposed Action.

Peak attenuated noise levels at offsite locations within the City of Oak Ridge from construction activities would be similar to background noise levels (53 to 62 dBA) as shown in Table 4.4-1.

The *Noise Control Act* of 1972 (42 U.S.C. §4901), and *Occupational Noise Exposure* (29 CFR 1910.95) include noise reduction and mitigation measures. Similar feasible administrative or engineered control and/or personal protective equipment would be used to reduce sound levels within acceptable levels. Continued compliance measures would be taken to ensure personnel do not experience hearing damage or loss.

Operation. Operation of upgraded equipment and systems would generate noise that is consistent with existing conditions. Operation under Alternative 2 would therefore have a negligible effect on ambient noise levels, and the facility would satisfy the noise regulations established by Anderson County (Table 3.4-1). Operation under this alternative would not require the addition of workers and would therefore, not produce an increase in noise from private motor vehicles used by workers to commute to and from work.

4.4.3 Alternative 3 – No Action Alternative

Construction. Under the No Action alternative, no new construction or land disturbing activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur, therefore there would be no impact on noise levels at the Y-12 Steam Plant.

Operation. Under the No Action alternative, no new construction or land disturbing activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur. The No Action alternative would not result in any changes to the current noise levels at the Y-12 Complex.

4.5 Water Resources

4.5.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. At the project site, minimal alteration of the natural drainage pattern of the surface water would occur during construction activities. The construction of the natural gas line across EFPC would follow the existing abandoned natural gas line route and be constructed on a pipe bridge across the EFPC. The construction activities are not expected to impact groundwater flow or quality therefore, no impacts are expected.

Minimal alteration of surface water flow drainage pattern due to excavation activities along the gas line extension and at the tie in location would be expected during construction activities. Some potential exists for temporary siltation due to surface erosion of construction and soil stockpile areas. This would be controlled by use of normal the Y-12 Complex construction techniques implementing best management practices (BMPs). In addition, DOE will prepare

and implement a Stormwater Pollution Prevention Plan (SWPP) in accordance with the Tennessee Erosion and Sediment Control Handbook. The SWPP will be prepared based on the scope of final design documents. If the Proposed Action's land disturbing activities are planned to exceed one acre, a Notice of Intent approval will be obtained from the TDEC prior to executing land disturbing activities. The installation of the underground gas line and facility construction are not expected to impact groundwater flow or quality therefore, no impacts are expected.

Operation. There would be no impacts to water resources beyond current conditions from the operation of the Proposed Action.

4.5.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. Construction activities are not expected to impact groundwater flow or quality.

Surface water flow drainage pattern would remain the same during excavation activities because the site for the boiler house has been previously developed. No effect to groundwater flow or quality is expected from the repair/replacement of existing Y-12 Steam Plant equipment. Surface erosion of the construction areas would be controlled by use of normal the Y-12 Complex construction techniques implementing BMPs.

Operations. There would be no impacts to water resources from the operation of Alternative 2.

4.5.3 Alternative 3 – No Action Alternative

Construction. Under the No Action alternative, no new construction activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur, therefore there would be no impact on the water resources at the Y-12 Steam Plant.

Operation. There would be no change to impacts to water resources from current operations. Average annual water use at the Y-12 Complex is approximately 2,000 million gal/yr; discharges are within NPDES requirements; and stormwater runoff and erosion control management

practices are ongoing. There would be no impact to groundwater under continued current operations.

4.6 Ecological Resources

4.6.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. Under this Proposed Action, construction of boiler house and bulk oil storage would be on previously disturbed land and therefore would not impact ecological resources. In addition, DOE will prepare and implement a SWPP in accordance with the Tennessee Erosion and Sediment Control Handbook. The SWPP will be prepared based on the scope of final design documents. If the Proposed Action's land disturbing activities are planned to exceed one acre, a Notice of Intent approval will be obtained from the TDEC prior to executing land disturbing activities.

Operation. There would be no impacts to ecological resources from the operations of this alternative.

4.6.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. No impacts to ecological resources would occur under the Life Extension of the Existing Plant Alternative due to construction activities consisting of mostly internal building modifications and renovation.

Operation. There would be no impacts to ecological resources from the operations of this alternative because activities would be located in previously disturbed or heavily industrialized portions of the Y-12 Complex that do not contain sufficient habitat to support ecologically diverse species.

4.6.3 Alternative 3 – No Action Alternative

Construction. Under the No Action alternative, no new construction or land disturbing activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur.

Operation. There would be no change to impacts on ecological resources from current operations or what has been previously assessed.

4.7 Cultural Resources

4.7.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. The Y-12 Complex has been previously surveyed for the presence of cultural resources. The proposed construction site for the new boiler house and bulk oil storage is located in a previously disturbed area. The construction and laydown areas would be fenced during all construction activities to prevent activities from being conducted outside these areas, and erosion control measures would be implemented during construction.

There would be no effect to historic properties from construction of the new boiler house and bulk oil storage. The historic district includes much of the Y-12 Complex; however the proposed site is not located within the district or near the two buildings proposed for National Historic Landmark status or other properties eligible for inclusion in the National Register.

Operation. There would be no impact on historic properties from the operation the Proposed Action.

4.7.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. No historic properties included in or eligible for inclusion in the NRHP, pursuant to 36 CFR 60.4, would be affected by the construction of Alternative 2 because construction activities would consist mostly of internal building modifications and renovation.

Operation. There would be no impact on historic properties from the operation of Alternative 2.

4.7.3 Alternative 3– No Action Alternative

Under the No Action alternative, no new construction or other activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents would occur. There would be no impacts to historic properties.

4.8 Socioeconomics

Socioeconomic impacts are determined relative to the context of the affected environment. Projected baseline conditions in the ROI, as presented in Section 3.8, provide the framework for analyzing the importance of potential socioeconomic impacts that could result from implementation of the Proposed Action or Alternatives.

4.8.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. Construction under the Proposed Action would require approximately 57,500 labor hours, and would have short- and long-term positive benefits on employment and income in the region. It is expected that most of the construction jobs would be filled by the existing labor force; having no noticeable effect on regional income, housing markets, or the demand for community services.

Operation. Currently, there are 20 full time employees running the Y-12 Steam Plant at a cost of approximately $4,500,000/yr. Operation of the new Steam Plant will require approximately 7 operators. There would be no net change in employment because the displaced 13 personnel would be transferred to other facilities at the Y-12 Complex. Maintenance of the new Steam Plant would be outsourced to the existing labor force. This would result in no noticeable effect on regional income, housing markets, or the demand for community services.

4.8.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. This alternative would require construction workers to make immediate repairs to the existing Y-12 Steam Plant. It is expected that most of the construction jobs would be filled by the existing labor force; having no noticeable effect on regional income, housing markets, or the demand for community services.

Operation. There would be no net change in employment because current personnel would be able to maintain and operate the Steam Plant.

4.8.3 Alternative 3 – No Action Alternative

Under No Action, none of the construction, needed repairs, or upgrades would be made immediately to the existing Y-12 Steam Plant. Instead, maintenance activities would continuously be conducted as each failure occurs. These activities would gradually increase in frequency and would be conducted by the existing labor force. There would be no construction workers employed from the pool of such workers in the ROI, and therefore there would be no short- or long-term positive benefits on employment and income in the region from construction work related to this action.

Operation. There would be no net change in employment since no change in operation would occur.

4.9 Environmental Justice

Pursuant to Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, environmental justice analyses identify and address any disproportionately high and adverse human health or environmental effects on minority or low-income populations. Adverse health effects may include bodily impairment, infirmity, illness, or death. Adverse environmental effects include socioeconomic effects, when those impacts are interrelated to impacts on the natural or physical environment.

Disproportionately high and adverse human health effects are identified by assessing these three factors:

- Whether the adverse health effects, which may be measured in risks or rates, are significant or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.

- Whether health effects occur in a minority population or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

- Whether the risk or rate of exposure to a minority population or low-income population to an environmental hazard is significant and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.
- As discussed in Section 3.9, of the three census tracts analyzed for the presence of minority and low-income populations, only census tract 020100, in Anderson County, meets the criteria for having a minority population. When considering the aggregate of the minorities, the sum of all minorities in the tract, the total percentage is more than 20 percentage points higher than the state percentage.

4.9.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

As discussed in Sections 4.1 through 4.13, Alternative 1 would pose no appreciable health and/or environmental risks to the public, and therefore, no disproportionately high and adverse effects to minority populations or low-income populations. In addition, there are no special circumstances that would result in disproportionately high and adverse impacts on minority or low-income populations from any exposure pathway. Therefore, there would be no environmental justice impacts.

4.9.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Environmental justice impacts from construction and operation would be similar to those described for Alternative 1, the Proposed Action.

4.9.3 Alternative 3 – No Action Alternative

Environmental justice impacts from construction and operation would be similar to those described for Alternative 1, the Proposed Action.

4.10 Traffic and Transportation Safety

4.10.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. Under the Proposed Action there would be a minimal increase in traffic during construction of the boiler house building and storage facility. Construction related traffic would

add negligible number of additional worker vehicles per day. Minor traffic interruptions would be expected near the project site due to construction vehicles entering and leaving the site. Construction activities would be temporary and would not result in long-term effects.

Operation. Operations under Alternative 1 would not change level-of-service (LOS) on roads because the Y-12 Complex workforce would not increase and therefore, no extra worker vehicles would be on site. Coal truck deliveries for the existing Y-12 Steam Plant (approximately 12-15 delivers, 5 days/week) would be eliminated for a net reduction in traffic.

4.10.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. Under the Proposed Action there would be a minimal increase in traffic during construction of the boiler house building and storage facility. Construction related traffic would add negligible number of worker vehicles per day. Minor traffic interruptions would be expected near the project site due to construction vehicles entering and leaving the site. Construction activities would be temporary and would not result in long-term effects.

Operation. Operations under this alternative would not change LOS on roads, because the Y-12 Complex workforce would not increase and therefore no extra worker vehicles would be on site.

4.10.3 Alternative 3 – No Action Alternative

Primary roads on the ORR serving the Y-12 Complex include SRs 58, 62, 95, 170 (Bethel Valley Road) and Bear Creek Road. All are public roads except Bear Creek Road which traverses the ORR. Traffic statistics associated with No Action alternative are shown in Table 3.10–1. Average daily traffic on the ORR and area roads serving the Y-12 Complex ranges from 9,350 at Bethel Valley Road to 31,620 at SR 62. Major off-site area roads for long-distance transport of materials and waste include I-40, I-75, and I-81. There would be no change in traffic and transportation effects under the No Action alternative.

4.11 Occupational and Public Health and Safety

4.11.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. Occupational hazards associated with construction of the facility would be considered standard industrial hazards. Such hazards are defined as meeting one of the following criteria: (1) routinely encountered or accepted by the public in everyday life; (2) encountered in general industry and significantly affecting a large number of people; or (3) encountered in general industry and controlled through the application of recognized codes and safety standards [e.g., OSHA standards]. Workers will comply with DOE Worker Safety and Health requirements in 10 CFR 851 and the Y-12 Complex safety provisions to mitigate the incidence of construction related injuries or illnesses.

All activities would be conducted in full accordance with DOE/NNSA policies regarding protection of personnel and the environment. Any materials removed from the construction site, such as wastes, would be contained and checked for radioactivity/toxicity and disposed of based on the content of the waste. To avoid exposure from potential spills of liquids during construction, construction personnel would be trained in accordance with the Y-12 Complex spill prevention control countermeasures and contingency plans.

Based on the seismic history of the area, a moderate seismic risk exists at the Y-12 Complex. However, this should not impact the construction and operation of the Boiler House Building System and storage facilities since the design criteria considers appropriate structural design factors for natural phenomena (seismic). There are no known currently active faults within or adjacent to the proposed project site. Slopes and underlying foundation materials are generally stable at the Y-12 Complex. The foundation soils are not susceptible to liquefaction.

Operation. Improvements to the existing Y-12 Steam Plant would result in a reduced risk to the Y-12 Complex workers and the surrounding public by replacing the aged boiler system with a new one.

The Proposed Action would require the transport, storage, use, and/or disposal of hazardous materials such as No. 2 fuel oil. The Proposed Action would not introduce any new hazardous materials.

4.11.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. Health and safety impacts from construction would be similar to those described for Alternative 1, the Proposed Action.

Operation. Improvements to the existing Y-12 Steam Plant would result in a reduced risk to the Y-12 Complex workers and the surrounding public by replacing/repairing the aged boiler system.

4.11.3 Alternative 3 – No Action Alternative

Under the No Action alternative, the existing Y-12 Steam Plant would continue to degrade and would require major maintenance in order to continue to operate or would have to be shut down. Furthermore, there would be an increased risk of system failure, resulting in a direct impact on the Y-12 Complex mission and on the health and safety of workers.

4.12 Waste Management

4.12.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. Under the Proposed Action, a boiler house and storage facility would be constructed for the new packaged boiler system technologies and associated fuel on the site that is currently occupied by office buildings. The existing structures would be removed by the IR program. Waste and recycle materials would be surveyed or reviewed and tagged by Radiological Control personnel unless noted otherwise. Waste materials, not including recyclable materials, would be characterized and packaged in accordance with the requirements of the master waste profiles in effect at the time of generation.

Soil. There is a potential for soil disturbance during construction of the boiler house and fuel storage facility. If there is a necessity to excavate and replace with an engineered fill due to unsuitability for construction, the material removed, though not environmentally contaminated, may require disposal and would be handled according to the *Soil Management Plan for the Oak Ridge Y-12 National Security Complex* (Y/SUB/92-28B9923C-Y-5).

Storm water and groundwater. Control and discharge of storm water and groundwater would be in accordance with the BMP Plan and Storm Water Control. Environmental Compliance personnel would approve, on a case-by-case basis, any discharge to the storm drain that is not covered by the BMP Plan or Storm Water Control Plan.

Sanitary refuse. Sanitary refuse such as lunch bags, food waste, plastic, and paper would be deposited in green sanitary waste dumpsters or transported to the onsite Industrial Landfill V (ILFV) or state-approved landfill.

Wood. Scrap wood, including excess pallets would be segregated into painted or treated wood and unpainted or untreated wood. Painted or treated wood would be transported to the onsite Construction Demolition Landfill VII (CDL VII) or state-approved landfill. Unpainted untreated wood would be recycled (DOE 2005d).

Scrap metal. Unpainted scrap metal that has not been in a posted radiological area and that is approved by Radiological Control personnel for release to the public would be recycled. Scrap metal that is generated from a posted radiological area cannot be recycled. Clean scrap metal would be transported to the onsite CDL VII for disposal. Painted metal with PCB concentrations of 50 ppm or greater would be managed as bulk PCB regulated waste. Radiologically-contaminated metal with bulk PCB concentration of 50 ppm or greater would be containerized as mixed waste.

Asphalt and concrete. Asphalt and concrete would be surveyed and evaluated by Radiological Control personnel before being disturbed. Any radiologically-contaminated asphalt or concrete would be removed and containerized as low-level radioactive waste (LLRW) and managed in accordance with Procedure Y71-936, *Radioactive Waste Management at the Y-12 Complex*. Asphalt and concrete approved by Radiological Control personnel would be transported to the onsite CDL VII for disposal.

Sewer pipe. Clay, concrete or cast iron pipe from storm and sanitary sewer lines may be encountered. Pipe that can be approved by Radiological Control personnel would be disposed of in CDL VII. Large accumulations of sediment within the pipe should be evaluated by the Environmental Compliance organization to determine the need for sampling for possible

hazardous constituents. Pipe that is determined to be radiologically-contaminated would be containerized for disposal as LLRW.

Asbestos insulation. Friable asbestos-containing materials (ACM), such as insulation, that can be approved by Radiological Control personnel would be packaged and sealed tightly in double-bagged 6-mil-thick plastic bags, double-wrapped 6-mil-thick plastic sheeting, or secured in drums or boxes. Asbestos insulation would be removed from pipes greater than 20 cm (8 in) in diameter. Insulation may be left on pipes with diameter of 20 cm (8 in) or less, and the entire waste may be managed as ACM. ACM approved by Radiological Control personnel would be disposed of as a special waste onsite at ILFV.

Non-asbestos insulation. Non-asbestos insulation would be surveyed by Radiological Control personnel before removal. Insulation that can be approved by Radiological Control personnel would be packaged and tightly sealed in single 6-mil-thick plastic bags, wrapped in 6-mil-thick plastic sheets, fiber drums, metal drums, plywood boxes, or metal boxes. The packages would be transported to ILFV by the construction subcontractor in such a manner to prevent airborne release or loss of the waste.

Corrugated cardboard and aluminum beverage cans. Corrugated cardboard and aluminum beverage cans would be recycled.

There would be no environmental impact resulting from waste management of generated wastes from the Proposed Action.

Operation. The waste generation (feedwater treatment system waste streams and boiler blowdown waste streams) from the operation of Alternative 1, the Proposed Action, would be less than current waste generation because the new boiler system would be producing less than half of the current steam production.

4.12.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. It is anticipated that impacts to current waste management at the Y-12 Complex from replacement and repair activities would be greater than those described for Alternative 1, Because of its current condition, the existing Y-12 Steam Plant would require extensive

renovation to or replacement of many of its existing systems and components including the coal-handling system, feedwater system forced-draft system, induced-draft system, ash-handling systems, and plant control and electrical systems and would therefore generate more waste than those described for Alternative 1.

Operation. There would be no change to current waste generation from the operation of Alternative 2.

4.12.3 Alternative 3 – No Action Alternative

Construction. It is anticipated that impacts to current waste management at the Y-12 Complex under the No Action Alternative would be similar to those described for Alternative 2, but on a lower scale. As discussed for Alternative 2, the existing Y-12 Steam Plant would require extensive renovation and replacement of many of its systems however, under this alternative renovation and replacement of systems would occur on an as needed basis and impacts would be spread over a longer timeframe.

Operation. Under the No Action Alternative, there would be no change to waste generation from that of current operations; however, there is a potential that as existing Y-12 Steam Plant systems fail waste generation could increase as a result of systems' continuing to deteriorate, becoming more unreliable, and obsolete.

4.13 Visual Resources

The visual resources analysis considers a ROI which includes those lands from which the Y-12 Complex is visible (viewshed). Impacts to the ROI include those associated with changes in the existing landscape character resulting from construction activities and operations under the No Action and action alternatives.

4.13.1 Alternative 1 – Skid Mounted Gas Fired Boilers (Proposed Action)

Construction. Under the construction of the Proposed Action, cranes and/or construction equipment would create short-term visual impacts. Construction staging and lay-down areas would be located at the proposed project site and existing roads would be used to support

construction needs. Temporary construction fencing would also be installed during construction activities.

Short-term visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be limited to the construction staging and lay-down areas and the immediate construction site of the boiler house building and storage facilities.

Operation. The Y-12 Complex is consistent with VRM Class IV which is used to describe a highly developed area. Most of the land surrounding the Y-12 Complex would be consistent with VRM Class II and III (i.e., left to its natural state with little to moderate changes). The stacks associated with the packaged boiler system technologies would be taller than the boiler house building being constructed and the adjacent buildings; however the overall visual classification of the Y-12 Complex would not change.

4.13.2 Alternative 2 – Life Extension of the Existing Plant Alternative

Construction. There would be no visual impact under the Life Extension of the Existing Plant Alternative because all replacements/repairs would be confined to indoors only.

Operation. There would be no change to the current viewshed at the Y-12 Complex under the operations of Alternative 2.

4.13.3 Alternative 3 – No Action Alternative

Under the No Action alternative, no new construction or other activities that would disturb the viewshed of the Y-12 Complex would occur beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents. Therefore, no impacts to visual resources are anticipated.

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5.0 CUMULATIVE IMPACTS

Under all the alternatives analyzed in this EA, cumulative impacts would be minor or insignificant for all resource areas assessed. Impacts to land use would not extend beyond those for the No Action Alternative for the construction of the boiler house and fuel storage facility. This would involve significantly less than one 1 percent of the available land at Y-12. Life extension of the existing Y-12 Steam Plant infrastructure would have no cumulative impact to geology and soils because of the stability of soils at the Y-12 Complex, and because all facilities would comply with regulatory requirements. Air quality at the Y-12 Complex is generally good. With the exception of the 8-hour O_3 (ozone) and $PM_{2.5}$ standards, the greater Knoxville and Oak Ridge areas are in attainment with the NAAQS for all other criteria pollutants for which EPA has made attainment designations. Actual emissions are expected to be significantly lower under the Proposed Action versus current operations for total particulate matter, sulfur dioxide, and nitrogen oxides. The alternatives analyzed in this EA would not have an adverse cumulative impact on air quality or regional climatic conditions.

All the alternatives analyzed, except for the No Action alternative, would have a beneficial effect on the existing Y-12 Steam Plant system. There would be no negative effects on the groundwater and surface water resources. Similarly, no cumulative impacts to ecological resources are expected due to the absence of any critical habitats for threatened or endangered species and significant ecological resources at locations potentially affected by the alternatives. This conclusion is also true for cultural resources. Socioeconomics would be relatively unchanged by any of the alternatives because the alternatives would not: create a significant number of jobs, exceed housing demands, community services, or transportation capabilities. With respect to human health, improvements to the existing Y-12 Steam Plant system would reduce air pollutants. Waste management activities would be unaffected by the alternatives. All wastes generated would be managed and disposed of in accordance with the project-specific waste management plan and in compliance with all regulatory requirements. Although the stacks associated with the packaged boiler system would be taller than the boiler house and the adjacent buildings, the overall visual classification of the Y-12 Complex would not from a highly developed site.

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Appendix A
COMMENT RESPONSE MATRIX

COMMENT RESPONSE MATRIX
Environmental Assessment for the Y-12 Steam Plant Life Extension Project – Steam Plant Replacement Subproject
Draft Comments

Comment #	Commentor	Comment Summary	Response (Contractor)
1	John Marsh	Commentor believes DOE should put a nuclear reactor onsite to provide power/steam for Y-12 instead of a natural gas unit because it would be cleaner.	Comment noted. This alternative was considered and was eliminated due to cost and schedule.
2	TDEC	TDEC supports DOE initiative for the Y-12 Steam Plant upgrades.	Comment noted.
3	TDEC	TDEC suggests that present and future generation wastes should be presented.	Updated with FY 2006 Waste Generation numbers.
4	TDEC	(Section 1.2) Does the waste water discharge to the East Fork Poplar Creek (EFPC)	Current steam plant operating procedures requires treatment of the liquid waste at the Steam Plant Wastewater Treatment Facility to satisfy the City of Oak Ridge Industrial and Commercial User Waste Water Discharge Permit, 1-91, for direct discharge to the Y-12 sanitary sewer system. Text updated.
5	TDEC	(Section 2.1) More description of what measures will be taken to ensure that normal operation of these tanks do not impact the environment. Also should include some discussion to address contingencies should there be a failure of these tanks.	Fuel oil storage tans and transfer of fuel oil from delivery trucks to the tanks will be located within a concrete secondary containment and transfer station structure that will conform to the Y-12 standard Y/TS-104, Standards for Primary and Secondary Containment Systems and Transfer Stations. The secondary containment structure will be sized to contain the volume of one tank plus the volume of rainwater from a 100-year, 24-hour storm event plus the appropriate fire water volume. Text updated.
6	TDEC	(Section 2.1, Site Development) Will soil characterization be part of the site development?	Soil characterization sampling and testing has been completed. The sampling and testing description along with the testing results are documented in BWXT Y-12 report RP-PJ-940107-A001, *Steam Package Plant and Oil Tank Farm Report on Site Characteristics and Sample Locations*. Text updated.

Comment #	Commentor	Comment Summary	Response (Contractor)
7	TDEC	(Section 3.5.1, Groundwater Quality) What does "limited" groundwater contamination mean?	Small amount of groundwater contamination.
8	TDEC	(Section 3.5.2, Surface Water Quality) What is "TBD"? The Big Springs Water Treatment Facility is in operation. It diverts flow from Outfall 051 and discharges through a CERCLA outfall into the UEFPC	Typographical error. TBD removed and description of the Big Springs Water Treatment Facility added.
9	TDEC	(Section 3.12.1, Other Waste Types) Add to end of first sentence "under a NPDES Permit issued by the State of Tennessee."	Comment noted. Text updated.
10	TDEC	(Section 4.12.2) What is the basis for the conclusion that Alternative 2 will generate more waste than Alternative 1?	Alternative 2 would require more heavy construction to update failing systems. If Alternative 1 is selected demolition of the existing Y-12 Steam Plant would not occur immediately.
11	TDEC	(Section 4.2.2) For Alternative 1, section is misnumbered.	Comment noted. Change made.
12	TDEC	(Section 4.2.2) Will the soil be characterized following the removal of the slab and before excavation of the soil?	Soil characterization sampling and testing has been completed. The sampling and testing description along with the testing results are documented in BWXT Y-12 report RP-PJ-940107-A001, Steam Package Plant and Oil Tank Farm Report on Site Characteristics and Sample Locations. Text updated.
13	TDEC	(Section 4.2.2) Typographical error. Also, explain why excavation backfilling and placement of foundations and slabs are necessary for Alternative 2. Also provide explanation in Section 2.	Comment noted. The last sentence of first paragraph deleted. The scope of Alternative 2 does include excavation and backfill. There is excavation and backfill for replacing the existing blowdown drain line along the south side of the steam plant building. There is also some earthwork associated with storm drain modifications to improve runoff drainage on second street along the north side of the steam plant building. Upgrades to the Steam Plant Wastewater Treatment Facility also includes excavation and backfill activities relating to foundations for the building extension for the clarifier as well as a foundation for the new sulfuric acid tank. Text updated.

Comment #	Commentor	Comment Summary	Response (Contractor)
14	TDEC	(Section 4.5.2) Typographical error. Explain why there is discussion of excavation.	Comment noted. Last sentence of first paragraph deleted. The scope of Alternative 2 does include excavation and backfill. There is excavation and backfill for replacing the existing blowdown drain line along the south side of the steam plant building. There is also some earthwork associated with storm drain modifications to improve runoff drainage on second street along the north side of the steam plant building. Upgrades to the Steam Plant Wastewater Treatment Facility also includes excavation and backfill activities relating to foundations for the building extension for the clarifier as well as a foundation for the new sulfuric acid tank. Text updated.
15	TDEC	(Section 4.8.3) What operation of the improved potable water system has to do with the coal-fired steam plant.	Comment noted. Text updated.
16	TDEC	Table 4.3-1. This table displays a worst case scenario of emissions from the proposed alternative. Does this scenario include the expected use of No. 2 fuel oil for 50 days a year? If so, please state this. If not, please adjust estimates to reflect the use of this alternative fuel source.	The scenario does include the expected use of No. 2 fuel oil for 50 days per year natural gas curtailment.
17	TDEC	(Sections 4.5.1 and 4.6.1) It is stated that under Alternative 1, there would be no expected impacts to the water resources or ecological resources. These statements do not appear credible given that the proposed natural gas line would have to cross EFPC. More elaboration on the methods to prevent any disturbance to these resources needs to be included to justify these statements.	The project will prepare and implement a Stormwater Pollution Prevention Plan in accordance with Tennessee Erosion and Sediment Control Handbook. The SWPP will be prepared based on the scope of the final design documents. If project land disturbing activities are planned to exceed one acre, the project will obtain a Notice of Intent approval from TDEC prior to executing land disturbing activities.
18	OR-CAP	The document has an overwhelming amount of background information on the ORR and Y-12 site that, although it may pertinent, makes it difficult to focus on the proposed project. Some of it is a review of the historic preservation considerations at Y-12.	Comment noted.

Comment #	Commentor	Comment Summary	Response (Contractor)
19	OR-CAP	The draft EA evaluates the replacement of the present Y-12 steam plant with 4 natural gas fired package boilers that can also burn No. 2 fuel oil during natural gas curtailment. The document does not specify where the fuel oil will be stored nor how it will be transferred to the steam plant if needed. The presence of underground storage tanks and pipelines that might conceivably leak should be addressed in the EA. What monitoring system(s) will be in place? Also, volatile organic compound (VOC) emissions from the fuel oil delivery and storage should be estimated and presented.	The packaged boiler system would tie into existing potable water, electrical, a ntural gas, steam distribution systems and other utilities. A figure was included in the document to show the location of the proposed natural gas line replacement. Fuel oil storage tanks and transfer of fuel oil from delivery trucks to the tanks will be located within a concrete secondary containment and transfer station structure that will conform to Y-12 Complex standard, Y/TS-104, Standards for Primary and Secondary Containment Systems and transfer stations. The secondary containment structure will be sized to contain the volume of one tank, plus the volume of rainwater from 100-year, 24-hour storm events, plus the appropriate fire water volume.
20	OR-CAP	The boilers would be between Buildings 9201-2 and 9201-3 in space made available by demolishing 9104-1, -2, and -3. The fuel storage would be east of 9201-3. One parameter that has been carefully specified is for each boiler to be less than 100 million Btu per hour heat input, a threshold that would require continuous monitoring of the stack. Also, if they operate on liquid fuel other than during periods of gas curtailment, additional regulatory requirements come into play. These should be mentioned in the event of changing fuels.	Comment noted. There is no intent to change fuel. Curtailment provisions are controlled by Y-12 Complex Air Permit.
21	OR-CAP	The stack height may be an issue due to the height of air flow intakes on the adjacent buildings. The draft EA does not specify the stack height. Topographically the area is near the lowest elevation of Y-12 and very close to the base and side of a ridge between two relatively tall buildings. The potential for increased exposure to emissions due to this placement should be discussed.	Preliminary design calculations have established a stack height using EPA recognized modeling programs that consider the dimensions and locations of the adjacent buildings and their outside air intake. The final stack height will be established during the final design phase of the project.
22	OR-CAP	The site of the steam plant is not close to most of the buildings that will require steam. Relocating the facility so that it is more convenient should be evaluated.	BWXT Y-12 initiated and completed studies to determine the most efficient site for the new steam plant based on criteria that included safety, security, operations, maintenance, and modernization issues. The site identified in the EA was determined to be the best site among the available sites within the Y-12 National Security Complex.

Comment #	Commentor	Comment Summary	Response (Contractor)
23	OR-CAP	The specific New Source Performance Standards (NSPS) and Maximum Achievable Control Technology (MACT) regulations applicable to the facility should be discussed as to their requirements for monitoring emissions and type of fuel that can be used.	The NSPS program establishes technology-based standards applicable to criteria pollutant emissions from new or modified stationary sources. Since the Y-12 Steam Plant package boilers capacity will be less than 100 million Btu/hr of heat input, they are subjected to Subpart Dc because they will burn only natural gas or Number 2 Fuel Oil during natural gas curtailment. Subpart Dc contains no continuous monitoring requirements. Subpart Dc applies to boilers that have a heat input rate between 10 and 100 million Bur per hour. Subpart Dc sets standards for PM, SO_2, and Opacity.
24	OR-CAP	The remediation of the existing steam plant and coal yard will need to be addressed.	Comment noted. Text added to the document stating that the steam plant and coal yard will be investigated and remediated under CERCLA.
25	OR-CAP	Has shrinking Y-12's footprint been considered in the proposal for the new steam plant? Will the site need that much steam?	Yes. BWXT conducted a study to determine the forecast steam requirements for the Y-12 National Security Complex. The study included provisions for the shrinking footprint as well as considerations for new facilities.
26	OR-CAP	Cumulative impacts are not appropriately calculated in Section 5.	EAs at Y-12 are prepared as tiered documents under the Sitewide EIS which provides a more comprehensive treatment of certain topics such as cumulative impacts. The Cumulative Impacts section, 5.0, of the Steam Plant EA was prepared at the same level of analysis as the Cumulative Impacts sections were for the Potable Water EA and the Alternate Financed Facility EA. This approach continues to be appropriate. No changes to the document are recommended unless we feel it is important to repeat in Section 5.0 the statement we make in Section 1.3 regarding the tiered nature of this document to the SWEIS.
27	OR-CAP	The References section has many web links that are no longer active. Although they may have been accessed in 2005, for a document issued in 2007, they should be updated.	References updated.

Comment #	Commentor	Comment Summary	Response (Contractor)
28	OR-CAP	On page 1-3, says the EA is tiered from the Final Site-Wide EIS for Y-12, DOE/EIS-0387. This is the draft SWEIS that is not out yet. However, Page 6-1 & 6-2 references include old sitewide EIS. References should be consistent with the latest available document.	Text updated.
29	OR-CAP	On page 1-4, says a public notice was placed in newspapers. Announcement of this EA did not appear in DOE Public Involvement News. It was posted inconspicuously as a new document on the DOEIC web site no earlier than July 5.	Comment noted. In the future we will use DOE Public Involvement News to notify the public of announcements.
30	OR-CAP	On page 2-6, says grading and top soil removal will be by Soil Management Plan for the Y-12 National Security Complex (SAIC 2005). There is no SAIC 2005 in References.	This was an old reference and has been removed from the document.
31	OR-CAP	Section 3.1, The Land Use description should be checked to ensure that it is consistent with other ORR documents It says there are five categories of land use on the ORR and that future land use will continue to incorporate the principles associated with ecosystem management.	Previous NEPA documents including the Y-12 SWEIS have indicated the same language.
32	OR-CAP	Section 3.4, says that tornadoes are relatively rare, but one did strike east end of Y-12 in February 1993. The use of a pre-engineered steel building might require more evaluation.	The pre-engineered building will be designed and constructed in accordance with the requirements of DOE STD-1020 for the appropriate Performance Category natural phenomena hazard loading, which includes seismic and wind loads.
33	OR-CAP	Page 3-7, Table 3.3-1. More extensive footnotes are needed to explain the timeframes of the ambient air quality standards (e.g., ozone is 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).	Additional footnotes added.
34	OR-CAP	Page 3-8, Table 3.3-2. This table should be for the entire Y-12 plant, not just the steam plant emissions. Also 2006 ASER is not available yet.	This table was prepared to show only the steam plant emissions and not the entire Y-12 Complex.

Comment #	Commentor	Comment Summary	Response (Contractor)
35	OR-CAP	Page 3-9. Need to discuss ambient sampling for hydrogen fluoride for completeness.	Comment noted. It is not a requirement of Y-12's air permit to sample for hydrogen fluoride. Discussion of HF deleted from Table 3.3-1.
36	OR-CAP	Section 3.7.3. This section implies that historic preservation is limited to 9731 and 9204-3 buildings.	Comment noted.
37	OR-CAP	Section 4.8.1. "(7 operators needed?)" appears to be some sort of self-reminder to the preparer that missed editing.	Text updated.
38	OR-CAP	Section 4.12.1 has a more extensive discussion of waste management than is needed unless the building demolition (which is already underway) is part of the evaluated action.	Comment noted.
39	OR-CAP	On page 2-2, the first bullet says the information used in the study is based on the 2004 version of the Comprehensive Site Plan. That document is not listed in the reference list, however the 2007 version is. The most recent version of the plan should be used.	Text changed to reference the 2007 Comprehensive Site Plan.

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