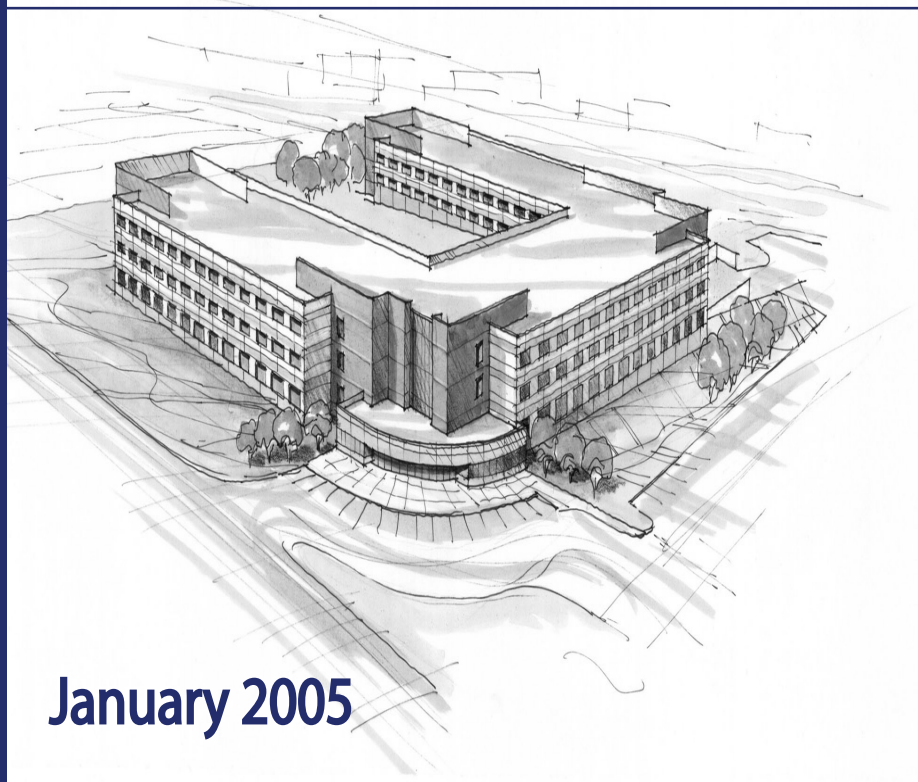
DOE/EA-1510

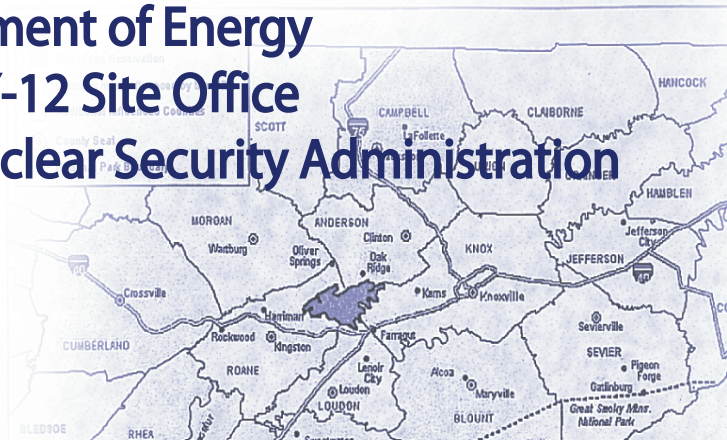
Final Environmental Assessment for the Alternate Financed Facility Modernization



January 2005

National Nuclear Security Administration

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



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LIST OF ACRONYMS AND ABBREVIATIONS

AEA	*Atomic Energy Act*
AFD	Alternate Financed Development
ALARA	as low as reasonably achievable
AQCRs	Air Quality Control Regions
ASER	Annual Site Environmental Report
BLM	Bureau of Land Management
BTEX	Benzene, toluene, ethylbenzene and xylene
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFR	Code of Federal Regulation
CY	calendar year
DCE	1,1-dichloroethane
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
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ES&H	Environment, Safety and Health
ETTP	East Tennessee Technology Park

FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Agreement
FFC Act	*Federal Facility Compliance Act*
FIRP	Facilities and Infrastructure Recapitalization Program
FY	Fiscal Year
GPP	General Plant Project
HEU	highly enriched uranium
LDR	land disposal restrictions
LLW	Low Level Waste
M&O	Management and Operating
MEI	maximally exposed individual
MSL	mean sea level
NAAQS	National Ambient Air Quality Standard
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
NPL	National Priority List
NRHP	National Register of Historic Places
ORR	Oak Ridge Reservation
ORNL	Oak Ridge National Laboratory
PCB	polychlorinated biphenyls
PCE	tetrachloroethylene

RCRA	*Resource Conservation and Recovery Act*
ROI	Region of Influence
SHPO	State Historic Preservation Officer
SWEIS	Site-Wide Environmental Impact Statement
T&E	threatened and endangered
TCE	trichloroethylene
TCPs	traditional cultural properties
TDEC	Tennessee Department of Environment and Conservation
TRU	transuranic
TSCA	*Toxic Substances Control Act*
TSRs	Tennessee State Routes
TVA	Tennessee Valley Authority
UEFPC	Upper East Fork Poplar Creek
USFWS	U.S. Fish and Wildlife Service
VOCs	volatile organic compounds
VRM	Visual Resource Management
WETF	West End Treatment Facility
Y-12	Y-12 National Security Complex

CHEMICALS AND UNITS OF MEASURE

$\mu g/m^3$	microgram per cubic meter
ac-ft	acre foot or acre feet
^oC	degree Celsius
cm	centimeter
CO	carbon monoxide
dB	decibel
dBA	adjusted decibel
ft	feet
ft^3/s	cubic feet per second
^oF	degree Fahrenheit
GSF	gross square foot
ha	hectares
HF	hydrogen fluoride
hr	hours
Hz	Hertz
in	inches
km	kilometer
lbs	pounds
m	meter
m^3/s	cubic meters per second
mg/L	milligram per liter
mi	miles
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
mSv	millisivert
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
O_3	ozone
$PM_{2.5}$	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
Pb	lead
ppb	parts per billion
ppm	parts per million
SO_2	sulfur dioxide
Tc	Technetium
tpy	tons per year
tpy	tons per year
USF	usable square feet
yr	year

CONVERSION CHART

To Convert Into Metric			To Convert Into English		
If You Know	**Multiply By**	**To Get**	**If You Know**	**Multiply By**	**To Get**
Length					
inch	2.54	centimeter	centimeter	0.3937	inch
feet	30.48	centimeter	centimeter	0.0328	feet
feet	0.3048	meter	meter	3.281	feet
yard	0.9144	meter	meter	1.0936	yard
mile	1.60934	kilometer	kilometer	0.62414	mile (Statute)
Area					
square inches	6.4516	square centimeter	square centimeter	0.155	square inch
square feet	0.092903	square meter	square meter	10.7639	square feet
square yard	0.8361	square meter	square meter	1.196	square yard
acre	0.40469	hectare	hectare	2.471	acre
square mile	2.58999	square kilometer	square kilometer	0.3861	square mile
acre-foot	1233.48	cubic meters	cubic meters	0.00081	acre-foot
Volume					
fluid ounce	29.574	milliliter	milliliter	0.0338	fluid ounce
gallon	3.7854	liter	liter	0.26417	gallon
gallon	0.0039	cubic meter	cubic meter	256.14	gallon
cubic feet	0.028317	cubic meter	cubic meter	35.315	cubic feet
cubic yard	0.76455	cubic meter	cubic meter	1.308	cubic yard
Weight					
ounce	28.3495	gram	gram	0.03527	ounce
pound	0.45360	kilogram	kilogram	2.2046	pound
short ton	0.90718	metric ton	metric ton	1.1023	short ton
Force					
dyne	0.00001	newton	newton	100,000	dyne
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

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	l00	=	10^{2}
deka-	da	l0	=	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) has identified a need for additional facilities to replace existing facilities at the Y-12 National Security Complex (Y-12) in Oak Ridge, Tennessee. As part of the NNSA modernization initiative, NNSA is proposing to implement the Alternate Financed Development (AFD) Project at Y-12. The AFD Project would be accomplished through a collaboration with private entities. The goal of this collaboration is to construct technical, administrative, and light laboratory facilities; enhance worker health and safety; and reduce operating costs. 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. In conjunction with the NEPA review for the property transfer, a *Comprehensive Environmental Response Compensation Liability Act* (CERCLA) 120(h) request for the transfer of real estate will be prepared and submitted to the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC) for approval.

1.1 PURPOSE AND NEED FOR ACTION

Purpose of the Action. The purpose of the Proposed Action is to transfer two parcels of real estate at Y-12, under Section 161(g) of the *Atomic Energy Act* (AEA), to a private development corporation. The private development corporation would finance and construct technical, administrative, and light laboratory facilities, in an integrated commercial office park approach, on the transferred property in support of the NNSA. The following functions will be housed in the new complex: an Administrative Center, Engineering Office, Cafeteria, Visitor Center/Security Office, Human Resource Office, Conference and Training Center, and Laboratory and Prototyping Center. When constructed, the buildings would then be leased to NNSA's Management and Operating (M&O) Contractor for use in support of the NNSA's AEA missions.

Need for the Action. Many of the Y-12's facilities are more than 50 years old and no longer efficiently support the mission, vision, and goals of Y-12. These facilities are in need of

upgrades and controls to meet health and safety standards, and are energy inefficient. This aging and inflexible infrastructure is impacting Y-12's ability to perform its mission and to attract the next generation of scientists and engineers. As Y-12's mission evolves from one of weapons production to weapons surveillance, maintenance, and nonproliferation, the proportion of employees requiring office space will increase. There is a growing shortage of office space, particularly at the east end of the complex. Many of these buildings were constructed as temporary structures, intended to last for the duration of World War II. During the Cold War, they were modified as needed for new uses.

The aging condition of many Y-12 facilities increases annual maintenance costs; burdens NNSA with an enormous backlog of deferred maintenance; contributes to escalating utility and operating costs; makes it increasingly costly to maintain a safe work environment; causes inefficiencies in space utilization; impacts productivity by limiting the ability to consolidate staff in fewer buildings; and hampers recruitment and retention of younger employees. The legacy of an aging Cold War plant, sized to meet Cold War needs, is directly related to Y-12's facility and infrastructure costs over the next 20 years.

The proposed AFD Project directly supports the recommendation of the December 2001 Nuclear Posture Review and the February 2002 NNSA Strategic Plan. The NNSA Strategic Plan (February 2002) states that "S*ubstantial effort is required to restore our facilities to ensure adequate capability and compliance with current environmental, safety, health, and security safeguards.*" The future Y-12 must be positioned to support a much smaller enduring stockpile, a steady demand for special nuclear material, a growing surplus of highly enriched uranium (HEU), and an increasing role in nuclear non-proliferation efforts. The objectives of this AFD project are to:

- Provide weapons and materials research and prototyping facilities that allow Y-12 to retain its leadership in this arena.
- Consolidate technical support functions for maximum efficiency and agility.
- Reduce NNSA cost of ownership for the next 25 years.
- Provide modern, competitive, high-quality space and amenities to attract and retain top science and engineering talent with identified critical skills.

- Provide enhanced public interface.

1.2 BACKGROUND

In 1999, the Department of Energy (DOE), Office of Defense Programs initiated activities to develop and implement a program to modernize Y-12's facilities and to ensure its capability to meet future stockpile needs. The Y-12 Modernization Program was established at that time to develop plans for modernizing Y-12.

A modernized Y-12 would possibly include the eventual replacement or upgrade of select major production and support facilities. Whereas current operations are housed in multiple facilities throughout the west end of the Y-12, a modernization initiative would consolidate operations into fewer, more efficient facilities. The Modernization Program was initiated in an effort to improve Y-12 capabilities by:

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

Several possible candidate sites were identified for potential modernization projects. Section 3.3 of the *Final Site Wide Environmental Impact Statement for the Y-12 National Security Complex* (Y-12 SWEIS) (DOE/EIS-0309) provides a brief description of the candidate sites and potential facilities proposed for modernization. Proposed Site A was considered as a potential candidate siting area for new modernization in the Y-12 SWEIS. Site B was not considered.

The scope and timing of Y-12's Modernization Program are in various stages of development and include the following major components:

- **Infrastructure Reduction.** The *Y-12 Ten-Year Comprehensive Site Plan*, August 2004, identifies about 600,000 gross square feet (GSF) in 18 office-type facilities that could be demolished or deactivated between 2003 and 2013 (Figure 1.2-1). Y-12 has identified 123 structures with a total area of 1,969,497 GSF as potential candidates for deactivation or demolition between Fiscal Year (FY) 2005 and 2014.

- **Integrated Construction Program Plan.** This plan includes two funded line item projects: HEU Materials Facility and a Purification Facility, and four unfunded projects: Depleted Uranium/Binary Consolidation, Quality Evaluation Relocation, Enriched Uranium Modernization, and the Complex Command Center. Siting, construction, and operation of the HEU Materials Facility and the Special Materials Complex were included in the Y-12 SWEIS.

General Plant Project (GPP) and Facilities and Infrastructure Recapitalization Program (FIRP). Some of the candidate GPP/FIRP projects over the next 10 years include technical office buildings and record storage facilities. These projects are covered under a separate NEPA review as small support facilities.

1.3 SCOPE OF EA ANALYSIS

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

This EA is tiered from the Y-12 SWEIS. One of the primary purposes of the Y-12 SWEIS was to provide an overall NEPA baseline for all DOE activities at Y-12, including modernization. Much of the "Affected Environment" discussion for this EA is taken or referenced from the Y-12 SWEIS.

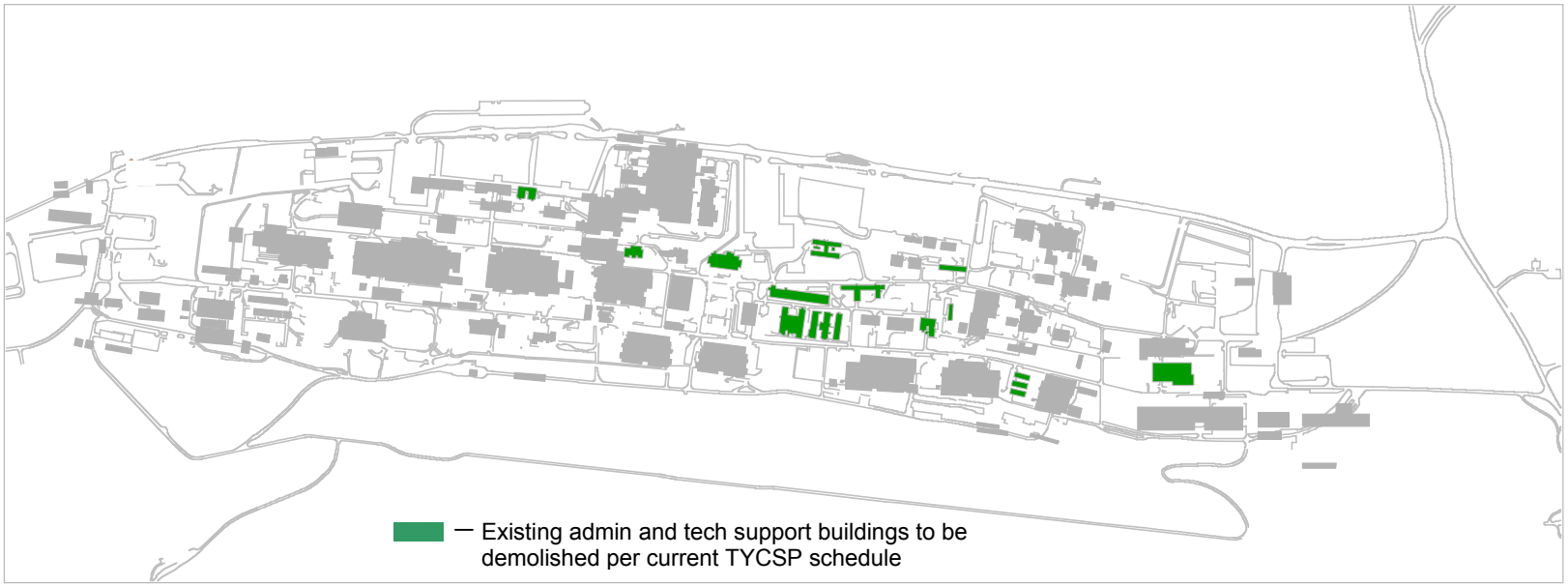


Figure 1.2–1. Buildings Scheduled to be Demolished under the Ten-Year Comprehensive Site Plan.

This EA addresses various options that impact modernization of Y-12. This EA does not address the demolition of existing facilities because those activities will be reviewed under NEPA on a project-by-project basis. This EA also does not encompass actions addressed under CERCLA, such as environmental restoration and D&D, as well as actions that have already been reviewed under NEPA.

The "action alternatives" addressed by this EA involve different funding mechanisms for achieving modernization of Y-12. Alternative 1 is the "No Action" alternative, under which DOE would continue occupying existing buildings. Alternative 2, the "Proposed Action" involves land transfer, construction of new facilities, lease, and relocation of staff and equipment. Under this Alternative, the EA evaluates CERCLA requirements (CERCLA Section 120[h]) that apply to the transfer of federally-owned land on the National Priorities List (NPL). Under Alternative 3, new facilities would be constructed using the Federal construction process: no land would be transferred, the buildings would be owned by DOE and not leased, but staff and equipment relocation would be the same as Alternative 2.

1.4 PUBLIC INVOLVEMENT

No Public meetings or workshops are planned for this EA. However, the public will have an opportunity to review and comment on the EA and NNSA is willing to meet with stakeholders.

2.0 DESCRIPTION OF THE ALTERNATIVES

This EA will analyze three alternatives: No Action, Land Transfer, and the Line Item Construction.

2.1 ALTERNATIVE 1 – NO ACTION

Under Alternative 1 – No Action, the NNSA would continue to occupy existing office space, laboratory, and support buildings on the east end of the Y-12 Complex. Most of the technical/administrative, laboratory/research and development, and support facilities are in the fenced area (i.e., Property Protected Area) at the east end of the Y-12 site (Figure 2.1-1). Y-12 support facilities include maintenance, shops, utility structures, guard portals, a medical facility, cafeteria, and a visitor's center. Administrative/Technical buildings are generally office-type structures, or buildings that have been converted over the years to house Y-12 employees. Former manufacturing facilities such as 9201-3 and 9204-1 are also being used as office space, as are buildings that housed some of the site's original laboratories.

Under the No Action alternative, NNSA would remain in the existing buildings shown in Figure 2.1-2. However, in order to continue occupying these buildings long term, extensive renovation would be necessary to provide adequate square footage for office needs and to continue to comply with safety and health requirements. The No Action alternative is used as a baseline against which the Proposed Action and alternatives are compared.

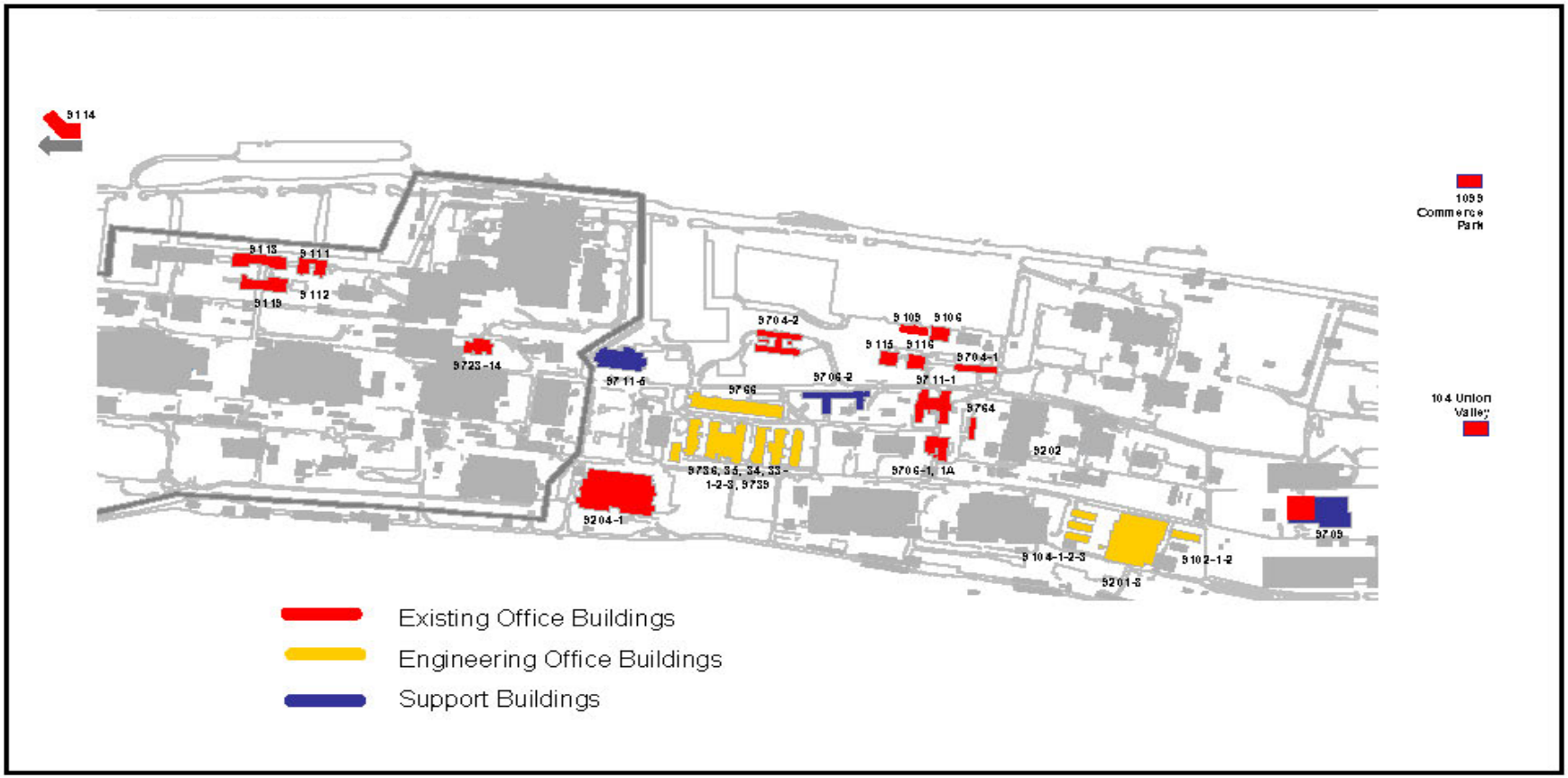


Figure 2.1–1. Existing Buildings by Type Located on the East End of the Y-12 Complex.

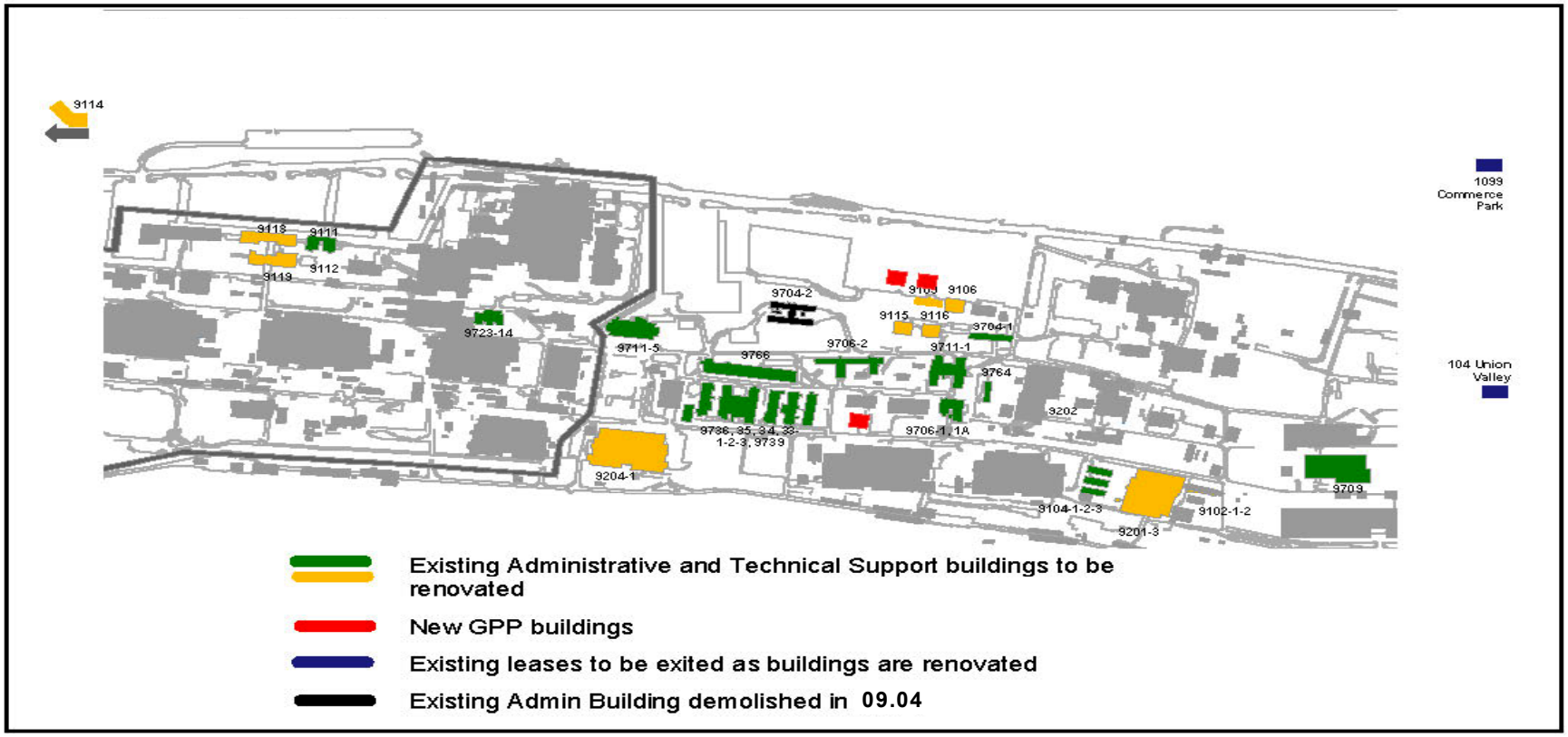


Figure 2.1–2. Renovated and New Buildings Proposed Under the No Action Alternative.

2.2 ALTERNATIVE 2 – PROPOSED ACTION – LAND TRANSFER

Alternative 2 – Land Transfer - is part of the NNSA's Modernization Initiative at Y-12, and is the preferred Alternative in this EA. Under this Proposed Action, two parcels of land (Sites A and B) at Y-12 would be transferred by DOE to a private entity under Section 161(g) of the AEA. (Refer to Figure 2.2-1 to see the approximate locations of Sites A and B). After DOE transfers the land, the property owner would work with a development team to design, finance, and construct two buildings. The buildings would then be leased to NNSA's Management and Operating (M&O) Contractor for use in support of the NNSA's AEA missions (Figure 2.2-2 shows the land transfer process). The two buildings combined would be approximately 540,000 GSF and would accommodate approximately 1,400 to 1,500 administrative, technical, scientific, and support personnel. The buildings could be constructed by FY 2006 and would be designed for a typical 40-year facility life. This would allow NNSA to vacate more than 66,000 square feet of offsite leased space.

The building at Site A would house functions requiring frequent interaction with Y-12 mission work including engineering, occupational health, Environment, Safety and Health (ES&H), BWXT Y-12 management, and the Y-12 Site Office. The building at Site B would house functions requiring frequent public interface including human resources, a visitor's center, Y-12 historical exhibits, procurement, training and a conference center. Figures 2.2-3 and 2.2-4 show conceptual renderings of the proposed buildings at Sites A and B.

The parcel to be transferred at Site A would be approximately 3.2 hectares (ha) (8 acres). This parcel is bounded to the south by the former location of Building 9704-2, Bear Creek Road to the north, the central parking lot to the west, and North portal parking lot to the east. Adjacent areas would be used for construction laydown, utility tie-ins, and parking lots. Thus, this EA addresses a larger area bounded by First Street to the south and Bear Creek Road to the north, the eastern edge starting at Post 8 behind Building 9711-5 and extending northward to Bear Creek Road, and a line that runs northward from a point opposite the northeastern corner of Building 9706-2 at First Street along the western wall of Building 9115 to its intersection with Bear Creek Road.

Figure 2.2–1. Approximate Locations of Proposed Sites A and B.

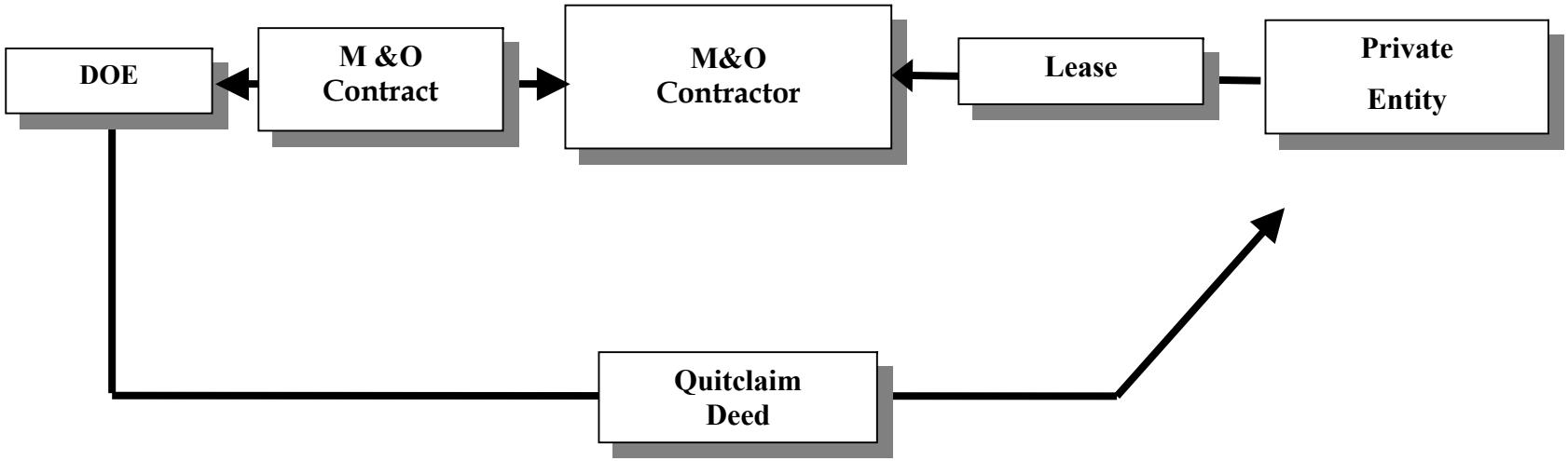


Figure 2.2–2. Land Transfer Process.

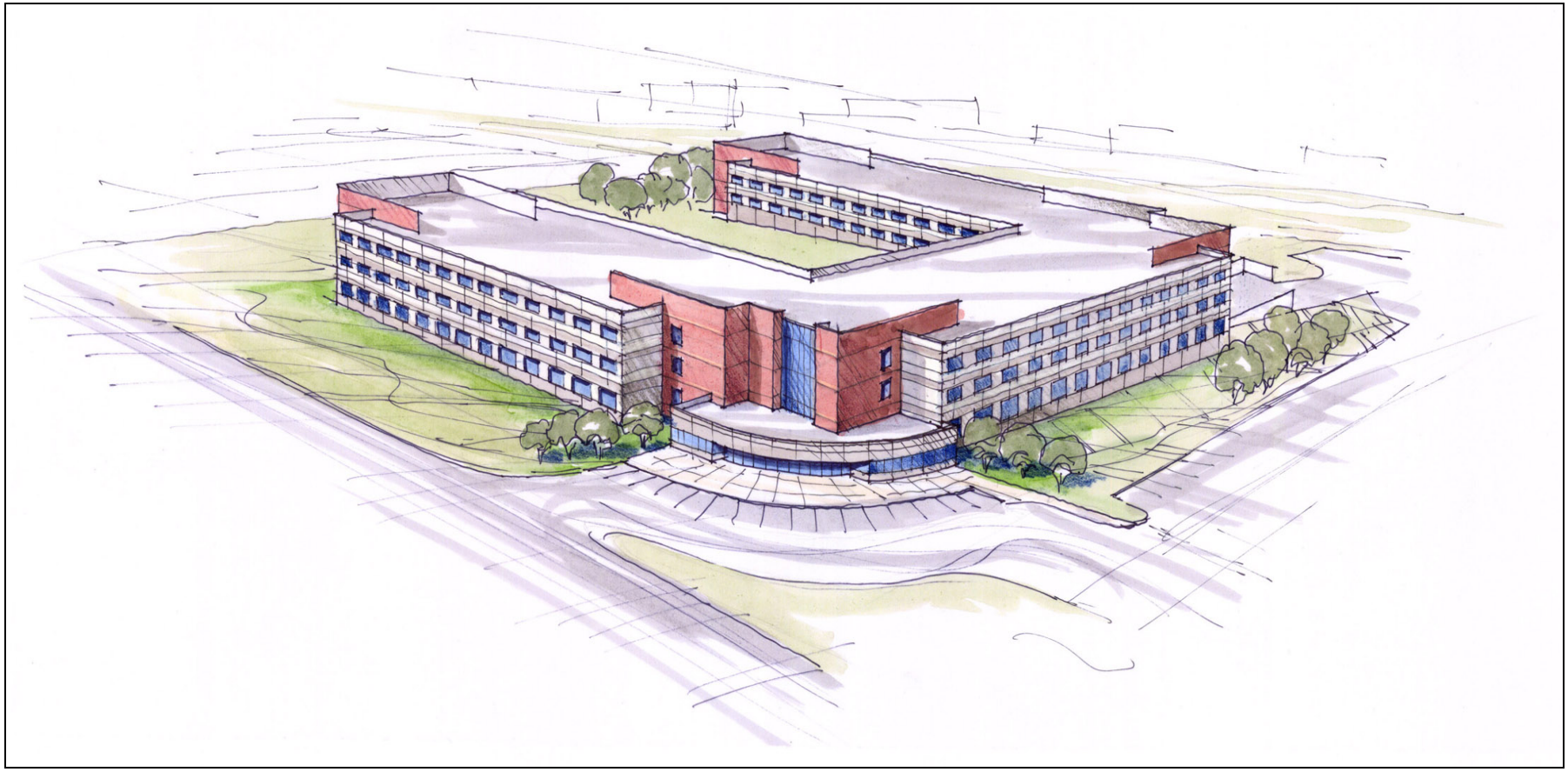


Figure 2.2–3. Conceptual Rendering of Proposed Complex at Site A.

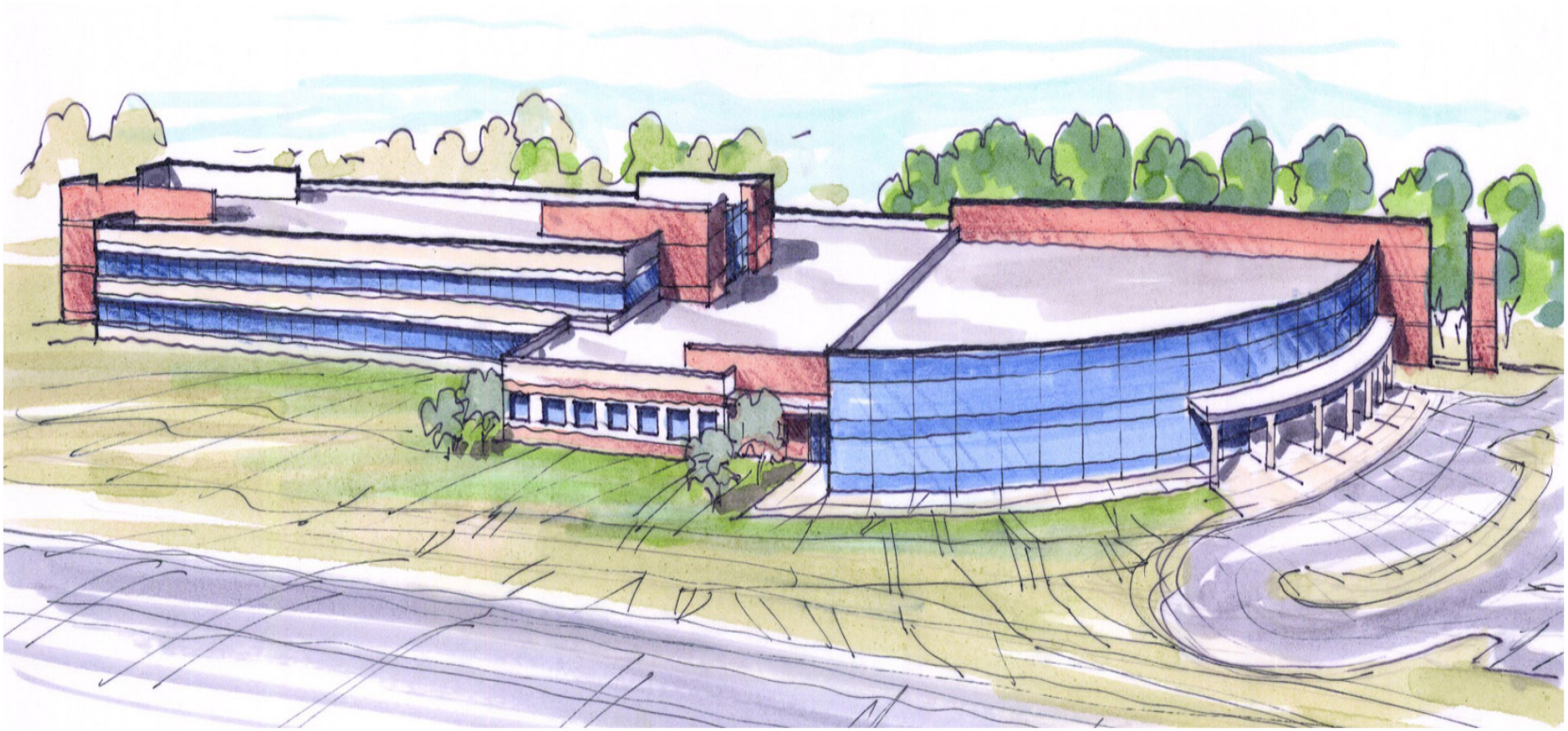


Figure 2.2–4. Conceptual Rendering of Proposed Complex at Site B.

The parcel to be transferred at Site B would be approximately 3.7 ha (9 acres). This parcel is bounded by Scarboro Road and a parallel line approximately 400 feet west of Scarboro Road between New Hope Pond Road (Second Street) and Bear Creek Road (Figure 2.2-2). Land adjacent to the transferred property would be used for construction laydown, utility tie-ins, and parking lots. Thus, this EA addresses a larger area bounded by Scarboro Road to the east, by East Fork Poplar Creek (EFPC) diversion channel to the west, a line running parallel to and approximately 400 feet south of Y-12's New Hope Pond Road (Second Street) to the south, and the southern edge of Bear Creek Road between the intersection of Bear Creek Road and Scarboro Road and the intersection of EFPC with Bear Creek Road.

Site Development. The following site development actions would prepare Sites A and B for construction. At Site A, water, electricity, telephone lines, and sanitary waste lines would be installed onsite. Topsoil would be removed and stored, and the facility site would be prepared for construction activities. Fences and gates would be installed to restrict access to the site. Site development actions would be performed to minimize environmental impacts and in compliance with applicable laws and regulations. Temporary roads and a staging area would be developed.

At Site B, the meteorological tower, city of Oak Ridge water and sewer lines, and the 13.2-kV overhead electrical transmission lines crossing the site may require relocation. Water, electricity, telephone lines, and sanitary waste lines (septic system or collection tanks) would be installed onsite. Topsoil would be removed and stored, and the facility site would be prepared for construction activities. Fences and gates would be installed to restrict access to the site. Site development actions would be performed to minimize environmental impacts and in compliance with applicable laws and regulations. Existing gravel roads and new roads would be constructed as required and temporary roads and a staging area would be developed.

Construction Laydown Areas and Traffic Planning. The construction staging area for Site A would be located either west of the site within the Central Portal parking area or south of Site A, in the former location of Building 9704-2. The location of the staging area for Site B would be just south of Second Street. These staging areas would be sufficiently graded and developed to accommodate a number of temporary construction trailers, storage buildings, and material

storage yards. They would have electrical power and potable water services. Sanitary service would be provided by collection tanks or portable toilets which would be pumped out as needed. Following the construction of the proposed facilities at Sites A and B, new parking areas would be constructed for the new facilities.

2.3 ALTERNATIVE 3 – CONSTRUCT NEW FACILITIES USING THE FEDERAL LINE ITEM PROCESS

Alternative 3 – Construct New Facilities Using the Federal Line Item Process (Line Item), differs from the Proposed Action in the manner in which funding for the new construction would be obtained. In addition, no land would be transferred under this alternative. Under Alternative 3, NNSA would request Federal appropriations from Congress to cover all construction costs for new facilities. However, given the demands for Congressional line item construction across the weapons complex, funding of these facilities is uncertain. Since an anticipated date of completion for these facilities is unknown, under the Line Item alternative, newer existing buildings would be renovated to health and safety standards, and identified maintenance would be completed. The two buildings combined would be approximately 540,000 GSF and would accommodate approximately 1,400 to 1,500 administrative, technical, scientific, and support personnel. This would allow NNSA to vacate more than 66,000 square feet of offsite leased space.

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 ha (34,513 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 Y-12, 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.

DOE classifies land use on the ORR according to 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 Reservation undeveloped. Land bordering the ORR is predominately rural, with agricultural and forest land dominating.

Y-12. Figure 3.1-1 shows the boundary of Y-12. The main industrialized area of Y-12 encompasses 328 ha (811 acres), with approximately 580 buildings that house about 1 million m^2 of laboratory, machining, dismantlement, and R&D areas. The land in the Y-12 area is classified in DOE's industrial category based on its mission.

The eastern portion of the Complex is occupied by Lake Reality and the former New Hope Pond, maintenance facilities, office space and training facilities, change houses, and former ORNL Biology Division facilities. The far western portion of the Complex consists primarily of waste management facilities and construction contractor support areas. The central and west-central portions of the Complex encompass the high-security portion, which supports core NNSA missions. There are no wetlands and limited forested areas within the Y-12 boundary (DOE 2001).

Figure 3.1–1. Y-12 Site Boundary Map.

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. For additional information on future land uses and leasing agreements, refer to Section 4.1.2 of the Y-12 SWEIS.

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 m (751 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

Y-12 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 is adequate to support structures using standard construction techniques.

Y-12 is located in the Upper East Fork Poplar Creek (UEFPC) watershed. Unconsolidated materials overlying bedrock in the UEFPC watershed include alluvium (stream-laid deposits), colluvium (material transported downslope), man-made fill, fine-grained residuum from the weathering of the bedrock, saprolite (a transitional mixture of fine-grained residuum and bedrock remains), and weathered bedrock. Fill material consists of reworked natural materials mixed with construction debris (DOE 2003a). The overall thickness of these materials in the Y-12 area is typically less than 12 m (39 ft). In the undeveloped areas of the Y-12, the saprolite retains primary texture features of the unweathered bedrock including fractures.

Y-12 is situated on carbonate bedrock such that groundwater flow and contaminant transport are controlled by solution conduits in the bedrock. These karst features, including large fractures, cavities, and conduits, are most widespread in the Maynardville Limestone and the Knox Group. These cavities and conduits are often connected and typically found at depths greater than approximately 33 m (108 ft).

3.2.3 Soils

Y-12 lies on soils of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskinghum associations. Very few areas within the UEFPC watershed have a sequence of natural soil horizons because extensive cut-and-fill grading during construction of Y-12 reworked much of the preexisting unconsolidated material. 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 are generally stable and acceptable for standard construction.

Contaminated Soil. There are shallow soil contaminations throughout Y-12, primarily from historic radiological processing operations. Leaks and spills from aboveground and underground pipelines, leaks from underground storage tanks, and spills from storage areas have also contributed to soil contamination from radionuclides, mercury, beryllium, chlorinated organics, polychlorinated biphenyls (PCBs), and other metals. Shallow soil contamination is not expected to have migrated significantly deeper into the subsurface unless disturbed in some manner to facilitate migration because many of the contaminants have low mobility (DOE 2003a).

3.2.4 Seismicity

The Oak Ridge area lies at the boundary between seismic Zones 1 and 2 of the Unified Building Code, indicating that minor to moderate damage could typically be expected from an earthquake. Y-12 is cut by many inactive faults formed during the late Paleozoic Era 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 city of Oak Ridge lies in a valley between the Cumberland and Blue Ridge mountain ranges and is bordered on two sides by the Clinch River. The Cumberland Mountains are 16 km (10 mi) to the northwest, and the Blue Ridge Mountains, which include the Great Smoky Mountains National Park, are 51 km (32 mi) to the southeast (DOE 2003a). The ROI specific to air quality is primarily the Bear Creek Valley for Y-12. This valley is bordered by ridges that generally confine facility emissions to the valley between the ridges.

The climate of the region may be broadly classified as humid continental. The Cumberland Mountains to the northwest help to shield the region from cold air masses which frequently penetrate south over the plains and prairies in the central United States during the winter months. During the summer, tropical air masses from the south provide warm and humid conditions that often produce thunderstorms. Anti-cyclonic circulation around high-pressure systems centered in the western Gulf of Mexico can bring dry air from the southwestern United States into the region, leading to occasional periods of drought (DOE 2003a).

The mean annual temperature for the Oak Ridge area is 14.2 degrees Celsius (°C) (57.5 degrees Fahrenheit [°F]). The coldest month is usually January, with temperatures averaging about 2.6°C (36.6°F), occasionally dipping as low as –31°C (–24°F). July is typically the hottest month of the year, with temperatures averaging 25.2°C (77.3°F), occasionally reaching over 37.8°C (100°F). In the course of a year, the difference between the maximum and minimum

daily temperatures averages 12.6°C (22.7°F). The 2002 average temperature was 15.4°C (59.7°F) (DOE 2003a).

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 exceeding 30 km/hr (18.5 mph) are rare in the Oak Ridge area, although on February 21, 1993, a tornado did strike the east end of Y-12, uprooting trees but causing minimal damage to buildings and equipment (DOE 2001a).

The 30-year annual average precipitation is 139.8 centimeters (cm) (55.05 inches [in]), including about 24.4 cm (9.6 in) of snowfall. Precipitation in 2002 was 1500.9 mm (59.09 in) (DOE 2003a). 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 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 addition, 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). A series of legal challenges in the U.S. Court of Appeals ensued, culminating with the U.S. Supreme Court upholding the NAAQS for ozone and $PM_{2.5}$ on February 27, 2001. Based on the ambient (outdoor) levels of the criteria pollutants, EPA evaluates individual Air Quality Control Regions (AQCRs) to establish whether or not they meet the NAAQS. Areas that meet the NAAQS are classified as attainment areas, and

areas that exceed the NAAQS for a particular pollutant(s) are classified as non-attainment areas for the pollutant(s).

The ORR is located in Anderson and Roane Counties in the Eastern Tennessee-Southwestern Virginia AQCR 207, and 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 encompassing several counties (EPA 2004). 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. EPA plans to designate Anderson County as a nonattainment area for the $PM_{2.5}$ standard based on a revision to the standards.

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

Table 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. Y-12 has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne emissions meet all regulatory requirements and do not adversely affect ambient air quality. Common air pollution control devices employed on the ORR (encompassing Y-12) include exhaust gas scrubbers, baghouses, and other exhaust filtration systems designed to remove contaminants from exhaust gases before release to the atmosphere. Process modifications and material substitutions are also made to minimize air emissions. In addition, administrative control plays a role in regulating emissions (DOE 2003a).

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

Pollutant	Averaging Time	NAAQS ($\mu g/m^3$)	Tennessee Standard ($\mu g/m^3$)
SO_2	Annual[1]	80 (0.030 ppm)	80 (0.030 ppm)
	24-Hour[2]	365 (0.14 ppm)	365 (0.14 ppm)
	3-Hour[2]	1,300 (0.5 ppm)	1,300 (0.5 ppm)
PM_{10}	Annual[1]	50	50
	24-Hour[2]	150	150
$PM_{2.5}$	Annual[1]	15	15
	24-Hour[2]	65	65
CO	8- Hour[2]	10,000 (9 ppm)	10,000 (9 ppm)
	1- Hour[2]	40,000 (35 ppm)	40,000 (35 ppm)
Ozone	8- Hour[3]	157 (0.08 ppm)	157 (0.08 ppm)
	1- Hour[2]	235 (0.12 ppm)	235 (0.12 ppm)
NO_2	Annual[1]	100 (0.05 ppm)	100 (0.05 ppm)
Lead	Quarter[1]	1.5	1.5
Gaseous Flourides (as HF)[a]	30-day	-	1.2 (1.5 ppb)
	7-day	-	1.6 (2.0 ppb)
	24-hr	-	2.9 (3.5 ppb)
	12-hr	-	3.7 (4.5 ppb)

Key:
[a] Secondary State Standard
$\mu g/m^3$ = micrograms per cubic meter
ppm = parts per million
ppb = parts per billion
HF = hydrogen flouride
1. Arithmetic mean.
2. Block average.
3. Rolling average.

Source: 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. The results show that ORR operations have an insignificant effect on local air quality (DOE 2003a).

The release of nonradiological contaminants into the atmosphere at Y-12 occurs as a result of plant production, maintenance, and waste management operations and steam generation. Most process operations are served by ventilation systems that remove air contaminants from the workplace. The air permits issued by TDEC for Y-12 emission sources are included in Appendix E of the 2002 *Oak Ridge Reservation Annual Environmental Site Report* (ASER) (DOE 2003a). The allowable level of air pollutant emissions from emission sources in 2002 was approximately 10,033 tons per year of regulated pollutants. The actual emissions are much lower than the allowable amount (DOE 2003a).

The primary source of criteria pollutants at Y-12 is the steam plant, where coal and natural gas are burned. Information regarding actual and allowable emissions from the steam plant is provided in Table 3.3-2.

Table 3.3–2. Actual vs. Allowable Air Emissions from the Oak Ridge Y-12 Complex, 2002

Pollutant	Emissions (tons/year)		Percentage of allowable
	Actual	Allowable	
Particulate	24	931	2.6
Sulfur dioxide	2,748	20,803	13.2
Nitrogen oxides[a]	1,007	7,718	13.1
Volatile organic compounds[a]	2	37	5.4
Carbon monoxide[a]	23	543	4.2

[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 h/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.* U.S. Environmental Protection Agency, Research Triangle Park, N.C. January 1995 and September 1998.)

Radiological and Hazardous Air Emissions. The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 occurs almost exclusively as a result of plant production, maintenance, and waste management activities. 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 2002 dose from the ORR activities was 0.3 mrem (DOE 2003a). Details on the annual radionuclide compliance modeling and other NESHAP that cover asbestos and specific source categories on the ORR are reported in the 2002 ASER (DOE 2003a). No releases of reportable quantities of asbestos were reported at Y-12 in 2002.

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

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

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

The State of Tennessee has not established specific community noise standards applicable to Y-12. The city of Oak Ridge has specific acceptable sound levels at property lines. Maximum allowable noise limits for the city of Oak Ridge are presented in Table 3.4–1 (DOE 2001a).

Table 3.4–1. City of Oak Ridge Maximum Allowable Noise Limits Applicable to the Oak Ridge Reservation

Decibel Level dBA						
Adjacent Use			**7 a.m. – 10 p.m.**			**10 p.m. – 7 a.m.**
	L_{50}	**L_{10}**	**Maximum Limit**	**L_{50}**	**L_{10}**	**Maximum Limit**
Residential	65	70	80	55	50	75
			7 a.m. – 12 Midnight			**12 Midnight – 7 a.m.**
	L_{50}	**L_{10}**	**Maximum Limit**	**L_{50}**	**L_{10}**	**Maximum Limit**
Business	70	75	80	70	75	80
Residential	75	NA	80	75	NA	80

Notes: L_{10} - sound level, expressed in dBA, which is exceeded 10 percent (%) of the time for a 1-hour survey.
L_{50} - sound level, expressed in dBA, which is exceeded 50 percent (%) of the time for a 1-hour survey.
Source: DOE 2001a.

3.5 WATER RESOURCES

3.5.1 Groundwater

Y-12, 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 contains the main plant area of Y-12 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 Y-12 is divided into three hydrogeologic regimes, which are delineated by surface water drainage patterns, topography, and groundwater flow characteristics. The regimes are further defined by the waste sites they contain. These regimes include the Bear Creek Hydrogeologic Regime, the UEFPC Hydrogeologic Regime, and the Chestnut Ridge Hydrogeologic Regime. For more details on these hydrogeologic regimes, refer to Section 4.5.2 of the Y-12 SWEIS.

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. Refer to Section 4.5.2 of the Y-12 SWEIS for discussion on groundwater flow for the aquitard and the aquifer. 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 provides 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 Y-12: 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 Y-12 has been contaminated by hazardous chemicals and radionuclides from past weapons production waste disposal activities. The contaminant sources include past waste disposal facilities sited on Aquitard bedrock north of Bear Creek. Former disposal facilities include the S-3 Ponds, the Oil Landfarm, the Boneyard/Burnyard site, and the Bear Creek Burial Grounds, all closed since 1988.

Among the three hydrogeologic regimes at Y-12, the UEFPC regime encompasses most of the known and potential sources of surface and groundwater contamination. The groundwater contamination is the result of a commingling of releases from multiple sources within Y-12. 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 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) (DOE 2003a). The most frequently detected metals are boron, beryllium, cobalt, copper, chromium, lead, lithium, mercury, manganese, nickel, and total uranium.

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 limited groundwater contamination. Contaminants consist primarily of VOCs detected in scattered monitoring wells. The only definable VOC contaminant plume in groundwater 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, 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) 2002, the observed concentrations of VOCs at the New Hope Pond distribution channel continue to remain low (DOE 2003a).

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 area the two major surface water drainage basins are those of Bear Creek and EFPC. The portion of EFPC that drains the majority of the industrial facilities of Y-12 is frequently referred to as the UEFPC. EFPC, which discharges into Poplar Creek east of the ETTP, originates within Y-12 and flows northeast along the south side of Y-12. Various Y-12 wastewater discharges to the UEFPC from the late 1940s to the early 1980s left a legacy of contamination, such as mercury, PCBs, and uranium that has been the subject of water quality improvement initiatives over the past 15 to 20 years.

The natural drainage pattern of UEFPC has been radically altered by the construction of Y-12. 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 water generated by plant operations. As a result of reduced operations and elimination of inadvertent direct discharges to UEFPC, flow in UEFPC decreased from 38 to 57 million liters per day (MLD) (10 to 15 million gallons per day [MGD]) in the mid-1980s to about 9 MLD (2.4 MGD) in the mid-1990s. To improve downstream water quality, Y-12'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 (7 MGD) at Station 17, just before the creek exits Y-12 on the east end.

Bear Creek Valley west of Y-12 is drained by Bear Creek. Bear Creek begins near the westernmost portion of Y-12 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 water gap in Pine Ridge to its confluence with Lower 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.

The Clinch River is a source of water for the city of Oak Ridge which provides potable water for Y-12, ORNL, and the city of Oak Ridge. The Clinch River has an average flow of 132 cubic meters per second (m^3/s) (4,700 cubic feet per second [ft^3/s]) as measured at the downstream side of Melton Hill Dam at mile 23.1. The average flow of Bear Creek near Y-12 is 0.11 m^3/s (4 ft^3/s). Prior to flow augmentation in UEFPC, the average flow in EFPC measured downstream of Y-12 was 1.3 m^3/s (46 ft^3/s). Y-12 uses approximately 7,530 million liters per year (MLY) (2,000 million gallons per year [MGY]) of water while the ORR uses approximately twice as much. The ORR water supply system, which includes the city of Oak Ridge treatment facility and the ETTP treatment facility, has a capacity of 44,347 MLY (11,715 MGY).

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, controls 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.

At Y-12, there are six treatment facilities with NPDES-permitted discharge points to UEFPC. Y-12 is also permitted to discharge wastewater to the city of Oak Ridge Wastewater Treatment Facility.

The water quality of surface streams in the vicinity of Y-12 is affected by current and past operations. Despite efforts to reroute discharge pipes and to treat all wastewater from plant processes, wastewater discharges from Y-12 are a major influence on water quality and flow in UEFPC. Stormwater, groundwater, and wastewater discharges contribute specific contaminants to UEFPC.

Surface water contaminants in UEFPC include metals (particularly mercury and uranium), chlorinated solvents, 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.

Routine surface water surveillance monitoring, above and beyond that required by the NPDES permit, is performed as a best management practice. Y-12 monitors the surface water as it exits each of the three hydrogeologic regimes that serve as an exit pathway for surface water (DOE 2003a).

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 sites are located inside the ORR within the boundaries of Y-12.

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 reservation 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 2002).

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 Y-12, grassy and unvegetated areas surround the entire site. Building and parking lots dominate the landscape at Y-12, with limited vegetation present. Fauna within the Y-12 area is limited due to the lack of large areas of natural habitat. One of the sites proposed for transfer, Site A, is located within the Property Protected Area of Y-12 and is bounded by the Bear Creek Road to the north and First Street to the south, North Portal parking area to the east and Central Portal parking area to the west. Site B is located outside of the fenced area of Y-12 and is currently an open, grassy area bounded to the east by Scarboro Road, to the south by Second Street, and to the west by the UEFPC diversion channel. The adjacent land has been previously disturbed to allow for construction of roads, structures and utilities. These sites provide little habitat for terrestrial resources. Woodchuck, opossum, raccoon, and striped skunk are among the largest abundant mammals, specifically near the area of Site B

(DOE 2001a, 2003b). Additional information and listing of species found at the ORR can be found in the Section 4.6 of the Y-12 SWEIS.

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 reported at Y-12 is a gray bat (*Myotis grisescens*). 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 Y-12, however, this bat has not been observed at Y-12 or other parts of the ORR (DOE 2001a).

No critical habitat for threatened or endangered species, as defined in the *Endangered Species Act*, exists on the ORR (DOE 2001a). The Y-12 site contains no designated habitat that could support threatened or endangered species of plants; however, most of the site has not been surveyed (DOE 2003b).

Federal or state threatened and endangered species observed on the ORR include 16 plants (3 of which are candidate endangered species), 2 mammals, and 2 raptor species (DOE 2001a). A number of rare or state-listed animals and plants are present in the vicinity of Y-12.

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 Y-12 lie within the 100- and 500-year floodplains of EFPC. The proposed Site A is neither within the 100- nor the 500-year floodplain. Site B is located outside the Property Protected Area of Y-12, near 100- and 500-year floodplain of the EFPC.

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
	Osprey	*Pandion haliaetus*	NL	T
	Plants			
	American ginseng	*Panax quinquefolius*	NL	S-CE
	Appalachian bugbane	*Cimicfuga rubifolia*	SC	T
	Branching whitlow-grass	*Draba ramosissima*	SC	T
	Butternut	*Uglans cinera*	NL	T
	Fen orchid	*Liparis loeselii*	NL	E
	Golden seal	*Hydrastis Canadensis*	NL	S-CE
	Heavy sedge	*Carex gravida*	NL	S
	Michigan lily	*Lilium michiganense*	NL	T
	Mountain witch alder	*Fothergilla major*	NL	T
	Northern bush honeysuckle	*Diervilla lonicera*	NL	T
	Pink lady's-slipper	*Cypripedium acaule*	NL	E-CE
	Purple fringeless orchid	*Platanthera peramoena*	NL	T
	Shining ladies-tresses	*Spiranthes lucida*	NL	T
	Spreading false foxglove	*Aureolaria patula*	SC	T
	Tall larkspur	*Delphinium exaltatum*	SC	E
	Whorled mountainmint	*Pycnanthemum verticillatum*	NL	E-P

[a]Status codes: CE-candidate endangered; DL-proposed for delisting; E-endangered; NL-not listed; P-possibly extirpated; S-special concern in Tennessee; T-threatened.
Sources: DOE 2001a.

Wetlands. Approximately 235 ha (580 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 (25 acres) at White Oak Lake (ORNL 2002).

There are two dominant aquatic features in the area of Site B, UEFPC and Lake Reality. The UEFPC channel has been extensively modified over the years and much of the channel lacks riparian vegetation. Lake Reality is a plastic-lined, steep-sided spill-control basin; it is home to turtles and fish but does not support much vegetation (DOE 2003b). No wetlands have been identified near Site A or Site B.

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 in the 17th century. 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). Traditional cultural practices 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 are also considered.

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 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 important resources, and consultation to avoid, reduce, or mitigate adverse effects. The NHPA does not require preservation of cultural resources, but does ensure that Federal agency decisions

concerning the treatment of these resources result from meaningful consideration of cultural and historic values, and identification of options available to protect the resources.

Identified cultural resources are fully recorded and evaluated to determine if they are eligible for listing on the National Register of Historic Places (NRHP). To be 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 Y-12

Architectural and archaeological studies have been conducted for the Y-12 site (Thomason and Associates 2003). In 1995 (final version 1999), Thomason and Associates completed a comprehensive architectural and historical evaluation of Y-12. A total of 248 properties were individually recorded and evaluated, and the remaining 325 facilities were identified and categorized by design and use. At least 10 major archaeological reconnaissance-level surveys have been conducted on the ORR. Y-12 contains only one known archaeological site. A survey conducted of Y-12 in the early 1990s identified one archeological site (40AN68) which is located on a flat rise overlooking the EFPC within the boundaries of Y-12. This site is of 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 Y-12 proper which meet the criteria for inclusion in the NRHP.

No cultural resources at Y-12 are currently listed on the NRHP. Y-12 has a historic district that has been determined eligible for listing and the Tennessee State Historic Preservation Officer (SHPO) has concurred with this determination (Thomason and Associates 2003). The district 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 Y-12 in relation to Sites A and B.

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 facility at Y-12 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 area. 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 site. Also, no artifacts of Native American religious significance are known to exist or to have been removed from the Y-12 site (DOE 2001a).

There are at least 68 cemeteries on the ORR, 7 of which are located on the Y-12 site. These cemeteries are associated with Euro-American use of the area prior to World War II (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 Sites A and B

The historic district includes much of the Y-12 site; however neither Site A nor Site B is located within the district (Figure 3.7-1). Neither Site A nor Site B is located near the two buildings proposed for National Historic Landmark status or other properties eligible for inclusion in the National Register. At the east end of the Y-12 site, near but not within Site B, is the cemetery associated with the New Hope Baptist Church, which was removed in 1942. The proposed undertaking to transfer the two parcels and to construct the new facilities would not adversely affect any properties eligible for listing in the National Register of Historic Places.

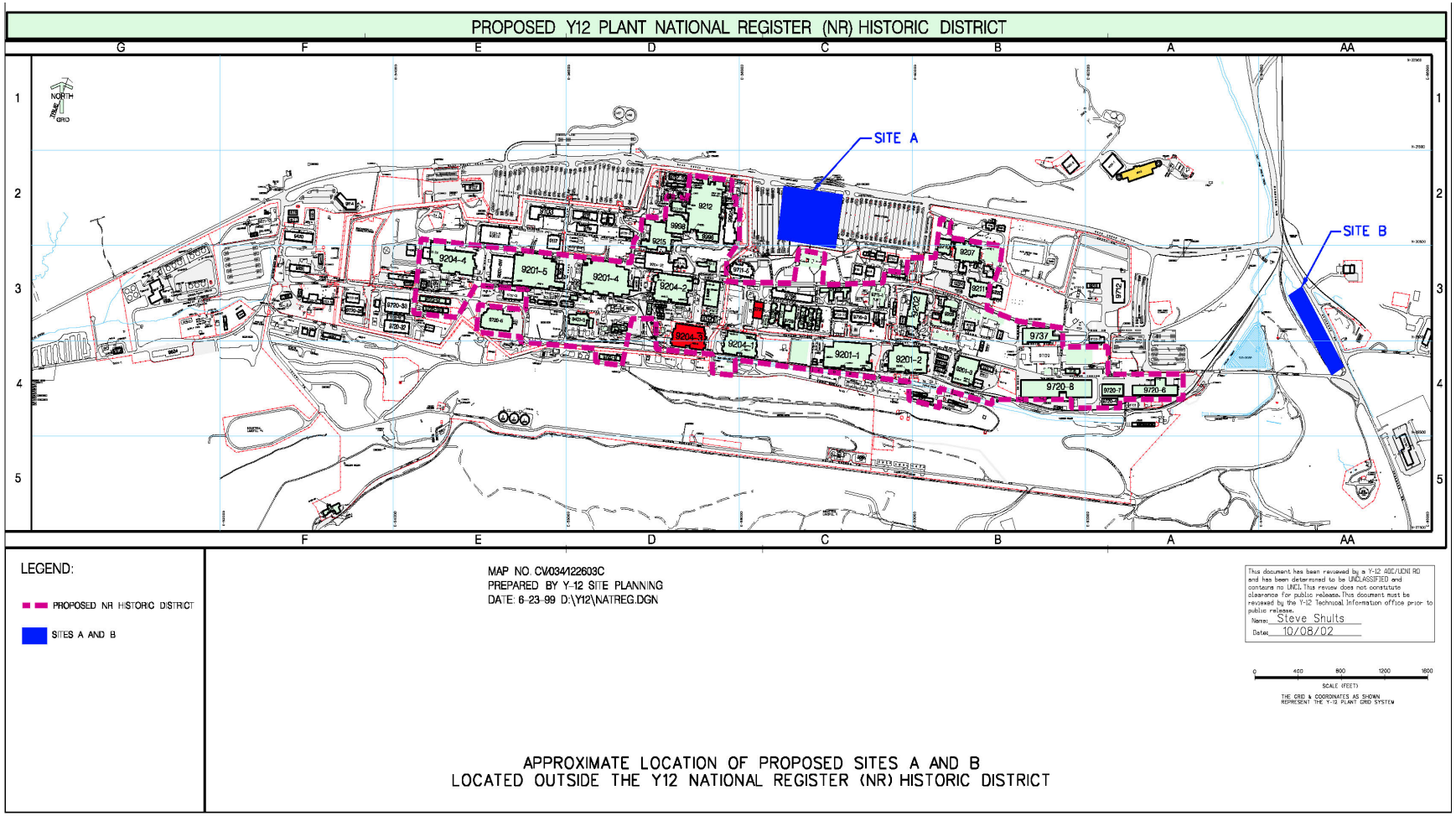


Figure 3.7–1. Location of the Historic District at Y-12 in Relation to Sites A and B.

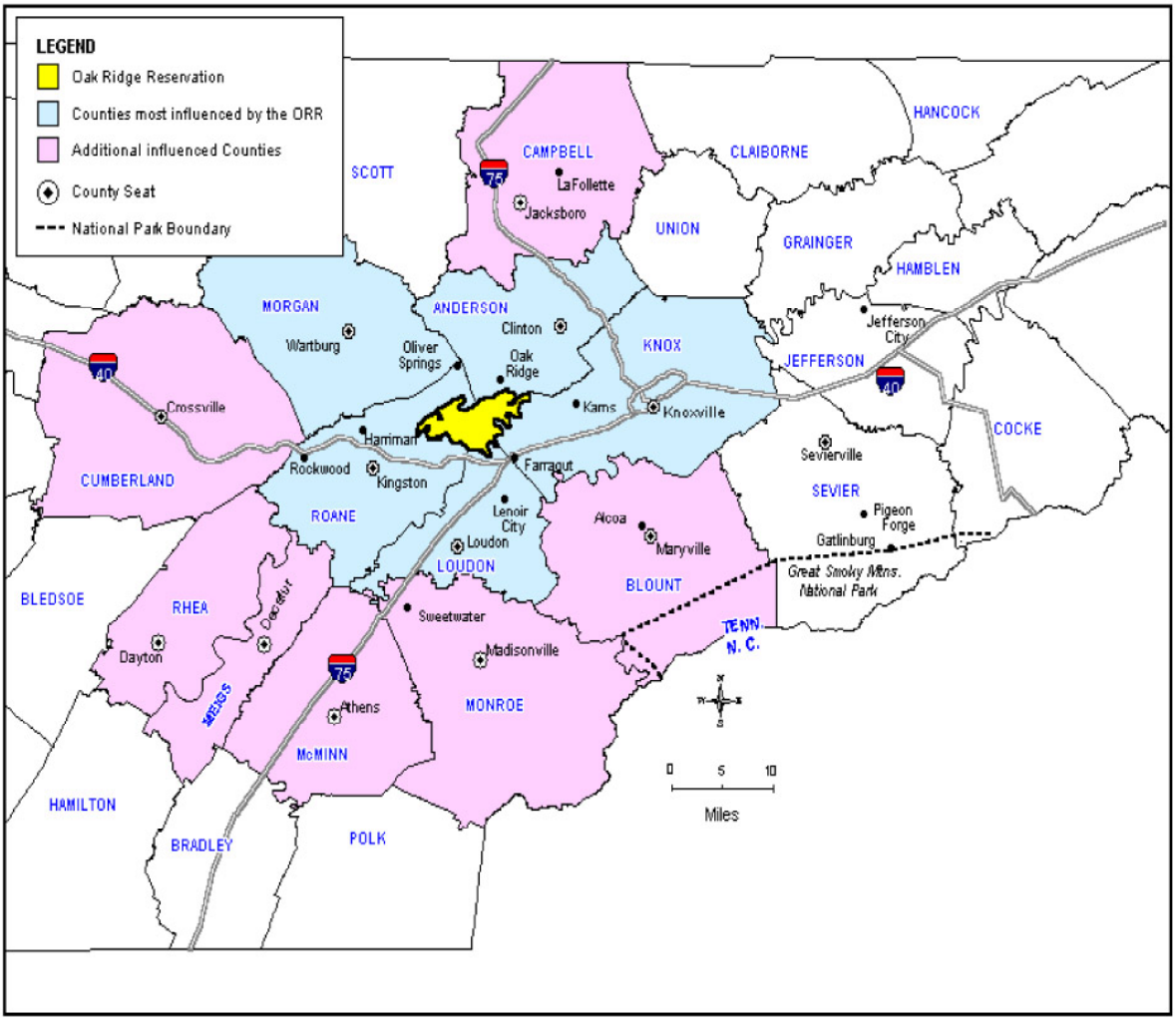
Site A is a previously developed area that housed several buildings in the 1940s. Those buildings have been demolished over the years and there are no archaeological resources located on Site A. Site B has been used as a staging area for construction, a holding area for media, and for placement of ground water monitoring wells. Although Site B is undeveloped, it has been heavily disturbed, and there is a low probability for archeological resources. A field survey of Site B has been conducted. There will be no disturbance of this area until the archeological report has been submitted, reviewed, and approved by the State Historic Preservation Office.

3.8 SOCIOECONOMICS

This section describes current socioeconomic conditions within a region of influence (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. In 2003, almost 40 percent of the ORR workforce resided in Knox County, 29 percent in Anderson County, 16 percent in Roane County, and 6 percent in Loudon County. The remaining 9 percent of the 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 5.8 percent from 280,579 in 1994 to 296,901 in 2003. Overall, ROI employment grew from 270,566 in 1994 to 286,256 in 2003 and continued to grow despite the fluctuations in the labor force (BLS 2004).



Source: DOE 2001a

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

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.

The ROI unemployment rate was 3.6 percent in 2003, continuing on an upward trend after a 10-year low of 2.7 percent in 2000, as shown in Table 3.8–2. In 2003, unemployment rates within the ROI ranged from a low of 3.1 percent in Knox County to a high of 5.5 percent in Roane County. The unemployment rate in Tennessee was 5.8 percent (BLS 2004).

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

County	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Anderson	3.9	3.9	4.8	5.6	3.7	3.6	3.7	4.1	3.9	4.6
Knox	3.3	3.4	3.4	3.6	3.1	2.6	2.3	2.5	2.8	3.1
Loudon	3.9	4.0	3.9	4.5	3.2	3.0	2.9	3.6	4.2	4.2
Roane	4.4	5.8	5.3	7.3	5.0	4.6	4.2	4.4	5.3	5.5
ROI Total	3.6	3.8	3.8	4.3	3.4	2.9	2.7	3.0	3.3	3.6
Tennessee	4.8	5.2	5.2	5.4	4.2	4.0	3.9	4.4	5.1	5.8

Source: BLS 2004.

Per capita income in the ROI was $28,204 in 2001, a 55 percent increase from the 1990 level of $18,198. Per capita income in 2001 in the ROI ranged from a low of $22,017 in Roane County to a high of $29,426 in Knox County. The per capita income in Tennessee was $26,808 in 2001 (BEA 2003).

Y-12 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 $30,802 (BEA 2003). 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 Y-12'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, Y-12 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 2001, USCB 2004). 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.

Knox County is the largest county in the ROI with a 2002 population of 389,327. 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 40,631. The city of Oak Ridge and the ORR are located in both Roane and Anderson Counties which had 2002 populations of 52,316 and 71,627, respectively (USCB 2004).

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 2001, USCB 2004, State of Tennessee 2003.

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 2000d). 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 2000d.

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 70,000 students in the ROI (TDE 2002). 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 Y-12 is provided by Wackenhut Services, Inc. (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 (DOE 2001b). 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 2004). 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.

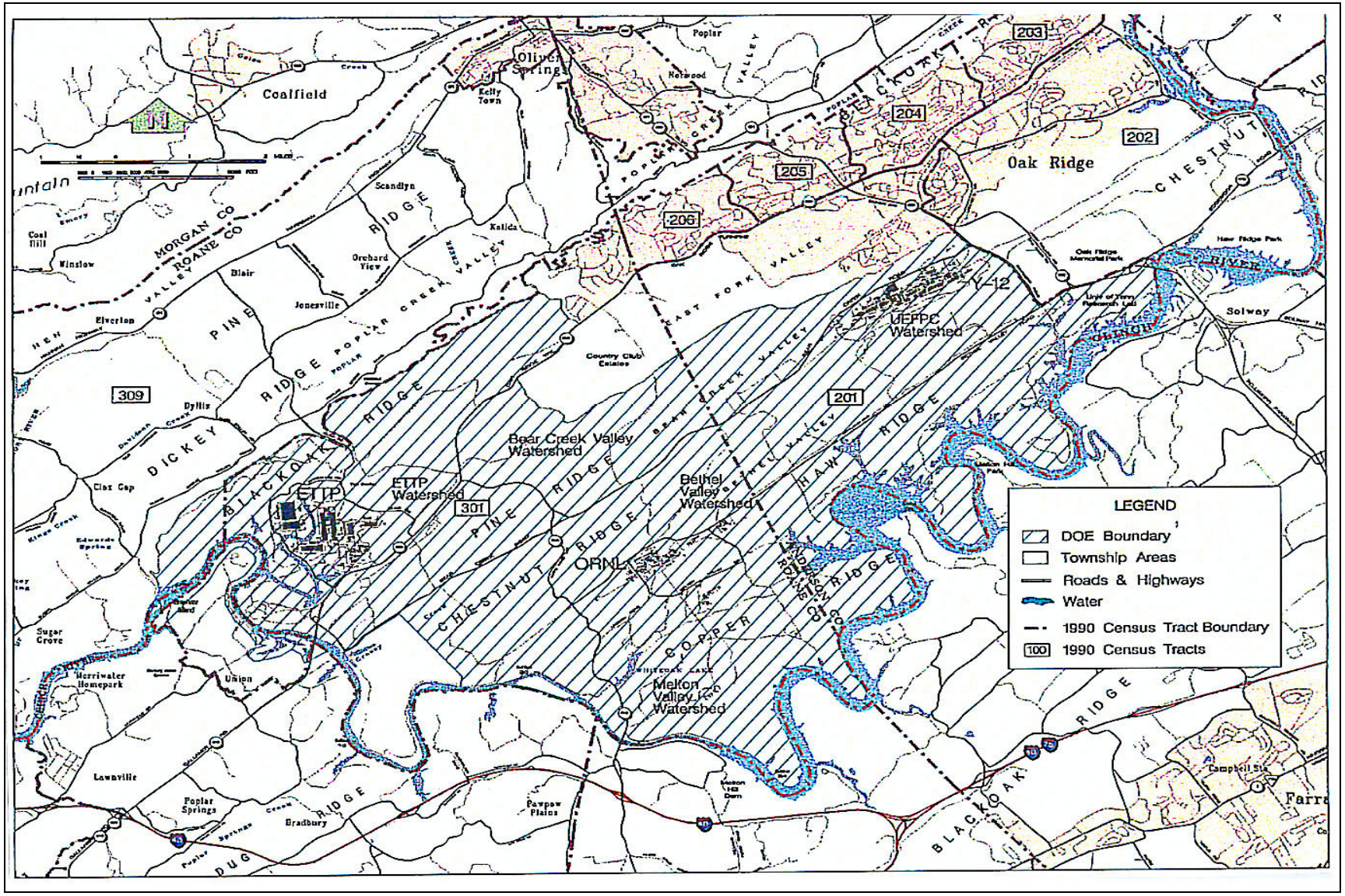
Any disproportionately high and adverse human health effects on minority populations and/or low-income populations that could result from the alternatives being considered for Y-12 are assessed for the census tract which contains the site, the area for which health effects are assessed. Any health effects 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 4.8, Socioeconomics.

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**	**%**
201	2,471	1,433	58.0	831	33.6	1038	42.0	92	3.7
202	7,227	6,458	89.4	343	4.7	769	10.6	125	1.7
301	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 2000a, 2000b.



Source: DOE 2001a

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

Table 3.9–2. Individuals Living Below Poverty Level in Census Tracts Containing the ORR (1999)

Census Tract	Total Population[a]	Number of Individuals Below Poverty Level	Percentage of Total Individuals in Census Tract Below Poverty Level
201	2,363	374	15.8
202	6,961	471	6.8
301	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 2000c.

Approximately 12,726 people live within the 3 census tracts containing the ORR. Minorities compose 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 201 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 2000c). The Scarboro community is predominately a minority community located approximately 1 km (0.6 mi) north of Y-12.

3.10 SITE INFRASTRUCTURE

An extensive network of existing infrastructure supports Y-12 facilities and activities. Site infrastructure available at Y-12 includes an extensive roads and railroad system; electric power provided by TVA; natural gas supplied by the East Tennessee Natural Gas Company; steam; raw, treated, demineralized, and chilled water; sanitary sewer; industrial gases, and telecommunications. These services are discussed in detail in Section 4.8.3 of the Y-12 SWEIS. Since the preparation of the Y-12 SWEIS, DOE has transferred the water plant to the city of Oak Ridge.

3.11 TRANSPORTATION

3.11.1 On-site Traffic

Y-12 is located within 80 km (50 mi) of three interstate highways: I-40, I-75, and I-81. Primary roads on the ORR serving Y-12 include Tennessee State Routes (TSRs) 95, 58, 62, and 170 (Bethel Valley Road) and Bear Creek Road. The daily traffic numbers for various roads at the ORR are given in Table 3.11–1.

3.11–1. Existing Average Daily Traffic Counts on the ORR Serving Y-12

Road	To	From	Average Daily Traffic Vehicles/day
TSR 58	TSR 95	I-40	12,710
TSR 95	TSR 62	TSR 58	21,730
TSR 62	TSR 170		29,980
Bethel Valley Road	TSR 62		9,300

Source: TDOT 2003

3.11.2 Off-site Traffic

Y-12 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, SR 61, SR 162, and US 25W at Clinton serve Y-12 transportation needs off site (DOE 2001a).

3.12 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

Current activities associated with routine operations at Y-12 have the potential to affect worker and public health. Air emissions at Y-12 can 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. The following discussion characterizes the human health impacts from current operations at Y-12.

3.12.1 Public Health

Radiological. In 2002, the total effective dose equivalent (EDE) to the maximally exposed individual (MEI) from Y-12 operations was 0.3 mrem (0.003 milliSivert [mSv]). The MEI for Y-12 was located approximately 870 m (0.54 mi) northwest of the main Y-12 Plant release point. Inhalation and ingestion of uranium isotopes accounted for more than 99 percent of the dose to the MEI (DOE 2003a). The standard for airborne releases is 10 mrem (0.10 mSv) 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). 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 2 mrem (0.02 mSv) in 2002 (DOE 2003a). The DOE standard is 4 mrem (0.04 mSv) per year to the MEI from the drinking water pathway. Table 3.12-1 summarizes the doses to the MEI from atmospheric and waterborne releases.

The population within 80 km (50 mi) of Y-12 was 1,040,041 in 2002. In 2002, the 50-year committed collective EDE to the population within 80 km (50 mi) of the ORR was 2.0 person-rem (0.020 person-Sv) from atmospheric releases at Y-12 and 6 person-rem (0.06 person-Sv) from waterborne releases. Based on a dose to risk conversion factor of 5.0×10^{-4} fatal cancers per person-rem (ICRP 1991), the collective EDE of 8 person-rem (0.08 person-Sv) would statistically result in less than one additional latent cancer death within the population. The collective dose is also presented in Table 3.12–1.

Table 3.12–1. Potential Radiological Impacts to the Public Resulting from Normal Operations at Y-12

Affected Environment	Individual Dose (mrem-year)	Percentage of Standard[a]	Collective Dose (person-rem)
Atmospheric Releases	0.3[b]	3	2
Waterborne Releases			
Ingestion of drinking water	0.04[c]	1	0.4[d]
Ingestion of fish	0.28[e]	N/A	6[e]
Other uses	0.07[c]	N/A	0.2
Totals	**0.69**	**0.7**	**8.6**

[a] Radionuclide NESHAP standard is 10 mrem per year from atmospheric releases. DOE Order 5400.5 Change 2 radiological standard for atmospheric releases is 10 mrem per year, 4 mrem per year for drinking water pathway, and 100 mrem per year from all exposures.
[b] As calculated using CAP88.
[c] Maximum potential exposure to the individual based on radionuclide discharges to the Clinch-Poplar Creek system.
[d] Based on radionuclide discharge data and Clinch River water sample data for the Kingston and Rockwood municipal water plant. Collective EDE based on population of 21,241 water users.
[e] Maximum potential dose to avid fish eaters form the Clinch River and Poplar Creek. Collective dose also includes Melton Hill Lake and the Tennessee River System down to Chattanooga.
Source: DOE 2003a.

3.12.2 Worker Health

Radiological. One of the major goals of DOE is to keep worker exposures to radiation and radioactive material as low as reasonable 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 Y-12 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.

Y-12 worker doses have typically been well below DOE worker exposure limits. Table 3.12–2 lists the individual and collective doses for all radiation (involved) workers from 1990 to 2000, as presented in the Y-12 Dosimetry Records System database.

For additional information on worker health, refer to the Y-12 SWEIS, Section 3.12.2 and Appendix D, Human Health and Worker Safety.

Table 3.12–2. Y-12 Radiological Worker Annual Individual and Collective Radiation Doses

Year	Number of Radiological Workers	Average Individual Worker Dose (mrem)	Radiological Worker Collective Dose (person-rem)
1990	2,907	14.8	43.16
1991	3,050	7.3	22.27
1992	2,787	13.1	36.46
1993	2,701	6.8	18.48
1994	2,533	5.4	13.58
1995	2,924	3.1	9.10
1996	3,140	3.1	9.73
1997	3,552	2.96	10.51
1998[a]	3,563	11.4	40.61
1999[a]	3,949[b]	35.6	140.7
2000[c]	3,264	20.1	65.7

[a] 1998 and 1999 data reflect higher doses due to the use of a more conservative risk model in 1998 than was used in previous years and the restart of some uranium operations.
[b] Increase in worker numbers in 1999 is due to the inclusion of M-K Ferguson Company as a Y-12 subcontractor.
[c] 2000 data reflect lower doses due to the use of the latest biokinetic modeling information provided by the ICRP.
Source: DOE 2001a

3.13 WASTE MANAGEMENT

There are several waste storage, treatment, and disposal facilities at Y-12. The majority of these facilities at Y-12 are operated under the Environmental Management (EM) Program but some are managed by NNSA. Waste management facilities are located in buildings or on sites, dedicated to their individual functions, or are collocated with other waste management facilities or operations.

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

3.13.1 Waste Generation from Routine Operations

The major waste types generated at Y-12 from routine operations include low level waste (LLW), mixed-LLW, hazardous waste, and nonhazardous waste. Table 3.13–1 presents a summary of waste generation totals for routine operations at Y-12 for FY2003. Other waste includes sanitary and industrial wastewater, PCBs, asbestos, construction debris, general refuse,

and medical wastes. Y-12 does not generate or manage high-level radiological waste or transuranic (TRU) waste.

Low-Level Waste. Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, and process equipment is generated at Y-12. In FY2003, Y-12 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). Y-12 is the largest generator of routine LLW at Oak Ridge. In FY2003, Y-12 generated 13.32 m^3 (17.42 yd^3) of liquid LLW.

Table 3.13–1. Summary of Waste Generation Totals by Waste Type for Routine Operations at Y-12

Waste Type	Waste Volume (FY-2003)
Low-Level Waste (Liquid)	13.32 m^3 (17.42 yd^3)
Low-Level Waste (Solid)	5,960.77 m^3 (7796.69 yd^3)
Mixed Low Level Waste (Liquid)	13.66 m^3 (17.87 yd^3)
Mixed Low Level Waste (Solid)	16.15 m^3 (21.12 yd^3)
RCRA Waste	13.04 metric tons (14.37 short tons)
TSCA Waste	13.46 metric tons (14.84 short tons)
Mixed TSCA	29.07 metric tons (32.04 short tons)
Sanitary Waste	7,188.34 metric tons (7923.71 short tons)

Source: Gilbert 2003.

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 Y-12. DOE is under a State Commissioner's Order (October 1, 1995) to treat and dispose of these wastes in accordance with milestones established in the *Site Treatment Plan for Mixed Waste on the Oak Ridge Reservation* and to comply with a *Federal Facilities Compliance Act* (FFC Act) that went into effect on June 12, 1992. *Toxic Substance Control Act* (TSCA)-regulated waste (containing PCBs) that is also radioactive waste is managed under a separate Federal Facilities Compliance Agreement (FFCA), first effective February 20, 1992.

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, Y-12 generated 13 metric tons (14 short tons) of RCRA waste. The hazardous waste is shipped offsite for treatment and disposal at either DOE or commercially-permitted facilities.

Other Waste Types. Treated industrial wastewater is discharged to the UEFPC. 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 a Y-12 sanitary industrial landfill, as are asbestos wastes and general refuse. Construction, demolition, and nonhazardous industrial materials are disposed of in a construction/demolition landfill at Y-12.

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

3.13.2 Waste Generation from Environmental Restoration Activities

Environmental Restoration Waste. EPA placed the ORR on the NPL 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. By 2006, greater than 95 percent of the current EM work scope will be completed, with 99 percent of the planned risk reduction accomplished. 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. Long-term surveillance, maintenance, and post-closure activities will continue past 2006.

3.14 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 [5,000 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 Y-12 and surrounding areas, the Bureau of Land Management's (BLM) Visual Resource Management (VRM) Classification System was used. Although this classification system is designed for undeveloped and open land managed by BLM, this is one of the only systems of its kind available for the analysis of visual resource management and planning activities. Currently, there is no BLM classification for Y-12, however, the level of development at Y-12 is consistent with VRM Class IV which is used to describe a highly developed area. Most of the land surrounding the Y-12 site would be consistent with VRM Class II and III (i.e., left to its natural state with little to moderate changes).

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 at Y-12, can be seen from the urban areas of the city of Oak Ridge.

Y-12 is situated in Bear Creek Valley at the eastern boundary of the ORR. It is bounded by Pine Ridge to the north and Chestnut Ridge to the south. The area surrounding Y-12 consists of a mixture of wooded and undeveloped areas. Facilities at Y-12 are brightly lit at night, making them especially visible. 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 structures are two meteorological towers erected in 1985 located on the east and west ends of the Complex. The east tower, located at Site B, reaches a height of 100 m (328 ft). The tower is painted orange and white, and is the only structure at Y-12 tall enough to require aviation beacons. The west tower is located on a slight rise across from the intersection of Old Bear Creek Road and Bear Creek Road. Although this tower only reaches a height of 60 m (197 ft), it is actually higher in elevation than the east tower. These towers are used to measure and transmit meteorological data to ETTP databases.

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

Site A is an open grassy area on a knoll that overlooks other facilities in the Y-12 Complex, and includes the former location of Building 9704-2 to the south. Site A is surrounded by buildings in the Y-12 Complex to the east, west, and south; and there is a wooded area just across Bear Creek Road to the north.

Site B consists of a relatively flat, vacant, grassy area bounded on the east by Scarboro Road, the south by Second Street, and the west by the UEFPC diversion channel. There are additional roads and buildings, including a visitor center, to the east of Site B, and Y-12 Complex buildings to the west. The balance of the surroundings consists of grassy fields and woods further north of Bear Creek Road.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 LAND USE

4.1.1 Alternative 1 – No Action

If Alternative 1 is implemented, it is assumed that neither the Land Transfer (Proposed Action) nor the alternative Line Item would occur. Y-12 personnel would remain in their current buildings, if practical.

The existing buildings, because of their age and condition, would require extensive renovation to reduce health and safety concerns, as well as to meet building codes. Off-site leasing and small support buildings are options to be considered if this project is not approved.

4.1.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. The main area of Y-12 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 new facilities that would replace the old facilities may include some or all of the following: administrative center, engineering office, cafeteria, visitor center/security office, human resources offices, conference and training center, and laboratory and prototyping center. The construction of the new facilities at both Sites A and B would be consistent with the current land use patterns at Y-12. There would be no alterations of current land use patterns or planning resulting from the new facility. The land transfer of Sites A and B would be less than 20 acres, and represents less than 1 percent of the land at Y-12.

Operation. Operation of the new facilities would be consistent with the current land use patterns at Y-12. There would be no alteration of current land use patterns or planning resulting from the new facilities.

4.1.3 Alternative 3 – Line Item

Land use impacts from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

4.2 GEOLOGY AND SOILS

4.2.1 Alternative 1 – No Action

Under the No Action Alternative, no new construction or land disturbing activities beyond those previously assessed in the Y-12 SWEIS for continued operations are expected to occur. Therefore, no impacts to soils and geology are anticipated.

4.2.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. Construction of the new facilities would have no impact on geological resources, and the hazards posed by geological conditions are expected to be minor. The bedrock at Y-12 is adequate to support structures using standard construction techniques.

The new facilities would require excavation of soil for the placement of the first level of the buildings. Soil erosion due to past land use has ranged from slight to severe. Wind erosion is slight and shrink-swell potential is low to moderate. An increased potential for soil erosion and soil compaction would occur as large equipment is used during the construction of the new facilities. The soils at the Y-12 site are generally stable and acceptable for standard construction techniques.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. All new facilities would be designed and constructed to meet all regulatory requirements.

Operation. No impacts to soils and geology are anticipated from the operation of the new facilities.

4.2.3 Alternative 3 – Line Item

The construction and operation impacts to geology and soils would be the same as those described for Alternative 2, the Proposed Action.

4.3 CLIMATE AND AIR QUALITY

4.3.1 Alternative 1 – No Action

The No Action Alternative would not significantly change the existing regional air quality or meteorology.

4.3.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. The primary means by which air quality would be affected would be from construction activities. Construction activities for the Proposed Action are expected to take approximately 18 months, starting in CY 2005.

During preparation and construction on Sites A and B, the use of heavy equipment would generate combustion engine exhaust containing 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 bringing supplies and equipment to the construction site, and from construction workers commuting 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 already operating in the area, and would not be expected to significantly change air quality at Y-12.

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 limiting nuisance

conditions (TDEC Rules Chapter 1200-3-8) such as fugitive dust. 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 in demolition of existing buildings or structures, construction operations, grading of roads, or the clearing of land
- 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 vent the handling 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 construction would not have a net effect on meteorological conditions or regional climatic conditions.

Operation. No additional boilers or other fuel-burning equipment, except for emergency generators, would be added as a consequence of building and operating the proposed facilities. There would be no increase in steam or power production from the Y-12 steam plant that would cause increased emissions of regulated pollutants. Permit limits for the Y-12 steam plant would not be exceeded or increased. Efficiencies associated with these state-of-the-art facilities would likely have a small positive effect on infrastructure requirements, which could lead to a slight positive effect on air quality. Because the proposed facilities would be for the purposes of relocating existing employees in the Y-12 Complex, rather than increasing the number of employees, there would be no associated increase in emissions from private motor vehicles during workers' commutes to and from work.

4.3.3 Alternative 3 – Line Item

Air quality impacts from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

4.4 NOISE

4.4.1 Alternative 1 – No Action

The No Action Alternative would not have an effect on the existing acoustical environment beyond the impacts previously assessed in the Y-12 SWEIS for continued operations. Existing noise levels would be expected to continue.

4.4.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. The onsite and offsite acoustical environments would be impacted during construction of the proposed facilities on Sites A and B. Construction activities would generate noise produced by heavy construction equipment, trucks, power tools, and percussion from pile drivers, hammers, and dropped objects. In addition, traffic and construction noise 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 large-scale building sites. 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, after this time, heavy equipment noise would become more sporadic and brief in duration. The noise from trucks, power tools, and percussion would be sustained through most of the building construction and equipment installation activities on the proposed facility site. 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.

Site A is approximately 1,700 ft (518 m) from the ORR boundary, and Site B is nearly adjacent to (within approximately 50 ft [30 m]) the ORR boundary. Peak attenuated noise levels at offsite locations within the city of Oak Ridge from construction on Site A would be similar to background noise levels (53 to 62 dBA) as shown in Table 4.4–1. Peak attenuated noise levels at offsite locations within the city of Oak Ridge from construction on Site B would be in the range of 73 to 102 dBA, resulting in a temporary increase above typical background noise levels in the area.

Noise reduction and mitigation measures include regulations contained within the *Noise Control Act of 1972* (42 U.S.C.§4901), and *Occupational Noise Exposure* (29 CFR 1910.95). For sound exceeding 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.

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

Operation. During operation of the proposed facilities, a low level of noise would be generated by operation of the HVAC system and associated air intakes and exhaust fans. The noise levels generated would be consistent with the operation of similar office facilities. Both operation of the facility and the HVAC system would have a negligible effect on ambient noise levels, and the facility would meet the city of Oak Ridge's noise guidelines (Table 3.4–2). Since construction of the proposed facilities would result in the relocation of Y-12 employees from offsite leased space rather than an increase in the number of employees, there would be no significant increase in noise from private motor vehicles during workers' commutes to and from work.

4.4.3 Alternative 3 – Line Item

Noise impacts from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

4.5 WATER RESOURCES

4.5.1 Alternative 1 – No Action

No groundwater would be extracted during the renovations of any existing facilities. All process, utility, and sanitary wastewater would be treated prior to discharge in accordance with NPDES permit. Therefore, there would be no impacts to groundwater or surface water.

Existing water capacity is sufficient. Sanitary wastewater would be discharged to the city of Oak Ridge publicly owned treatment works under Industrial and Commercial Users Wastewater Permit Number 191.

4.5.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. All water for construction of the new facilities would be taken from the Clinch River as part of the normal water uses at Y-12. No groundwater would be extracted during the construction of the new facilities. All process, utility, and sanitary wastewater would be treated prior to discharge into UEFPC in accordance with NPDES permit. Therefore, no impacts to groundwater or surface water from construction of the new facilities are anticipated.

Existing water capacity is sufficient. During construction, stormwater and erosion control measures would be implemented to minimize soil erosion and transport to UEFPC.

Operation. No groundwater would be extracted during the operation of the new facilities. All process and utility water would be treated prior to discharge into UEFPC in accordance with NPDES permit. Sanitary wastewater from the new facilities would be discharged to the city of Oak Ridge publicly owned treatment works under an Industrial and Commercial Users Wastewater Permit. Therefore, no impacts to groundwater or surface water from operation of the new facilities are anticipated.

Water requirements for operation of the new facilities are not known at this time. However, since these facilities would be used primarily as replacements for administrative functions and light laboratory, the water requirements would be significantly less or the same as current usage. No adverse impacts to surface water quality are expected because all discharges would be maintained in compliance with NPDES permit limits.

4.5.3 Alternative 3 – Line Item

Impacts to groundwater and surface water from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

4.6 ECOLOGICAL RESOURCES

4.6.1 Alternative 1 – No Action

Ecological resources at Y-12 include terrestrial, aquatic, threatened and endangered species, floodplains, and wetlands. Under this alternative, no new facilities beyond those previously assessed in the Y-12 SWEIS for continued operations would be constructed; therefore, there would be no change or impacts to ecological resources.

4.6.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. Under this Proposed Action, construction of new facilities at Sites A and B would occur. Site A is located in a developed area of Y-12 that has been previously disturbed and contains minimal ecological resources. Site B is located in an open, grassy area outside the Property Protected Area of Y-12 and contains minimal ecological resources. Temporary disturbance and/or dislocation of wildlife (e.g., geese, squirrels) may be expected due to construction of the new facilities. The Y-12 area contains no designated habitat for threatened and endangered species of plants or animals, therefore no impacts are expected.

Site A is located outside the 100-year and 500-year floodplain and no wetlands have been identified near the area of Site A. Therefore, there would be no impacts to floodplains or

wetlands. Site B is located near the 100 and 500-year floodplain areas of the EFPC, and no wetlands have been identified near the site. Construction activities would occur outside the 500-year floodplain, therefore, no impacts are anticipated. Aquatic features found in the area of Site B have been extensively modified over the years and lack riparian vegetation.

Operation. There would be no significant impact to wildlife, wetlands, or floodplains from the operation of the proposed facilities at Sites A and B.

4.6.3 Alternative 3 – Line Item

Impacts to ecological resources from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

4.7 CULTURAL RESOURCES

4.7.1 Alternative 1 – No Action

Under the No Action Alternative, no transfer of parcels or construction would be undertaken at Sites A and B, and no significant changes to existing grounds would be made. As a result, no significant impacts to cultural resources would occur.

4.7.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. In accordance with 800.8 (c) of the Council's regulations, the SHPO and the Council have been notified that the process and documentation prepared for the EA would be used to comply with Section 106 of the NHPA for this proposed undertaking. Using the NEPA process in lieu of the procedures set forth in 36 CFR Part 800.3 through 800.6 of the Council's regulations (i.e., the Section 106 process) ensures that the standards set forth in 36 CFR Part 800.8(c)(1) through 800.8(c)(5) are met.

The Programmatic Agreement between the DOE Oak Ridge Operations, the NNSA, the Tennessee State Historic Preservation Office, and the Advisory Council on Historic Preservation

(Council) Concerning the Management of Historical and Cultural Properties at Y-12 (PA) stipulates how proposed undertakings at Y-12 should be reviewed to determine if there would be a potential to affect cultural resources eligible for listing on the NRHP, and whether consultation with the SHPO is required (see Programmatic Agreement in Appendix A). To comply with Section 106 of the NHPA, the Proposed Action to transfer land at Sites A and B from NNSA to a private entity and to construct new buildings on the two sites have been reviewed in accordance with the PA.

Y-12 has been previously surveyed for the presence of cultural resources. Site A 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 through the transfer of Site A or construction of the new facility.

Site B is located in an undeveloped area. There would be no effect to historic properties through the transfer of Site B or construction of the new facility. Site B has not been previously surveyed for the presence of archaeological resources. An archaeological survey has been conducted and a report will be prepared in coordination with the SHPO. The New Hope Baptist Church cemetery, located near Site B, would not be affected by the Proposed Action because it would be avoided during construction activities and the construction work areas would be fenced to prevent inadvertent damage.

Sites A and B are not adjacent to any NRHP-eligible properties or to the two buildings determined eligible for National Historic Landmark status, thus, there would be no visual effect to these properties from the construction of the new building. In a letter dated September 21, 2004, the State Historic Preservation Office has concurred that the proposed undertaking to transfer the parcels, Sites A and B, would not adversely affect any property eligible for listing in the National Register of Historic Places.

Operation. There would be no significant impact on historic properties from operation of the proposed facilities at Sites A and B.

4.7.3 Alternative 3 – Line Item

Impacts on cultural resources from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

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 any of the land transfer, new facility construction, and existing facility renovation activities.

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, Y-12 would experience a brief peak in its employee population as the transition is made from one generation to another. During this period, a shortage of office space is anticipated. However, while there may be some fluctuations in operations employment during the period analyzed in this EA, these changes are outside of this scope and will not be analyzed in this document. Alternatives would be analyzed assuming net changes in employment strictly related to the Proposed Action and alternatives as described Chapter 2.

4.8.1 Alternative 1 – No Action

Under Alternative 1 – No Action, the Y-12 personnel would continue to occupy existing office space, laboratory, and support buildings on the east end of the Y-12 Complex. NNSA would proceed as outlined in the *Ten-Year Comprehensive Site Plan*. Therefore, there would be no change from current or already-approved future activity levels. There would be no net change in employment levels for operations, renovation, and routine maintenance of the existing facilities. Because there would be no change in employment, there would be no resulting effects on the local economy, housing market, or in the demand for community services.

4.8.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. Under the Proposed Action, two parcels of land at Y-12 would be transferred to a private entity. A private developer would supply design, finance, and construction services to construct a building or building complex in support of the NNSA mission. For construction employment, Y-12 facilities construction 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, so there would be no noticeable effect on regional income, housing markets, or the demand for community services.

Operation. There would be no net change in operations employment because current employees would be relocated to the new complexes and older buildings would be demolished or converted to other uses.

4.8.3 Alternative 3 – Line Item

Socioeconomic impacts from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

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 from the alternatives included in this EA. 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 201, 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 – No Action

For environmental justice impacts to occur, there must be disproportionately high and adverse human or environmental impacts on minority populations or low-income populations. As discussed in Sections 4.1 through 4.14, adverse impacts to human health or the environment from implementation of Alternative 1 would be negligible, and there are no special circumstances that would result in disproportionately high and adverse impacts on minority or low-income populations. Therefore, there would be no environmental justice impacts.

4.9.2 Alternative 2 – Land Transfer (Proposed Action)

As discussed in Sections 4.1 through 4.14, Alternative 2 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 in any exposure pathway. Therefore, there would be no environmental justice impacts.

4.9.3 Alternative 3 – Line Item

Environmental justice impacts from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

4.10 SITE INFRASTRUCTURE

4.10.1 Alternative 1 – No Action

If Alternative 1 is implemented, decontamination, decommissioning, demolition, and renovation activities under the *Y-12 Ten-Year Comprehensive Site Plan* would proceed as planned, but there would no development at Sites A and B. Minor reductions in energy requirements are anticipated with the demolition of more than 1 million GSF of existing, inefficient space at the Y-12 site. Existing utilities, the electric distribution system, processed/chilled water systems, ventilation and exhaust systems, sanitary water treatment system, stormwater collection system, water supply system, fire protection system, natural gas, compressed air systems, and steam supply systems would remain. Infrastructure and utility upgrades would be implemented as part of ongoing operations and landlord activities.

4.10.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. Under this alternative, the proposed office complexes would be constructed on Sites A and B with private sector funding. At Site A, electrical and water utilities would be relocated and a sanitary sewer would be extended to the new facility. At Site B, the city of Oak Ridge raw water sanitary sewer lines may be relocated and existing utilities would be extended to the new facility from existing tie-in points.

Operation. Site infrastructure requirements of the new facilities at Sites A and B are not expected to have any adverse effect on current site infrastructure resources because reductions in

energy requirements are anticipated with the demolition of the existing, inefficient space at the Y-12 site. The new complexes at Sites A and B would be designed to be energy efficient.

4.10.3 Alternative 3 – Line Item

The site infrastructure impacts from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

4.11 TRAFFIC AND TRANSPORTATION

4.11.1 Alternative 1 – No Action

Primary roads on the ORR serving Y-12 include SRs 95, 58, 62, 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 3.11–1. Average daily traffic on the ORR and area roads serving Y-12 ranges from 9,300 at Bethel Valley Road to 29,980 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.

4.11.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. Under the Proposed Action there would be a minimal increase in traffic during renovation and construction activities at Y-12. Minor traffic interruptions would be expected during construction at Site B along Second Street and Scarboro Road. Portions of North Portal and Central Portal parking areas would be used as construction laydown areas and would result in a temporary unavailability of parking during the construction period. Renovation and construction activities would be temporary and would not result in long-term effects.

Operation. During operation, there would a marginal increase in employee traffic to the Y-12 Plant along Bear Creek Road due to the relocation of employees from off-site leased space.

4.11.3 Alternative 3 – Line Item

Site infrastructure impacts from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

4.12 HEALTH AND SAFETY

4.12.1 Alternative 1 – No Action

Under the No Action alternative, current facility operations would continue in support of assigned missions. In the short term, exposures to workers and the public would be bounded by the affected environment as reported in Section 3.12. However, as buildings continue to age, increasing controls would be needed to ensure worker health and safety, and additional funds would be needed to remain in compliance with environmental, health, and safety (ES&H) standards.

4.12.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. Under Alternative 2, there would be negligible increases in criteria pollutants in air emissions or fugitive dust from building construction. Engineering controls and personal protective equipment would be used to prevent worker exposure to hazardous materials such as asbestos or lead-based paint. Construction workers directly involved in these activities would have a potential exposure to standard construction hazards (e.g., slips-trips-falls, electrical shock, heat stress, or fire and explosion hazards). The construction contractor/developer will comply with the OSHA Standard for Construction (29 CFR 1926). No changes to process air emissions would occur, and effects to public receptors would remain consistent with current operations. Therefore, there would be no increased risk of adverse effects on the health of Y-12 workers or the public due to exposure to radioactive or toxic materials.

Operation. Employees who would be relocated to the new buildings would experience long-term benefits from improved working conditions in the new facilities.

4.12.3 Alternative 3 – Line Item

Health and safety impacts from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

4.13 WASTE MANAGEMENT

4.13.1 Alternative 1 – No Action

Under the No Action alternative, there would be no change to current waste generation from routine operations.

4.13.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. Waste generated from material brought onsite by the private developer during site development and construction of the buildings would be disposed of offsite by the private developer. Existing earthen materials such as stumps, masonry waste, rock and gravel, and excess soil would be disposed of onsite. Earthen spoil would be minimized by balancing the cut and fill of soil at Sites A & B.

Operation. Liquid and solid waste would be generated from facility operations at Sites A and B. The following waste would be generated and treated/disposed of as follows:

- Wastewater would discharge into piping and sanitary sewer lines installed during construction of the buildings. At sites A and B the sanitary sewer lines would be tied directly into the Oak Ridge City Sewer System. Connection points will be determined in consultation with the city of Oak Ridge.
- Materials such as paper, cardboard, and aluminum cans would be placed in labeled containers and recycled.
- Sanitary trash such as waste paper, food waste, and empty containers would be placed in labeled dumpsters and disposed of in onsite landfills.

- Operations and building maintenance will generate waste such as light bulbs, batteries, etc., some of which would be managed under RCRA regulations for recycling, storage, and disposal. RCRA waste would be collected and stored in RCRA accumulation and/or storage areas. RCRA waste requiring disposal would be manifested and shipped offsite to a RCRA permitted disposal facility.
- No radiologically contaminated waste is anticipated.

4.13.3 Alternative 3 – Line Item

Waste management impacts from construction and operation would be similar to those described for Alternative 2, the Proposed Action, but waste may not be disposed of offsite.

4.14 VISUAL RESOURCES

4.14.1 Alternative 1 – No Action

The No Action Alternative would not affect the existing visual resources beyond those impacts previously assessed in the Y-12 SWEIS for continued operations.

4.14.2 Alternative 2 – Land Transfer (Proposed Action)

Construction. The proposed facilities would consist of new buildings on Sites A and B, as described in Chapter 2, and would be the primary means by which visual resources are affected. These facilities would be less than 12 m (40 ft) in height, which is consistent with the size of most facilities at the Y-12. Construction lay-down areas for Sites A and B would be located within each site.

Short-term visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be limited to the construction lay-down areas and the immediate construction site of the new facilities. Following construction activities, the construction lay-down areas would be regraded and incorporated into the landscape design of the Y-12 Site.

Operation. The proposed building on Site A would be three stories, which is comparable to existing facilities within the Y-12 Site area, and would have an exterior of concrete, glass, and metal, as shown in Figure 2.2-3. The proposed building on Site B would be one to two stories, and would have an exterior of concrete, glass, and metal, as shown in Figure 2.2–4. These buildings would fit in visually with the surrounding masonry and concrete buildings. Visibility of Sites A and B outside the ORR is restricted by the surrounding Chestnut and Pine Ridges. The proposed facilities on Site A would have minimal effect on the overall viewshed.

Given the industrial nature of the surrounding facilities and probable future land use, construction and operation of these new facilities would be consistent with visual impacts from other ORR and Y-12 Site land use.

4.14.3 Alternative 3 – Line Item

Visual impacts from construction and operation would be the same as those described for Alternative 2, the Proposed Action.

5.0 CUMULATIVE IMPACTS

Under all alternatives, cumulative impacts would be minor and insignificant for all resource areas assessed. Impacts to land use would range from "no change to continued operations" (No Action alternative) to the legal transfer of less than 20 acres and the associated construction of two new office complexes. This would involve significantly less than 1 percent of the available land at Y-12. Renovations to existing facilities, or construction of new facilities at Sites A and B, would not cause a cumulative impact to geology and soils because of the stability of soils at Y-12, and because all facilities would comply with regulatory requirements. Air quality at Y-12 is generally good. With the exception of the 8-hour O_3 standard, 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. The alternatives encompassed by this EA would improve the overall efficiency of operations at Y-12 and would not have an adverse cumulative impact on air quality.

Because of the availability of ample surface water, none of the alternatives would create a cumulative burden on the existing water supply. Because there are no critical habitats for threatened or endangered species, and because of the absence of any significant ecological resources at any of the locations potentially affected by the alternatives, no cumulative impacts to ecological resources are expected. 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, and would not exceed housing demands, community services, or transportation capabilities. With respect to human health, the alternatives would improve working conditions for the workers, but would not significantly change the existing risks or health effects to the public. Waste management activities would be unaffected by the alternatives. All wastes generated would be managed by the private developer or in accordance with existing waste management facilities and would comply with all regulatory requirements.

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7.0 LIST OF AGENCIES AND ENTITIES CONTACTED

Tennessee Historical Commission.