DOE/EA-2218

# ENVIRONMENTAL ASSESSMENT FOR ACTIVITIES IN SUPPORT OF THE Y-12 NATIONAL SECURITY COMPLEX MATERIALS MANUFACTURING MISSION



**Final**
**January 2024**

# EXECUTIVE SUMMARY

The National Nuclear Security Administration (NNSA), a semi-autonomous agency within the United States (U.S.) Department of Energy (DOE), has the primary responsibility to maintain and enhance the safety, security, and performance of the U.S. nuclear weapons stockpile, and support other DOE/NNSA missions. One of NNSA's critical production sites is the Y-12 National Security Complex (Y-12) in Oak Ridge, Tennessee. Y-12 is the lead production plant for the materials mission and is responsible for maturing the manufacturing process and deploying the capacity to produce the required materials components that are used in support of the nuclear weapons stockpile. NNSA does not currently have the capability to manufacture these materials in the required quantities that are the subject of this environmental assessment (EA).[1] NNSA has prepared this EA to analyze the potential environmental effects associated with materials manufacturing activities performed in support of the materials mission.

NNSA is proposing a two-phase approach to materials manufacturing. Initially (2024-2025), NNSA would install government-furnished equipment in the Teledyne Brown Engineering (TBE) Test and Demonstration Facility (TDF), located at 350 Centrifuge Way in Oak Ridge, approximately 0.75 miles northeast of Y-12. TBE would also make some minor internal upgrades to the TDF to support materials manufacturing. During this first phase, TBE would productionize the existing materials research and development (R&D) technology at TDF to provide initial capacity to prove the materials manufacturing process and support qualification evaluations. Operations at the TDF would be conducted by TBE personnel, with oversight from Y-12 personnel. In parallel with this first phase, NNSA would repurpose Building 9225-03 at Y-12 as a long-term Materials Manufacturing Facility (MMF). Repurposing Building 9225-03 would consist of internal building modifications, utility upgrades, installation of equipment, and a 3,000 square feet expansion of the building to accommodate utilities and additional equipment. Once operational in approximately 2027, NNSA would shift materials manufacturing operations from the TDF to Building 9225-03. After NNSA achieves full-scale operations in Building 9225-03 (in approximately 2028), the TDF would provide a long-term supplemental capacity. The operations at both facilities would use non-nuclear, non-hazardous materials.

The analysis in Chapter 3 of this EA shows that effects associated with construction and operation would be minor at both the TDF and Building 9225-03 at Y-12. Because only internal facility modifications and equipment installations would occur at the TDF, no land would be disturbed. At Y-12, land disturbance would be limited to less than one acre of previously disturbed land (currently partially paved and used to support utility equipment) adjacent to Building 9225-03. Visually, there would be no change at the TDF or Y-12. Short-term air quality effects associated with construction at Y-12 would occur, but emissions would be below *de minimis* thresholds. There would be no notable operational air emissions. There would also be no notable noise sources associated with construction and operation at either the TDF or Y-12. Water requirements for construction and operation would be negligible. Although there would be cooling tower blowdown to Outfall 113, which reaches East Fork Poplar Creek, no water quality effects are expected from operations. Stormwater would be managed in accordance with existing stormwater

[1] The materials that are the subject of this EA are non-nuclear and non-hazardous (CNS 2022).

pollution prevention plans. Construction activities at either the TDF or Y-12 would not affect ecological or cultural resources.

Because the peak construction workforce (30 persons) at either TDF or Building 9225-03 would be negligible compared to the population in the region of influence (ROI), socioeconomic effects during construction, although beneficial, are expected to be negligible. The operational workforce (5 TBE workers at TDF and 10 Y-12 workers at Building 9225-03) would be comprised of existing workers. No disproportionate and adverse environmental or economic effects on minority or low-income populations are expected. Workers would be subject to minimal occupational risks. Because materials manufacturing operations do not utilize hazardous chemicals or radiological materials, there would be no offsite accidents that could adversely affect the public. Operations would generate nonhazardous waste that would be disposed of in existing landfills. With regard to utility requirements, the existing infrastructure at TDF would be adequate to support the materials manufacturing mission. Infrastructure utility upgrades at Y-12 will be necessary to support the material manufacturing mission.

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AMSL | above mean sea level |
| BLM | Bureau of Land Management |
| BLS | Bureau of Labor Statistics |
| BMAP | Biological Monitoring and Abatement Program |
| CAA | *Clean Air Act of 1990* |
| CEQ | Council on Environmental Quality |
| CERCLA | *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* |
| CFR | Code of Federal Regulations |
| CNS | Consolidated Nuclear Security, LLC |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | $CO_2$ equivalent |
| dB | decibels |
| dBA | A-weighted decibels |
| DNL | Day-night Sound Level |
| DOE | U.S. Department of Energy |
| DOE-EM | DOE Office of Environmental Management |
| EA | environmental assessment |
| EFPC | East Fork Poplar Creek |
| EIS | environmental impact statement |
| EMDF | Environmental Management Disposal Facility |
| EMWMF | Environmental Management Waste Management Facility |
| EO | Executive Order |
| EPA | U.S. Environmental Protection Agency |
| ETTP | East Tennessee Technology Park |
| FHWA | Federal Highway Administration |
| FIR | Federal Industry and Research |
| FONSI | finding of no significant impact |
| FR | *Federal Register* |
| GHG | greenhouse gas |
| HEPA | High Efficiency Particulate Air |
| HPP | historic preservation plan |
| HVAC | heating, ventilation, and air conditioning |
| IFDP | Integrated Facilities Disposition Program |
| ISMS | Integrated Safety Management System |
| KCNSC | Kansas City National Security Campus |
| kW | kilowatt |
| $L_{eq}$ | Equivalent Sound Level |
| LPF | Lithium Processing Facility |
| MMF | Materials Manufacturing Facility |
| MTF | Mercury Treatment Facility |
| MW | megawatts |
| MVA | megavolt ampere |

| | |
|---|---|
| NAAQS | National Ambient Air Quality Standards |
| NEI | National Emissions Inventory |
| NEPA | *National Environmental Policy Act of 1969* |
| NERP | National Environmental Research Park |
| NHPA | *National Historic Preservation Act* |
| NNSA | National Nuclear Security Administration |
| NOx | oxides of nitrogen |
| NPDES | National Pollutant Discharge Elimination System |
| NRHP | National Register of Historic Places |
| $O_3$ | ozone |
| OREM | Oak Ridge Office of Environmental Management |
| ORETTC | Oak Ridge Enhanced Technology and Training Center |
| ORNL | Oak Ridge National Laboratory |
| ORR | Oak Ridge Reservation |
| ORUD | Oak Ridge Utility District |
| PA | Programmatic Agreement |
| $PM_n$ | particulate matter less than or equal to n microns in aerodynamic |
| PPtF | Purification Facility |
| psig | pounds per square inch gauge |
| R&D | research and development |
| RCRA | *Resource Conservation and Recovery Act* |
| RFP | request for proposal |
| ROI | region-of-influence |
| SHPO | State Historic Preservation Officer |
| $SO_2$ | sulfur dioxide |
| SPCC | spill prevention, control, and countermeasures |
| SR | State Route |
| SWPPP | Stormwater Pollution Prevention Plan |
| TAPCB | Tennessee Air Pollution Control Board |
| TBE | Teledyne Brown Engineering |
| TDEC | Tennessee Department of Environment and Conservation |
| TDF | Test and Demonstration Facility |
| TDOT | Tennessee Department of Transportation |
| THC | Tennessee Historical Commission |
| TSWMA | *Tennessee Solid Waste Management Act* |
| TVA | Tennessee Valley Authority |
| UEFPC | Upper East Fork Poplar Creek |
| UPF | Uranium Processing Facility |
| U.S. | United States |
| U.S.C. | United States Code |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VOC | volatile organic compound |
| VRM | Visual Resource Management |
| Y-12 | Y-12 National Security Complex |

# 1 INTRODUCTION

## 1.1 Introduction and Background

The National Nuclear Security Administration (NNSA), a semi-autonomous agency within the United States (U.S.) Department of Energy (DOE), has the primary responsibility to maintain and enhance the safety, security, and performance of the U.S. nuclear weapons stockpile. One of NNSA's critical production sites is the Y-12 National Security Complex (Y-12) in Oak Ridge, Tennessee (Figure 1-1). Y-12 is the lead production plant for the materials mission and is responsible for maturing the manufacturing process and deploying the capacity to produce the required materials that are used in support of the nuclear weapons stockpile. NNSA has prepared this environmental assessment (EA) to analyze the potential environmental effects associated with materials manufacturing activities performed in support of the materials mission.

In accordance with the Council on Environmental Quality (CEQ) regulations at 40 Code of Federal Regulations (CFR) Parts 1500−1508 and DOE *National Environmental Policy Act* (NEPA) implementing regulations at 10 CFR Part 1021, NNSA has prepared this EA to analyze the potential environmental effects associated with conducting materials manufacturing at Oak Ridge, Tennessee. Depending on the results of this EA, NNSA could: (1) determine that the potential environmental effects of the Proposed Action would be significant to human health and/or the environment, in which case NNSA would prepare an environmental impact statement (EIS); or (2) determine that a finding of no significant impact (FONSI) is appropriate, in which case NNSA could proceed with the Proposed Action with no additional NEPA documentation.

**Environmental Assessment**

A primary purpose of an EA is to determine if a Proposed Action would have significant environmental impacts. If there would be none, no further NEPA documentation is required. If there would be significant environmental impacts, an EIS is required.

## 1.2 Purpose and Need for Agency Action

NNSA does not currently have the technology and manufacturing capability in the Nuclear Weapons Enterprise to manufacture certain materials in the required quantities that are the subject of this EA.[2] NNSA needs to develop and certify a replacement materials capability because the legacy materials can no longer be produced. In addition, NNSA is seeking to establish new technologies that would utilize materials that meet performance requirements and are less hazardous to use than legacy materials. If the materials capability is not developed and certified, NNSA would not be able to meet its mission requirements. In order to meet materials manufacturing requirements for decades to come, NNSA is proposing to establish this capability and capacity at both an onsite facility at Y-12 and an off-site facility in Oak Ridge in the most timely, reliable, cost-effective, and flexible manner possible (NNSA 2021a).

[2] The materials that are the subject of this EA are non-nuclear and non-hazardous (CNS 2022).

**If materials manufacturing is not implemented in the quantities required, NNSA would…**

- Not meet mission requirements;
- Incur increased risk to mission capability and worker safety.

Source: CNS 2023.

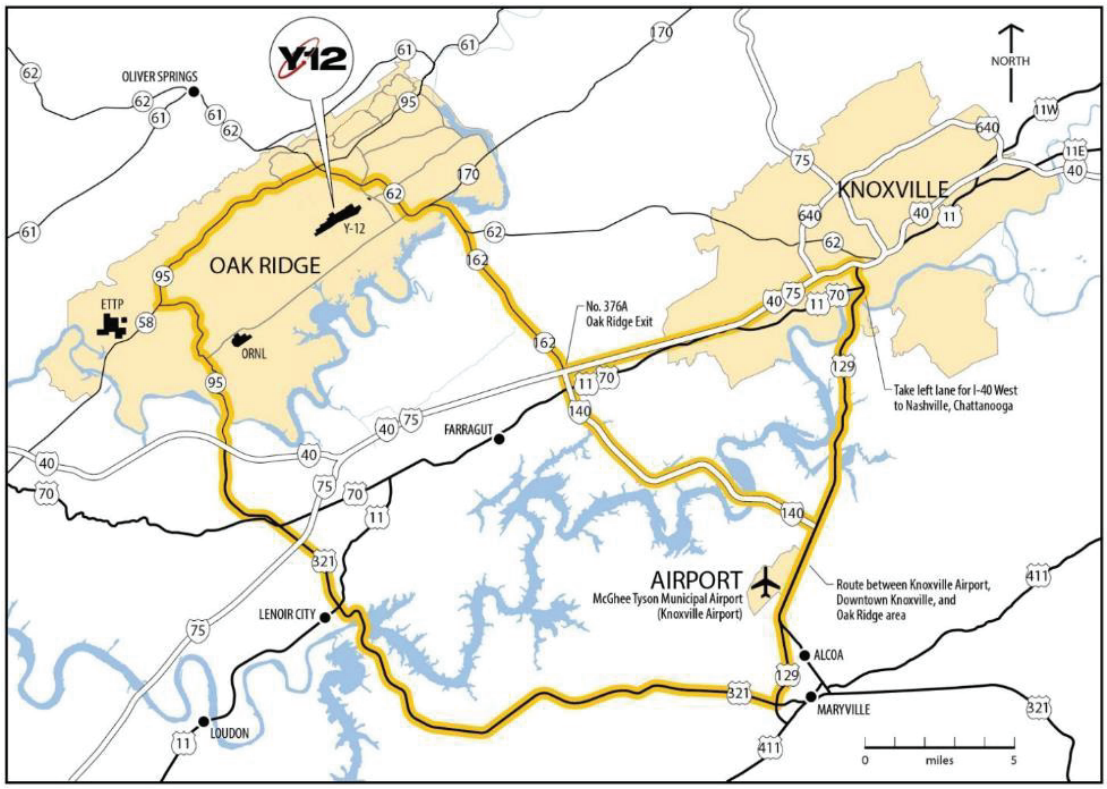



**Figure 1-1. Location of Y-12**

## 1.3 Proposed Action Evaluated in this Environmental Assessment

NNSA is proposing a two-phase approach to materials manufacturing. Initially (2024-2025), NNSA would install government-furnished equipment in the Test and Demonstration Facility (TDF), which is operated by Teledyne Brown Engineering (TBE). The TDF is located at 350 Centrifuge Way in Oak Ridge, approximately 0.75 miles northeast of Y-12 (Figure 1-2). To support the equipment installation, TBE would make some minor internal upgrades to the TDF. During this first phase, TBE would productionize the materials research and development (R&D) technology at TDF to provide initial capacity to prove the materials manufacturing process and support qualification evaluations. Operations at the TDF would be conducted by TBE personnel, with oversight from Y-12 personnel. Although TDF is an off-site facility, several factors supported the determination that the TDF activities should be included in this EA, including the fact that NNSA funds the lease payments and the internal upgrades to the TDF; there is continued federal involvement in the activities to be performed to productionize the materials process; and

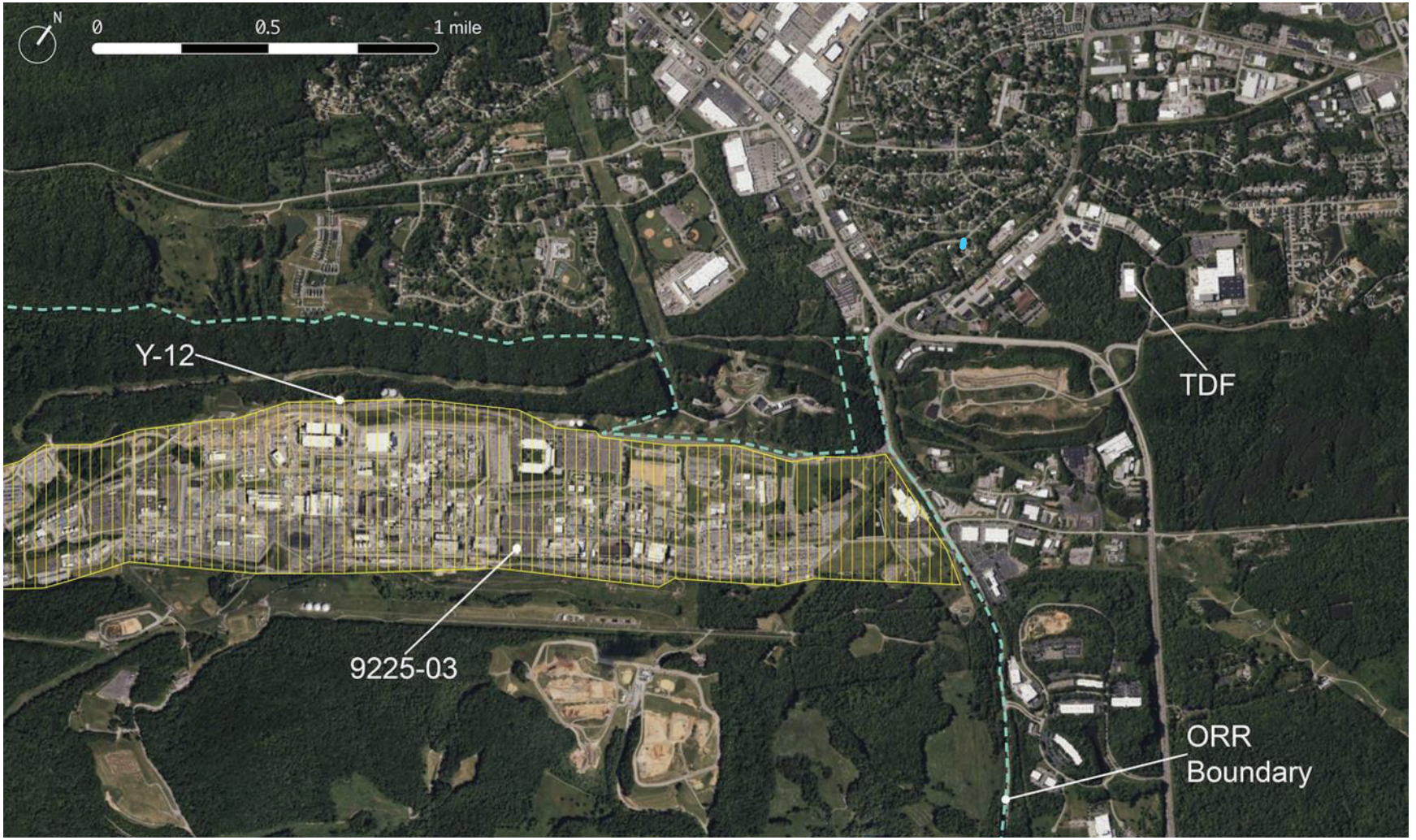



**Figure 1-2. Locations of Building 9225-03 and the Test and Demonstration Facility**

NNSA and its contractor would maintain control or supervision over portions of the materials activities at the TDF.

In parallel with this first phase, NNSA would repurpose Building 9225-03 at Y-12 as a long-term Materials Manufacturing Facility (MMF). Repurposing Building 9225-03 would consist of internal building modifications, utility upgrades, installation of equipment, and a 3,000 square feet expansion of the building to accommodate utilities and additional capacity equipment. Once operational in approximately 2027, NNSA would shift materials manufacturing operations from the TDF to Building 9225-03. When NNSA achieves full-scale operations in Building 9225-03 (in approximately 2028), the TDF would provide a long-term supplemental capacity, and operate as needed. Figure 1-2 shows the locations of the TDF and Building 9225-03 relative to each other. The operations at both facilities would use non-nuclear, non-hazardous materials. A detailed description of the Proposed Action is presented in Section 2.1.

## 1.4 Scope of this Environmental Assessment and Organization

This EA analyzes the potential environmental effects of NNSA's proposal to perform materials manufacturing at the TDF, located approximately 0.75 miles northeast of Y-12, and at Building 9225-03, located at Y-12. This EA considers the potential direct, indirect, and cumulative effects. Direct effects are those that would occur as a direct result of the Proposed Action. Indirect effects are those that are caused by the Proposed Action but would occur later in time and/or farther away in distance; perhaps outside of the study area. Cumulative effects result when the incremental effects from the Proposed Action are added to effects that have occurred or could occur from other actions, including past, present, or reasonably foreseeable future actions.

The organization of this EA is as follows:

- An introduction and discussion of the purpose and need for the NNSA action (Chapter 1);
- A description of the Proposed Action and the No-Action Alternative (Chapter 2);
- A description of the existing environment relevant to potential effects of the Proposed Action and the No-Action Alternative (Chapter 3);
- An analysis of the potential direct and indirect environmental effects that could result from the Proposed Action and the No-Action Alternative (Chapter 3);
- Identification and characterization of cumulative effects that could result from materials manufacturing construction and operation in relation to past, present, and other reasonably foreseeable actions within the surrounding area (Chapter 4); and
- A listing of the references cited in this EA (Chapter 5).

## 1.5 Public Participation

In October 2023, NNSA published this Draft EA on the NNSA NEPA web page (https://www.energy.gov/nnsa/nnsa-nepa-reading-room) and the DOE NEPA web page (https://www.energy.gov/nepa/public-comment-opportunities) for public review and comment. NNSA also provided the Tennessee Department of Environment and Conservation (TDEC) with a copy of this Draft EA for review and notified the City of Oak Ridge. NNSA announced the availability of the Draft EA in local newspapers and provided an email address and postal address

where comments could be submitted. NNSA provided an approximately 31-day comment period on the Draft EA. No comments were received on the Draft EA.

# 2 PROPOSED ACTION AND ALTERNATIVES

## 2.1 Proposed Action

Due to its nature, the decision to pursue materials manufacturing at Y-12 was reached through an NNSA-initiated request for proposal (RFP) process (NNSA 2019a, CNS 2023a). Only two sites -- Y-12 and the Kansas City National Security Campus (KCNSC) -- responded to the RFP. After reviewing the proposals, NNSA selected Y-12 as the only reasonable location for the materials mission (NNSA 2019b, CNS 2023a). The Y-12 proposal would locate the materials manufacturing in Building 9225-03, which is the only existing building on site that would be capable of meeting the RFP requirements. A new facility was considered unreasonable from both a mission and cost standpoint (CNS 2023a). The Y-12 proposal also provided a near-term materials manufacturing capability using the TDF, which is operated by TBE. TBE is under contract with Consolidated Nuclear Security, LLC (CNS), the management and operating contractor for NNSA at Y-12, to conduct R&D of new technologies. Section 2.3 explains why other sites and other facilities at Y-12, or offsite, were not considered reasonable.

### 2.1.1 Test and Demonstration Facility (TDF)

The 39-year-old TDF (Figure 2-1) is 51,000 square feet in size, and primarily supports R&D activities for various material processing technologies. Approximately 20,000 square feet of the facility is used to support Y-12's mission, which is funded by NNSA. Current operations in the TDF do not result in the discharge of process water, and thus, do not require a National Pollutant Discharge Elimination System (NPDES) permit. Cooling tower discharge is discharged to the sanitary sewer system as needed, which has been approved by the City of Oak Ridge.[3] Current air emissions are below threshold amounts for R&D activities. The TDF consumes approximately 400,000 kilowatt-hours annually and uses approximately 1,440,000 gallons of water annually. Of the 25 operational workers at the TDF, five TBE workers currently support this manufacturing.

To support the materials manufacturing mission, upgrades to the TDF would be required for the installation of government-furnished equipment, installation of a new transformer, and other utility upgrades, including heating, ventilation, and air conditioning (HVAC) and ductwork. A backup diesel generator would be installed to provide emergency electrical supply in the event of a loss of normal electrical supply. There would be minor changes to the exterior walls of the TDF to support equipment installation, but no additional land disturbance. All construction activities would be managed and performed by TBE and funded by NNSA. A peak construction workforce of 30 would be required, with construction activities expected to be completed in 18 months. Operations would begin by 2025. Materials manufacturing operations are discussed in Section 2.1.3.

[3] The cooling water is treated with rust inhibitor. Both an initial flush and a preventative maintenance flush are used.

**Figure 2-1. Test and Demonstration Facility (looking east)**

### 2.1.2 Building 9225-03

Building 9225-03 (Figure 2-2) is a relatively new building at Y-12, having been commissioned in 2004 as on-site materials purification facility (PPtF). The building's original purpose and need -- to purify a different material than the materials that are the subject of this EA -- is described in the "Supplement Analysis for Purification Facility, Site-Wide Environmental Effect Statement for the Y-12 National Security Complex" (NNSA 2002). That original mission ended in 2019, and there are no operations currently conducted in Building 9225-03. The PPtF previous processes have been fully decommissioned, demolished, and dispositioned. Building 9225-03 is approximately 6,000 square feet in size, and has existing utilities/infrastructure, including electricity, potable water, fire water, steam, nitrogen, instrument air, and a security system. Building 9225-03 has a service life of 50-years. When PPtF operations were conducted, Building 9225-03 did not discharge any permitted wastewater or have any notable air emissions. Incidental stormwater associated with a small dike near the building discharged to Outfall 113 to East Fork Poplar Creek (EFPC). The dike has since been demolished and the discharge pipe plugged.

To support the materials manufacturing mission, NNSA would repurpose Building 9225-03 with internal building modifications, utility upgrades, installation of equipment, and a 3,000 square feet expansion of the building to accommodate utilities and additional equipment. Exterior changes would include the installation of a roll-up door, foundation improvements, and concrete slabs for utility support equipment. Site work would include grading, trenching, utility installation, backfill, and stormwater management. Less than 1 acre of previously disturbed land, which currently supports utility equipment and is partially paved, could be re-disturbed. Utility upgrades would include electrical systems, HVAC systems (ductwork, cooling water, and replacement of the existing ventilation stack with a new stack), inert gas connections, and an upgrade of the existing fire suppression system. A backup diesel generator would be installed to provide emergency electrical supply in the event of a loss of normal electrical supply.

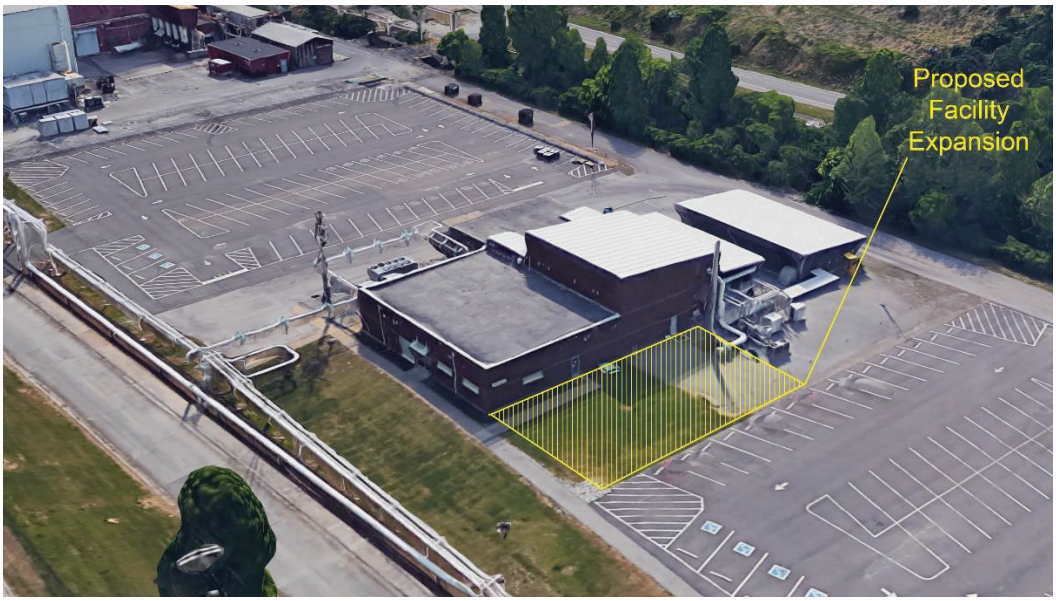



**Figure 2-2. Building 9225-03 (looking south)**

There would be internal modifications to support equipment installation and achieve the desired operational layout. During peak construction, approximately 30 construction workers would be required, with construction activities expected to be completed in 18 months. Initial operations would begin by 2027, with full-scale operations expected to be achieved in 2028. The materials manufacturing operations are discussed in Section 2.1.3.

### 2.1.3 Operations at the TDF and Building 9225-03

Operations at both the TDF and Building 9225-03 would consist of converting the materials into feed for future components. The materials manufacturing process would utilize a closed loop cooling systems and no wastewater discharge is anticipated except for cooling tower blowdowns.[4] Any blowdown would be directed to Outfall 113, which is not currently permitted for cooling tower blowdown, and could require modification to the facility NPDES permit. Minimal quantities of makeup water for cooling systems would be required occasionally.

High Efficiency Particulate Air (HEPA) filters in the TDF would limit emissions to less than 2.5 tons per year of particulates. Building 9225-03 would use MERV-8 filters, which are HEPA-like, and emissions are expected to be less than 5 tons/year of particulates; the emissions would not be classified as hazardous air pollutants and estimated emissions at either facility would be less than the criteria to require a permit from the Tennessee Air Pollution Control Board (TAPCB) (CNS 2023a).

During operations at the TDF, peak electrical energy demand would be 3.5 megawatts (MW) and average electrical demand would be 2.5 MW. At Building 9225-03, peak electrical energy demand would be 7.0 MW and average electrical demand would be 4.9 MW. Up to 5 TBE workers at TDF and 10 Y-12 workers at Building 9225-03 would conduct operations. Y-12 workers would provide

[4] Occasionally, the cooling water system could be drained and replaced with new cooling water.

oversight to TBE workers at the TDF. Operations would generate nonhazardous waste that would be disposed of in existing Y-12/DOE landfills. There could also be non-hazardous wastes generated at both TDF and Building 9225-03 that would be disposed of at the Y-12/DOE landfills. Once Building 9225-03 becomes fully operational, the supplemental operations at TDF are expected to be reduced by approximately 50 percent compared to initial operations (CNS 2023a). Table 2-1 displays the materials manufacturing operational requirements at both the TDF and Building 9225-03.

**Table 2-1. Operational Requirements for Materials Manufacturing**

| | Consumption/Use at TDF[a] | Consumption/Use at Building 9225-03[b] |
|---|---|---|
| Operational Workers | 5 | 10 |
| Electricity Use (kilowatt-hours/year)[c] | 101,250 | 202,500 |
| Potable Water Use (gallons/year)[d] | 43,750 | 87,500 |
| Natural gas use (cubic feet/year)[e] | 108,000 | 216,000 |
| Wastewater (gallons/year)[f] | 31,250 | 62,500 |
| **Waste Generation** | | |
| Hazardous waste ($yd^3$/year) | 0 | 0 |
| Nonhazardous waste (tons/year)[g] | 2.4 | 4.8 |

a. Based on 4,500 square feet at TDF dedicated to materials manufacturing.
b. Based on 9,000 square feet at Building 9225-03 dedicated to materials manufacturing.
c. Based on 22.5 kilowatt-hours/square foot/year.
d. Based on potable water use of 35 gallons/day/person.
e. Based on 24 cubic feet/square foot/year.
f. Based on wastewater generation of 25 gallons/person/day.
g. Based on generation of 3 pounds of nonhazardous waste/person/day. Nonhazardous process wastes are estimated at 0.5 tons/year at the TDF and 1 ton/year at Building 9225-03.

Source: CNS 2023a.

## 2.2 No-Action Alternative

Under the No-Action Alternative, NNSA would not perform materials manufacturing at either the TDF or Building 9225-03. Because NNSA does not currently have the capability to manufacture the materials in the required quantities that are the subject of this EA, if this capability is not established in the quantities required, NNSA would not be able to meet its mission requirements.

## 2.3 Alternatives Considered but Eliminated from Detailed Analysis

**Other NNSA Site Alternatives for the Materials Manufacturing Mission.** Based on responses to the RFP process, NNSA only received one proposal— from KCNSC— to perform the materials manufacturing mission besides the Y-12 proposal. After reviewing the proposals, NNSA selected Y-12 as the only reasonable location for the materials manufacturing mission. The KCNSC proposal was determined to be less cost-effective and higher risk for meeting requirements (NNSA 2019b).

**Other Building Alternatives at Y-12 for the Materials Manufacturing Mission.** The only building at Y-12 that was proposed in response to the RFP for the materials manufacturing mission was Building 9225-03. Other existing facilities have on-going missions that cannot be displaced, do not possess excess space needed for the materials manufacturing mission, and/or do not have service life that would support the materials manufacturing mission for the long-term (CNS 2023a).

**Other Alternatives for the Materials Manufacturing Mission in Oak Ridge**. The TDF currently supports Y-12's materials manufacturing mission and can provide the initial capacity to prove the materials manufacturing process and support qualification evaluations with minimal construction activities. NNSA did not identify any other existing facilities in the Oak Ridge area that possess the same level of attributes as the TDF for supporting the materials manufacturing mission.

# 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

## 3.1 Introduction

This chapter includes an analysis of the potential environmental consequences or effects that could result from the Proposed Action and the No-Action Alternative. The affected or existing environment is the result of past and present activities in Oak Ridge and at Y-12 and provides the baseline from which to compare effects from the Proposed Action and the No-Action Alternative, as well as the baseline to which reasonably foreseeable future actions and the incremental effect of the Proposed Action are added for the cumulative effects analysis presented in Chapter 4.

The purpose of this EA is to enable NNSA to determine if the potential environmental effects of the Proposed Action would be significant to human health and the environment. Certain aspects of the Proposed Action have a greater potential for creating adverse environmental effects than others. For this reason, CEQ regulations (40 CFR 1502.1 and 1502.2) recommend a "sliding-scale" approach so that those actions with greater potential effect can be discussed in greater detail in NEPA documents than those that have little potential for effect. Preparation of this EA was guided by that sliding-scale approach.

As discussed in Section 1.4, this EA considers the potential direct, indirect, and cumulative effects. Sections 3.2 through 3.14 present the affected environment and potential environmental consequences for each of the resource areas analyzed in detail. For the Proposed Action, the analysis in Sections 3.2 through 3.14 focus on the effects associated with construction activities and materials manufacturing operations.

This EA evaluates the environmental effects of the alternatives within a defined region of influence (ROI), as described for each resource below. The ROIs encompass geographic areas within which any notable effect would be expected to occur. The level of detail in the description of each resource varies with the likelihood of a potential effect to the resource. The following resources are described/evaluated in this chapter.

- **Land use:** land use practices and land ownership information. The ROI for land use is the TDF, Building 9225-03, and adjacent areas.

- **Visual resources:** visual resources in terms of land formations, vegetation, and the occurrence of unique natural views. The ROI for visual resources is the TDF, Building 9225-03, and adjacent areas.

- **Geology and soils:** the geologic characteristics of the area at and below the ground surface, the frequency and severity of seismic activity, and the kinds and qualities of soils. The ROI for geology and soils is the TDF, Building 9225-03, and adjacent areas.

- **Water resources:** surface-water and groundwater features, water quality, and water use. The ROI for water resources is TDF, Building 9225-03, and adjacent surface water bodies and groundwater.

- **Air quality and noise:** the quality of the air and greenhouse gas emissions; baseline noise environment. The ROI for air quality and noise is Anderson County where air quality or noise effects could potentially occur.

- **Biological resources:** plants and animals that live in the area, including aquatic life in the surrounding surface waters, and the occurrence of threatened or endangered species. The ROI for ecological resources is the TDF, Building 9225-03, and adjacent areas.

- **Cultural and paleontological resources:** historic and archaeological resources of the area and the importance of those resources. The ROI for cultural resources is the TDF, Building 9225-03, and adjacent areas.

- **Socioeconomics and environmental justice:** the labor market, population, housing, some public services, and personal income; location of low-income and minority populations in the vicinity of the project location. The socioeconomics ROI is a four-county area in Tennessee comprised of Anderson, Knox, Loudon, and Roane counties where a majority of the Y-12 workforce resides.

- **Waste management:** solid waste generation and management practices. The ROI for waste management is TDF, Y-12, and offsite locations where waste generation, recycling, and waste management activities could occur.

- **Human health and safety:** the existing public and occupational safety conditions and baseline conditions to support analysis of effects to health and potential accident scenarios. The human health and safety analysis focuses on effects to workers and offsite members of the public.

- **Transportation:** the existing transportation systems in the area to facilitate analysis of effects locally. The ROI for transportation is Oak Ridge and adjacent areas where transportation could occur.

- **Infrastructure:** utilities, energy, and site services, including capacities and demands at TDF and Y-12. The ROI for infrastructure is TDF, Y-12, and adjacent areas.

## 3.2 Land Use

### 3.2.1 Affected Environment

This section summarizes existing onsite and surrounding land uses at the Oak Ridge Reservation (ORR), and specifically, Y-12. The ORR lies within Oak Ridge's city limits but operates autonomously. City or county organizations have no planning jurisdiction at the site because the ORR is comprised of numerous facilities owned by the DOE.[5] Figure 3-1 shows the location of the project sites in relation to the ORR.

[5] Legally, land is owned by the U.S. and in the custody of a particular federal agency, but for the purposes of this EA, the term 'owned' is used to refer to land "in the custody of DOE/NNSA."


**Figure 3-1. Aerial View of the ORR, Building 9225-03, and the TDF**

The ORR consists of approximately 35,000 acres in the Valley and Ridge Physiographic Province of east Tennessee. Approximately 25,000 of the ORR's roughly 35,000 acres have remained undeveloped in a relatively natural state. Approximately 20,000 of the 25,000 acres have been designated a DOE National Environmental Research Park, an international biosphere reserve, and part of the Southern Appalachian Man and the Biosphere Cooperative.

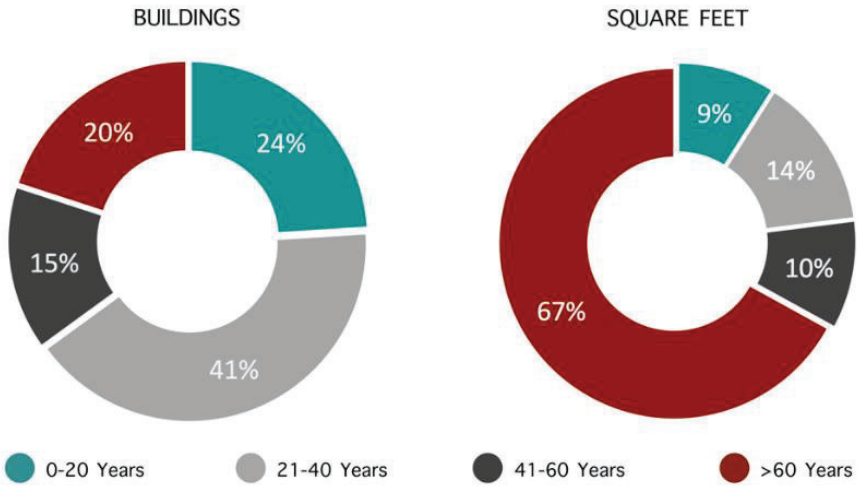
DOE classifies land use on the ORR into five categories: Institutional/Research, Industrial, Mixed Industrial, Institutional/Environmental Laboratory, and Mixed Research/Future Initiatives. Development on the ORR accounts for about 35 percent of the total acreage, leaving approximately 65 percent of the ORR undeveloped. Land bordering the ORR is predominately rural, with agricultural and forest land being predominant. Lands bordering Y-12 are predominantly rural and are used primarily for residences, small farms, forest land, and pasture land. The City of Oak Ridge has a typical urban mix of residential, public, commercial, and industrial land uses; it also includes almost all of the ORR (NNSA 2011).

The entire ORR, which includes Y-12, was designated a *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) site by the U.S. Environmental Protection Agency (EPA) in 1989. About 15 percent of the ORR is contaminated by hazardous and radioactive materials, including waste sites or remediation areas (NNSA 2011). This legacy contamination is being cleaned up in accordance with the existing Federal Facility Agreement.

The Y-12 site covers approximately 3,024 acres on the ORR including 810 acres in the Bear Creek Valley. Y-12 at Bear Creek is where the historic operations began in 1943 and where the majority of principal facilities are co-located today. Development in Bear Creek spans 2.5 miles in length between its east and west boundaries down the valley and 1.5 miles in width across the valley. Housed within its borders are manufacturing, production, laboratory, support, and research and

development areas. While modernization/transformation activities have reduced the footprint of operating facilities, Y-12 remains a highly developed area. Nearly 600 of the 810 acres at Bear Creek are enclosed by perimeter fences (DOE 2022). The eastern portion of Y-12 is occupied by maintenance facilities, office space, and training facilities. The far western portion of Y-12 consists primarily of waste management facilities and construction contractor support areas. The central and west-central portions of Y-12 encompass the high-security portion, which supports core NNSA missions.

Real property at Y-12 includes approximately 390 facilities, totaling approximately 7.3 million gross square feet. While NNSA is the site landlord and is responsible for approximately 75 percent of the floor space, other DOE program offices have responsibility for the remaining 25 percent. Twenty (20) percent of the buildings and 67 percent of Y-12's footprint are more than 60 years old (*see* Figure 3-2). As facilities age past their design life, they are being consolidated and replaced with modern structures and infrastructure. Approximately 53 excess facilities are currently pending decontamination and demolition or transfer to DOE's Office of Environmental Management (DOE-EM) within the next ten years (DOE 2022).




Source: DOE 2022

**Figure 3-2. Age of Facilities at Y-12**

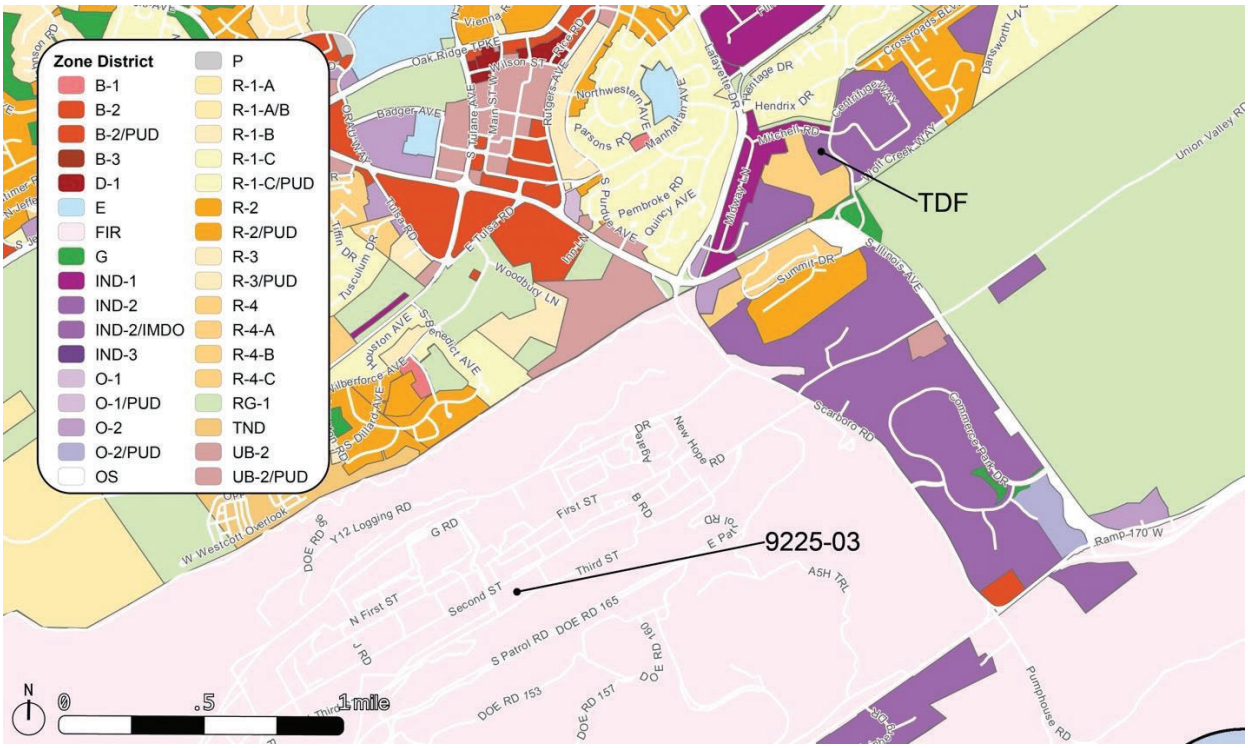
As shown on Figure 1-2, Building 9225-03 is sited near the eastern and southern boundaries at Y-12. Building 9225-03 is classified as a core manufacturing and processing facility. As it is a relatively newer facility, commissioned in 2004, the 'End-State Site Plan' for Y-12 depicted in Figure 3-3 shows it enduring past 2040 (CNS 2023a).

The TDF is located offsite and to the north of the ORR, approximately 0.75 miles from the ORR boundary and approximately 2 miles from Building 9225-03. As shown on Figure 2-1, the TDF is an approximately 51,000 square foot industrial building built in 1983. It is located on an 8.23-acre lot with a 20-foot clear ceiling height and two high bays. The 51,000 square foot facility features approximately 20,000 square feet of production space and 31,000 square feet of office space.


Source: CNS 2023a.

**Figure 3-3. Y-12 End-State Site Plan**

As outlined in Figure 3-4, the TDF is located in the City of Oak Ridge's Heavy Industrial Zoning District (IND-2, shown in Dark Purple on Figure 3-4). The City of Oak Ridge created the IND-2 district to provide areas for industries that are primarily engaged in the processing of raw materials into refined materials in large volumes (Oak Ridge 2022). The TDF is adjacent to neighboring industrial facilities along Mitchell Road and Centrifuge Way, including Centrus Energy's 440,000 square foot Technology and Manufacturing Center located approximately 900 feet to the northeast.




Source: Oak Ridge 2022

**Figure 3-4. Zoning Designation for the ORR and TDF[6]**

There is a diverse mix of land uses surrounding the TDF. The closest non-industrial land uses to the TDF are:

- Residence: approximately 710 feet to the north at Hendrix Drive
- Church: New Life Church of the Nazarene, approximately 1,800 feet to the west at Lafayette Drive

[6] The City of Oak Ridge defines the zoning districts for the TDF and Y-12 as follows:

- Industrial-II (IND-2): The IND-2, general industrial district is established to provide areas in which the principal use of land is for processing, manufacturing, assembling, fabrication and for warehousing. The IND-2 district provides for enterprises in which goods are generally mass produced from raw materials on a large scale through use of an assembly line or similar process, usually for sale to wholesalers or other industrial or manufacturing uses.
- Federal Industry and Research (FIR): The Federal Industry and Research District Classification is established for the United States Government Oak Ridge Reservation and operations within its boundaries.

Note: city or county organizations have no planning jurisdiction at the site because the ORR is a federal facility owned by DOE.

- School: Woodland Elementary School, approximately 2,840 feet to the west at Manhattan Avenue
- Nursing home: Diversicare of Oak Ridge, approximately 4,180 feet to the northeast at Elmhurst Drive
- Daycare: Oak Ridge Early Head Start, approximately 1.05 miles to the northwest at Oak Ridge Turnpike.

### 3.2.2 Proposed Action Effects

**Construction**. The Proposed Action would include two phases, the short-term operations at the TDF and long-term operations at 9225-03 at Y-12. During the first phase, the TDF would undergo light retrofits to support the mission needs. The existing structure is well maintained and outfitted for manufacturing operations but would need minor interior upgrades to the HVAC system, electrical system, and additional diesel generators for back-up power supply during outages. Figure 3-5 shows an interior view of the TDF production area. No land disturbance would occur at the TDF during the first-phase operations. The use of the TDF for manufacturing would be consistent with past uses of the facility, neighboring uses, and zoning.

Source: Loopnet 2019

**Figure 3-5. TDF Production Area Interior**

During short-term operations at the TDF, Building 9225-03 would simultaneously undergo more extensive renovations to ready it for long-term operations. As described in Section 2.1.2, renovations at Building 9225-03 would include a 3,000 square foot building expansion, foundation improvements, utility upgrades (including back-up diesel generators), HVAC renovations, and upgrades to the fire suppression system.

Construction at Building 9225-03 to ready the facility for production operations would not disturb any previous undisturbed land or include the construction of any wholly new facilities. Y-12 would utilize the existing facility and staging areas to meet the needs of the Proposed Action. Y-

12 has adequate capacity for the number of workers expected at the site during construction. Because the affected land has been previously disturbed from past development, no new land disturbance is expected. Existing land uses at Y-12 would remain unchanged and use of Building 9225-03 for the materials manufacturing mission would be consistent with previous uses of that facility, as well as the current Y-12 mission and historic uses of the site. As there will be no land disturbance to previously undisturbed lands, the short-term effects on land-use are expected to be negligible.

**Operation.** In 2027, after renovations at Building 9225-03 are complete, materials manufacturing would migrate to Building 9225-03 at Y-12 from the TDF. The TDF would remain online to provide a long-term supplemental capacity and support for the foreseeable future. Once both facilities are fully operational, long-term effects on land use related to materials manufacturing at Building 9225-03 and back-up capacity at the TDF would be compatible with existing uses and future development. No long-term effects to land use are expected.

### 3.2.3 No-Action Alternative

Under the No-Action Alternative, NNSA would not install new or upgrade any facilities at Y-12 or off-site to accommodate the materials manufacturing mission. The TDF would not be utilized for this mission and Building 9225-03 would remain in a standby mode for a different use. Neither building would undergo renovations and retrofits. Land use would remain unchanged when compared to existing conditions.

## 3.3 Visual Resources

### 3.3.1 Affected Environment

The scenic quality or character of an area consists of the landscape features and social environment from which they are viewed. The landscape features that define an area of high visual quality may be natural, such as mountain views, or man-made, such as city skyline. To assess the quality of visual resources in the project area, this section describes the overall visual character and distinct visual features on or in the viewshed of Building 9225-03 and TDF. Locations of visual sensitivity are defined in general terms as areas where high concentrations of people may be present or areas that are readily accessible to large numbers of people. They are further defined in terms of several site-specific factors, including:

- Areas of high scenic quality (i.e., designated scenic corridors or locations);
- Recreation areas characterized by high numbers of users with sensitivity to visual quality (i.e., parks, preserves, and private recreation areas); and
- Important historic or archaeological locations.

The land is not readily accessible to the public; therefore, no visually sensitive locations are defined on the Y-12 site. 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 of development are constrained by the terrain and vegetation. 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.

The ORR is largely undeveloped with the exception of Y-12, Oak Ridge National Laboratory (ORNL), and East Tennessee Technology Park (ETTP), where development is concentrated. Before government acquisition, the agrarian landscape was made up of forest (approximately 50 percent), isolated woodlots, fields, and homesteads. Since acquisition, most of the original open fields were replanted and the forest cover has increased significantly. In 1994, remote-sensing analyses revealed an expansion of forest cover to about 70 percent of the ORR (Mann et al. 1996).

As shown in Figure 3-, 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. Structures at Y-12 are mostly low profile, reaching heights of three stories or less, and largely built in the 1940s of masonry and concrete. The tallest structure is the 197-foot-tall meteorological tower erected in 1985 and located on the west end of the Complex. The west tower is located on a slight rise across from the intersection of Old Bear Creek Road and Bear Creek Road. The west tower is used to measure and collect meteorological data for ETTP databases. The transmission lines towers installed on Pine Ridge in 2019, and the two water towers north of the Jack Case Center, are two of the most visible features on the site.

**Figure 3-6. Aerial View of Y-12 (looking southwest)**

For the purpose of rating the scenic quality of Y-12, TDF, 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 these areas;

however, the level of development at Y-12 is consistent with VRM Class IV which is used to describe highly developed areas with major modifications to the landscape. The undeveloped land immediately surrounding the Y-12 site would be consistent with VRM Class II and III (i.e., primarily left to its natural state with little to moderate changes).

The TDF is located approximately 0.75 miles to the north of the ORR and the Y-12 boundary in a developed industrial park. The TDF is unremarkable from a visual perspective. As shown on Figure 2-1, it is typical of a purpose-built industrial facility with design and materials chosen for utilitarian function over form; it would fall into the Class IV VRM rating. The lands surrounding TDF, and to the northeast of Y-12 are heavily developed and considered Class IV; they feature a mix of light industrial, commercial, and residential buildings representative of the development patterns within the City of Oak Ridge. The TDF does not abut any residential developments, however there are homes that border the industrial park to the north at Hendrix Drive and to the west across Lafayette Drive. The intervening industrial facilities and vegetation screen the TDF from the residences; there are no sightlines to the TDF from any nearby homes.

### 3.3.2 Proposed Action Effects

**Construction**. Construction activity at the TDF is primarily limited to interior retrofits. Backup generators would be located at the exterior of the property but would not require major modifications to the building's exterior or site. The TDF site is heavily screened from public viewpoints with mature vegetation. An increase in construction related traffic and material staging and laydown areas would be virtually imperceivable to the casual viewer. Additionally, the type of work needed to retrofit the facility to accommodate a new user is typical for the neighboring industrial facilities. The visual landscape as described in Section 3.3.1 would not change appreciably due to the developed nature of the site.

Building 9225-03 is located in the Bear Creek Valley between Pine Ridge and Chestnut Ridge. Bear Creek Valley is relatively flat and heavily developed. The land is not readily accessible to the public, and there are no visually sensitive locations on Y-12. Many viewsheds surrounding Y-12 are constrained by topography and vegetation. Development and design of the Building 9225-03 extension would be driven by function and purpose and would be consistent with the vision to modernize Y-12. Construction activities would use cranes that would create short-term visual effects, but would not be out of character for an industrial site such as Y-12. After construction and renovations of Building 9225-03 are complete, cranes would be removed and any construction laydown area would be restored, if required. Because Building 9225-03 is located within the margins of Y-12, construction-related activities would not draw attention beyond the installation's boundary. Site visitors and employees observing construction would find these activities similar to past and ongoing construction activities at the site.

**Operation.** Once the Proposed Action is implemented and both sites are operational, the visual landscape as described in Section 3.2.2 would not change appreciably due to the developed nature of the sites. The Proposed Action would occur within the context of similar development and would mirror the improvements that have historically occurred and are occurring. They would feature layouts, designs, and materials in keeping with the highly developed nature of the existing built environment. Y-12 and the TDF would remain highly developed areas with an industrial appearance, and there would be no change to the VRM Class IV ratings.

### 3.3.3 No-Action Alternative

Under the No-Action Alternative, NNSA would not install new or upgrade any facilities at Y-12 or off-site to accommodate the materials manufacturing mission. The TDF would not be utilized for this mission and Building 9225-03 would remain in a standby mode for a potential different use in the future. Visual resources would remain unchanged compared to existing conditions.

## 3.4 Air Quality

### 3.4.1 Affected Environment

Air pollution is the presence in the atmosphere of one or more contaminants (e.g., dust, fumes, gas, mist, odor, smoke, and vapor) such as to be injurious to human, plant, or animal life. Air quality as a resource incorporates several components that describe the levels of overall air pollution within a region, sources of air emissions, and regulations governing air emissions. The following sections include a discussion of the existing conditions and the environmental consequences of the Proposed Action and No-Action Alternative.

Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The levels of pollutants are generally expressed on a concentration basis in units of parts per million or micrograms per cubic meter. The baseline standards for pollutant concentrations are the National Ambient Air Quality Standards (NAAQS) and state air quality standards established under the *Clean Air Act of 1990* (CAA). These standards represent the maximum allowable atmospheric concentration that may occur and still protect public health and welfare. The NAAQS specify acceptable concentration levels of six criteria pollutants: particulate matter (measured as both particulate matter less than or equal to 10 microns in diameter [$PM_{10}$] and particulate matter less than or equal to 2.5 microns in diameter [$PM_{2.5}$]), sulfur dioxide ($SO_2$), carbon monoxide (CO), nitrogen dioxide ($NO_2$), ozone ($O_3$), and lead.

All areas of the U.S. are designated as having air quality better than the NAAQS (attainment) or worse than the NAAQS (nonattainment). Areas where there are insufficient air quality data for the EPA to form a basis for attainment status are unclassifiable. Thus, such areas are treated as attainment areas until proven otherwise. "Maintenance areas" are those that were previously classified as nonattainment but where air pollution concentrations have been successfully reduced to levels below the standard. Maintenance areas are subject to special maintenance plans to ensure compliance with the NAAQS.

The Proposed Action would occur in Anderson County, which is used as the ROI for the air quality analysis. According to EPA, Anderson County is in attainment for all criteria pollutants (EPA 2023a). Anderson County emissions were obtained from the latest EPA National Emissions Inventory (NEI), as shown in Table 3-1. The county data include emissions amounts from point sources, area sources, and mobile sources. *Point sources* are stationary sources that can be identified by name and location. *Area sources* are point sources from which emissions are too low to track individually, such as a home or small office building, or a diffuse stationary source, such as wildfires or agricultural tilling. *Mobile sources* are any kind of vehicle or equipment with gasoline or diesel engine, an airplane, or a ship. Two types of mobile sources are considered: on-

road and non-road. On-road sources consist of vehicles such as cars, light trucks, heavy trucks, buses, engines, and motorcycles. Non-road sources are aircraft, locomotives, diesel and gasoline boats and ships, personal watercraft, lawn and garden equipment, agricultural and construction equipment, and recreational vehicles.

**Table 3-1. Baseline Criteria Pollutant Emissions for Anderson County, TN (2020)**

| Anderson County | Criteria pollutant (tons/year)[a] | | | | | |
|---|---|---|---|---|---|---|
| | CO | NOx | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | VOCs |
| Mobile & Area Sources | 11,551 | 1,621 | 1,659 | 639 | 28 | 12,295 |
| Point Sources | 326 | 532 | 98 | 77 | 247 | 73 |
| Totals: | 11,877 | 2,153 | 1,757 | 716 | 275 | 12,368 |

a. Ozone is not included in the table because ozone is not emitted directly. NOx and VOCs are regulated as ozone precursors. Lead emissions are so low that they are typically not included. For example, baseline lead emissions in Anderson County were listed as 0.0 tons per year.

Source: EPA 2023b.

Airborne discharges from DOE Oak Ridge facilities are subject to regulation by the EPA, the TDEC, and DOE Orders. Permits issued by the State of Tennessee are the primary vehicle used to convey the clean air requirements that are applicable to Y-12. New projects are governed by construction permits and modifications to the site-wide Title V Major Source Operating Permit, and eventually the requirements are incorporated into that operating permit. Y-12 is currently governed by Title V Major Source Operating Permit 571832 (DOE 2022). TDF airborne discharges are less than requirements to be classified as a major source and thus, TDF operations do not require any operating permits.

Y-12 has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne emissions satisfy all regulatory requirements and do not adversely affect ambient air quality. Common air pollution control devices employed on the ORR include exhaust gas scrubbers, fabric filters, and HEPA filtration systems designed to remove contaminants from exhaust gases before release to the atmosphere. Process modifications and material substitutions are also made to minimize air emissions. In addition, administrative control plays a role in regulation of emissions. 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 (DOE 2022).

The release of non-radiological contaminants into the atmosphere at Y-12 occurs as a result of plant production, maintenance, waste management operations, and steam generation. Most process operations are served by ventilation systems that remove air contaminants from the workplace. Approximately three-fifths of the permitted air sources release primarily non-radiological contaminants. The remaining two-fifths of the permitted sources process primarily radiological materials. TDEC air permits for the non-radiological sources do not require stack sampling or monitoring. For non-radiological sources where direct monitoring of airborne emissions is not required, or is required infrequently, monitoring of key process parameters is done to ensure compliance with all permitted emission limits (DOE 2022). The primary source of criteria pollutants at Y-12 is the steam plant, where natural gas and fuel oil are burned. Actual and

allowable emissions from the steam plant are shown in Table 3-2; actual emissions are well below allowable emission limits (DOE 2022).

**Table 3-2. Air Emissions from Y-12 Steam Plant (2021)**

| Pollutant | Emissions (tons/year)[a] | | Percentage of allowable |
|---|---|---|---|
| | Actual | Allowable | |
| Particulate | 2.81 | 41.0 | 6.9 |
| Sulfur dioxide | 0.22 | 39.0 | 0.6 |
| Nitrogen oxides[b] | 11.84 | 81.0 | 14.6 |
| VOCs[b,c] | 2.03 | 9.4 | 21.6 |
| Carbon Monoxide[b] | 31.08 | 139.0 | 22.36 |

Note: The emissions are based on fuel usage data for January through December 2021.

a. 1 ton = 907.2 kg.

b. When there is no applicable standard or enforceable permit condition for a pollutant, the allowable emissions are based on the maximum actual emissions calculation, as defined in Tennessee Department of Environment and Conservation Rule 1200-3-26-.02(2)(d) 3 (maximum design capacity for 8,760 hr/year). Actual and allowable emissions were calculated based on the latest EPA compilation of air pollutant emission factors. Ozone and lead are not included as discussed in footnote "a" to Table 3-1.

c. The volatile organic compound (VOC) emissions include VOC hazard air pollutant emissions.

Source: DOE 2022.

**Greenhouse gases**. Greenhouse gases (GHGs) are gases that trap heat in the atmosphere; the accumulation of these gases in the atmosphere contributes to climate change and global warming. Regulations to inventory and decrease emissions of GHGs have been promulgated. On October 30, 2009, the EPA published a rule for the mandatory reporting of GHGs from sources that, in general, emit 25,000 metric tons or more of carbon dioxide equivalent ($CO_2e$) per year in the United States (74 *Federal Register* [FR] 56260). With regard to this EA, on January 1, 2023, the CEQ published interim guidance to assist agencies in analyzing GHG and climate change effects of their proposed actions under NEPA (88 FR 1196).

Based on that interim guidance, CEQ stated that, "agencies should consider: (1) the potential effects of a proposed action on climate change, including by assessing both GHG emissions and reductions from the proposed action; and (2) the effects of climate change on a proposed action and its environmental effects. Analyzing reasonably foreseeable climate effects in NEPA reviews helps ensure that decisions are based on the best available science and account for the urgency of the climate crisis. Climate change analysis also enables agencies to evaluate reasonable alternatives and mitigation measures that could avoid or reduce potential climate change-related effects and help address mounting climate resilience and adaptation challenges." The CEQ interim guidance also states that, "when considering GHG emissions and their significance, agencies should use appropriate tools and methodologies to quantify GHG emissions, compare GHG emission quantities across alternative scenarios (including the No-Action Alternative), and place emissions in relevant context, including how they relate to climate action commitments and goals."

Baseline GHG emissions, which are represented by $CO_2e$, for Anderson County and the State of Tennessee, are presented in Table 3-3.

**Table 3-3. Baseline Greenhouse Gas Emissions for Anderson County, TN (2020)**

| Area | Greenhouse Gases (million metric tons/year) |
|---|---|
| | $CO_2e$ |
| Anderson County | 1.5 |
| Tennessee | 83.3 |

Sources: EIA 2021, EPA 2023b.

### 3.4.2 Proposed Action Effects

There would be short- and long-term minor adverse effects to air quality. Short-term effects would be due to generating airborne dust and other pollutants during construction. Long-term effects would be due to personnel commutes and the heating/cooling of Building 9225-03.[7] Air quality effects would be minor unless the emissions would exceed the general conformity rule *de minimis* (of minimal importance) threshold values, or would contribute to a violation of any federal, state, or local air regulation.

**Construction**. A construction air permit from TDEC would not be required for either the TDF or Building 9225-03. Because there would only be internal construction activities at the TDF, no notable air emissions associated with construction are expected. For Building 9225-03, less than one acre of previously disturbed land could be re-disturbed. Construction emissions were estimated for construction equipment and worker trips (Table 3-4).

**Table 3-4. Maximum Annual Air Emissions at Y-12 for the Proposed Action Compared to *De Minimis* Thresholds**

| Activity | CO (tpy) | $NO_x$ (tpy) | VOC (tpy) | $SO_x$ (tpy) | $PM_{10}$ (tpy) | $PM_{2.5}$ (tpy) | *De Minimis Threshold* (tpy) | Exceeds *De Minimis* Thresholds? [Yes/No] |
|---|---|---|---|---|---|---|---|---|
| Construction Emissions | 0.5 | 0.5 | 0.4 | <0.1 | 1.8 | 0.02 | 100 | No |
| Operational Emissions | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 100 | No |

tpy = tons per year

Note 1: The allowable site-wide emissions in the current Y-12 Title V Major Source Operating Permit 571832 are as follows: NOx = 483.26 tpy; VOC = 109.15 tpy; $SO_2$= 39.03 tpy; and PM = 204.95 tpy. Materials manufacturing operations would be conducted in accordance with the permit requirements.

Source: derived from NNSA 2021b.

During construction, NNSA would take reasonable precautions to prevent fugitive dust from becoming airborne, although this is expected to be minimal given that the area to be re-disturbed in less than one acre and is currently partially paved. Reasonable precautions might include wetting by water spray any areas likely to generate fugitive dust during on site construction activities as needed. Additionally, all construction equipment employed on site would be well-maintained and equipped with emissions control equipment. Consequently, there would be minimal emissions associated with fugitive dust and earthmoving equipment.

[7] Because the TDF is currently operating, heating and cooling of that facility is an ongoing action, and the Proposed Action would not change those air quality impacts. Consequently, there would be no additional air quality impacts associated with the heating and cooling of the TDF.

**Operation**. Operational emissions were estimated at Y-12 for changes in heated/cooled space and emissions associated with commuting workers. At the TDF, there would be no change in heated/cooled space and emissions associated with commuting workers (5 workers) would be minimal. No new stationary sources of air emissions would be associated with the Proposed Action, with the exception of a backup emergency diesel generator.[8] Although the area is in attainment and the general conformity rules do not apply, the *de minimis* threshold values were carried forward to determine the level of effects under NEPA. As shown in Table 3-4, the estimated emissions from the Proposed Action would be below the *de minimis* thresholds; therefore, the level of effects would be minor.

***Greenhouse Gases and Climate Change.*** Per the CEQ interim guidance, this EA quantifies the reasonably foreseeable GHG emissions associated with the Proposed Action by examining GHGs as a category of air emissions. Table 3-5 presents the estimated GHG emissions (represented by $CO_2e$) from the Proposed Action in relation to the global, nationwide, and statewide GHG emissions.

**Table 3-5. Global, Countrywide, and Statewide GHG Emissions (2020)**

| Scale | $CO_2e$ Emissions (million metric tons/year) |
|---|---|
| Global | 35,963 (note 1) |
| United States | 4,535 |
| Tennessee | 83.3 |
| Anderson County, Tennessee | 1.5 |
| Proposed Action | 0.0000006 (note 2) |

Note 1: As a result of the COVID-19 pandemic, primary energy demand dropped nearly 4 percent in 2020 and global energy-related $CO_2$ emissions fell by 5.8 percent, the largest annual percentage decline since World War II. Demand for fossil fuels was hardest hit in 2020, especially oil, which fell 8.6 percent, and coal, which dropped by 4 percent. Oil's annual decline was its largest ever, accounting for more than half of the drop in global emissions. Global emissions from oil use fell by well over 1,100 million metric tons of $CO_2$, down from around 11,400 million metric tons in 2019. The drop-in road transport activity accounted for 50 percent of the decline in global oil demand, and the slump in the aviation sector for around 35 percent. Meanwhile, low-carbon fuels and technologies such as solar and wind reached their highest ever annual share of the global energy mix, increasing it by more than one percentage point to over 20 percent.
Note 2: Conservatively assumes construction emissions and annual operational emissions occur in same year.
Sources: EIA 2021, EPA 2023b, EDGAR 2021.

Per the CEQ interim guidance, "Climate change is a defining national and global environmental challenge of this time, threatening broad and potentially catastrophic effects to the human environment. It is well established that rising global atmospheric GHG concentrations are substantially affecting the Earth's climate, and that the dramatic observed increases in GHG concentrations since 1750 are unequivocally caused by human activities including fossil fuel combustion" (88 FR 1196).

Per the CEQ interim guidance, "actions with only small GHG emissions may be able to rely on less detailed emissions estimates." As shown in Table 3-5, the Proposed Action in this EA is an action with only small GHG emissions. As such, NNSA has determined that a monetary cost-

[8] For backup emergency diesel generators, NNSA would provide TDEC with a copy of the EPA Certification of Conformity to document compliance with air quality requirements. Emergency Standby Power Systems can be run up to 100 hours a year for testing and maintenance. There is no hour limit for true emergency operation.

benefit analysis is not needed and would not be relevant to the choice among the alternatives considered in this EA.

Table 3-6 outlines potential climate stressors and their effects from the construction and operation of the Proposed Action.

**Table 3-6. Effects of Potential Climate Stressors**

| Potential Climate Stressor | Effects from the Proposed Action |
|---|---|
| More frequent and intense heat waves | negligible |
| Longer fire seasons and more severe wildfires | negligible |
| Changes in precipitation patterns | negligible |
| Increased drought | negligible |
| Harm to water resources, agriculture, wildlife, ecosystems | negligible |

Source: NCA 2014.

### 3.4.3 No-Action Alternative

Under the No-Action Alternative, no new facilities would be constructed and no additional air emissions would occur. Air quality would be unaffected compared to baseline levels discussed in Section 3.4.1.

## 3.5 Noise

### 3.5.1 Affected Environment

Sound is a physical phenomenon consisting of vibrations that travel through a medium, such as air, and are sensed by the human ear. Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type and characteristics of the noise, distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities essential to a community's *quality of life*, such as construction or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level, described in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz are used to quantify sound frequency. The human ear responds differently to different frequencies. "A-weighing," measured in A-weighted decibels (dBA), approximates a frequency response expressing the perception of sound by humans. Sounds encountered in daily life and their dBA levels are provided in Table 3-7.

**Table 3-7. Common Sounds and Their Levels**

| Outdoor | Sound Level (dBA) | Indoor |
|---|---|---|
| Motorcycle | 100 | Subway train |
| Tractor | 90 | Garbage disposal |
| Noisy restaurant | 85 | Blender |
| Downtown (large city) | 80 | Ringing telephone |

| Outdoor | Sound Level (dBA) | Indoor |
|---|---|---|
| Freeway traffic | 70 | TV audio |
| Normal conversation | 60 | Sewing machine |
| Rainfall | 50 | Refrigerator |
| Quiet residential area | 40 | Library |

Source: Harris 1998.

The dBA noise metric describes steady noise levels, although very few noises are, in fact, constant. Therefore, A-weighted Day-night Sound Level has been developed. Day-night Sound Level (DNL) is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime levels (10:00 p.m. to 7:00 a.m.). DNL is a useful descriptor for noise because: (1) it averages ongoing yet intermittent noise, and (2) it measures total sound energy over a 24-hour period. In addition, Equivalent Sound Level ($L_{eq}$) is often used to describe the overall noise environment. $L_{eq}$ is the average sound level in dB.

The *Noise Control Act of 1972* (PL 92-574) directs federal agencies to comply with applicable federal, state, and local noise control regulations. In 1974, the EPA provided information suggesting continuous and long-term noise levels in excess of DNL 65 dBA are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals. The acoustic environment along Y-12 site boundary, in rural areas, and at nearby residences away from traffic noise, is typical of a rural location with a DNL in the range of 35 to 50 dBA. Areas near Y-12 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 Y-12 site boundary and at residences located near roads is traffic. During peak hours, Y-12 worker traffic is a major contributor to traffic noise levels in the area.

Because Y-12 is an industrial site, there are many existing noise sources. Major noise emission sources within Y-12 include various industrial facilities, equipment, and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most of the 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 range between 50 and 70 dBA, which is typical for industrial facilities (NNSA 2015). The State of Tennessee has not established specific community noise standards applicable to Y-12; however, Anderson County has quantitative noise-limit regulations as shown in Table 3-8 (Anderson 2009).

**Table 3-8. Allowable Noise Level by Zoning District in Anderson County**

| Zoning District | Allowable Noise Level (in dBA) | |
|---|---|---|
| | 7 AM – 10 PM | 10 PM – 7 AM |
| Suburban Residential (R-1) | 60 | 55 |
| Rural Residential (R-2) | 65 | 60 |
| Agricultural – Forest (A-1) | 65 | 60 |
| General Commercial (C-1) | 70 | 65 |
| Light Industrial (I-1) | 70 | 70 |

| | | |
|---|---|---|
| Heavy Industrial (I-2) (see note) | 80 | 80 |
| Floodway (F-1) | 80 | 80 |

Note: Per the City of Oak Ridge Zoning Ordinance, which was last amended in 2019, Y-12 falls into the FIR zoning district, which is zoning classification assigned to areas of the city that are part of the ORR. Although the ordinance does not provide guidelines on use within the FIR district, Y-12 would likely be classified as heavy industrial.
Source: Anderson 2009.

At the TDF, the nearest sensitive noise receptor is the New Life Church of the Nazarene, which is approximately 1,800 feet west of the TDF. The nearest residence to the TDF is approximately 710 feet to the north. At Y-12, the nearest sensitive noise receptor from Building 9225-03 is the Oak Ridge Schools' Preschool at Scarboro Park, which is approximately 4,030 feet away, to the northwest. The nearest residence to Building 9225-03 is approximately 3,230 feet to the northwest. There have been no known noise complaints associated with TDF or Y-12 operations in the recent past.

### 3.5.2 Proposed Action Effects

**Construction.** Construction activities would consist of site preparation, internal construction at the TDF, and internal and external construction at Building 9225-03. Maximum noise levels generated by construction equipment that could be used on this type of project are listed in Table 3-9 at a reference distance of 1,000 feet. At this distance, the highest noise level generated by the equipment types listed would be 64 dBA. Under a highly conservative scenario in which all of the listed equipment types are operating during a single day at a single location, the $L_{eq}$ during workday hours at a distance of 1,000 feet would be 64 dBA. Because the nearest residence to Building 9225-03 is more than 1,000 feet, noise levels would be less than 64 dBA. At TDF, there would be little to no external construction, and noise levels from internal construction would not be expected to exceed 64 dBA at any receptor due to noise attenuation from the TDF exterior walls.

**Table 3-9. Noise Levels of Common Construction Equipment**

| Equipment type | Lmax at 1,000 ft |
|---|---|
| Crane | 55 |
| Dozer | 56 |
| Dump Truck | 50 |
| Excavator | 55 |
| Fork Lift | 49 |
| Front End Loader | 53 |
| Concrete Saw | 64 |
| **$L_{eq}$ during workday hours at 1,000 ft (Total)** | **64** |

Source: FHWA 2006.

As discussed in Section 3.2.1, the TDF is located in the City of Oak Ridge's Heavy Industrial Zoning District, which is not considered to be a noise sensitive area. At Y-12, the area surrounding the proposed MMF is generally used for industrial purposes and is also not considered to be noise sensitive. Thus, the construction activities associated with the Proposed Action would take place in areas that are relatively insensitive to noise. For example, current activities in the area near Building 9225-03 include construction of the Uranium Processing Facility (UPF), which is

expected to continue through approximately 2028. Construction of the MMF for Building 9225-03 would be similar to UPF construction, albeit on a smaller scale.

Although construction-related noise effects would be minor, the following best management practices would be performed to reduce the already limited noise effects:

- Construction would primarily occur during daytime hours;
- Equipment mufflers would be properly maintained and in good working order; and
- On-site personnel, and particularly equipment operators, would don adequate personal hearing protection to limit exposure and ensure compliance with federal health and safety regulations.

**Operation**. There would be no major sources of noise from operations and no long-term increases in the overall noise environment (e.g., $L_{eq}$) would be expected; therefore, no long-term changes in the noise environment would occur.

### 3.5.3 No-Action Alternative Effects

Under the No-Action Alternative, the Proposed Action would not proceed and there would be no changes to noise effects from current operations discussed in Section 3.5.1.

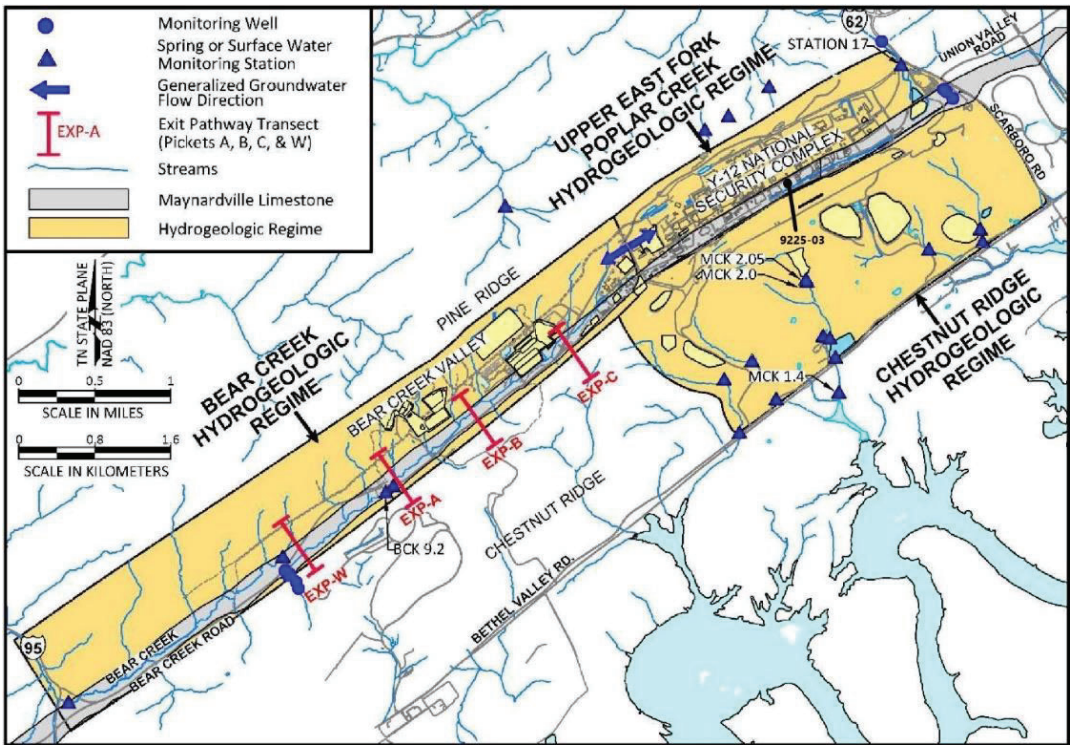
## 3.6 Water Resources

### 3.6.1 Affected Environment

**Groundwater.** Y-12 is divided into three hydrogeologic regimes, which are delineated by surface water drainage patterns, topography, and groundwater flow characteristics. The regimes are further defined by the waste sites they contain. These regimes include the Bear Creek Hydrogeologic Regime, the Upper East Fork Poplar Creek (UEFPC) Hydrogeologic Regime, and the Chestnut Ridge Hydrogeologic Regime (Figure 3-7). Most of the Bear Creek and UEFPC regimes are underlain by geologic formations that are part of the ORR aquitard. The ORR aquitard is comprised of six geologic formations (Nolichucky Shale, Maryville Limestone, Rogersville Shale, Rutledge Limestone, Pumpkin Valley Shale, and Rome Formation) which collectively have low permeability and low transmissivity. The northern portion of Bear Creek and UEFPC regimes is underlain by aquitard formations including the Nolichucky Shale, Maryville Limestone, and Rogersville Shale. The southern portion of the Bear Creek and UEFPC regimes is underlain by the Maynardville Limestone, which has higher permeability and transmissivity, and is part of the Knox aquifer.

In general, near surface groundwater flow follows topography at Y-12; therefore, it flows off areas of higher elevation into the valley and then flows parallel to the valley, along geologic strike. Shallow flow in the Bear Creek and UEFPC regimes is divergent from a topographic and groundwater divide located near the western end of Y-12. In the Chestnut Ridge regime, a groundwater divide nearly coincides with the crest of the ridge. On Chestnut Ridge, shallow groundwater flow tends to be toward either flank of the ridge, with discharge primarily to surface streams and springs in Bethel Valley to the south and Bear Creek Valley to the north. In Bear Creek Valley, groundwater in the intermediate and deep intervals moves through fractures in the

aquitard, converging on and then moving through fractures and solution conduits in the Maynardville Limestone. Karst development in the Maynardville Limestone has a significant effect on groundwater flow paths in the water table and intermediate intervals. Groundwater flow rates in Bear Creek Valley vary; they are slow within the deep interval of the fractured non-carbonate rock (less than 10 feet/year) but can be quite rapid within solution conduits in the Maynardville Limestone (10 to 5,000 feet/day) (DOE 2022).




Source: DOE 2022.

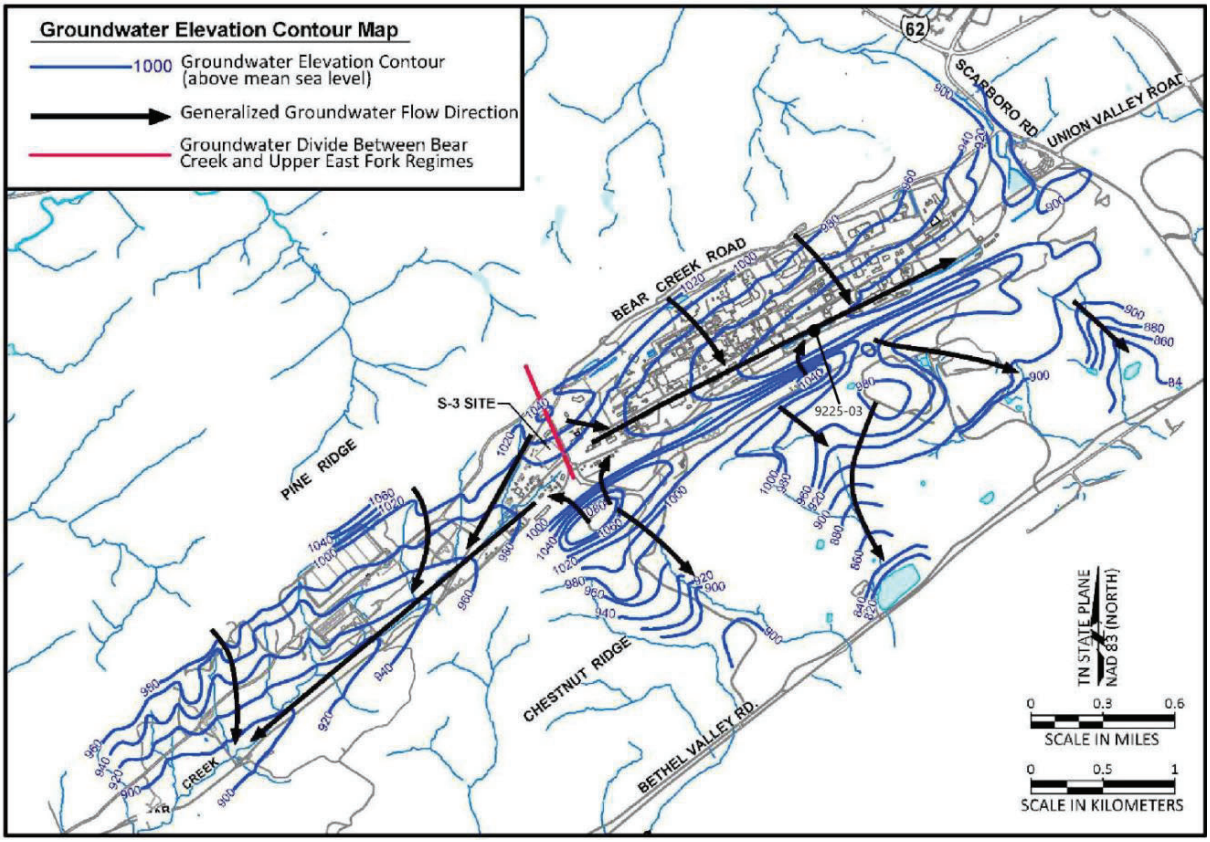
**Figure 3-7. Hydrogeologic Regimes at Y-12**

Contaminants are transported along with flowing groundwater through the pore spaces, fractures, or solution conduits of the hydrogeologic system. More than 200 sites have been identified at Y-12 that represent known or potential sources of contamination to the environment as a result of past waste management practices (NNSA 2011). Because of this contamination, extensive groundwater monitoring is performed to comply with regulations and DOE orders. Historical monitoring efforts have shown that four types of contaminants have affected groundwater quality at Y-12: nitrate, volatile organic compounds, metals, and radionuclides. Of those, nitrate and volatile organic compounds are the most widespread. Among the three hydrogeologic regimes underlying the Y-12 Complex, the UEFPC regime encompasses most of the known and potential sources of surface water and groundwater contamination. Because of the many legacy source areas, VOCs are the most widespread groundwater contaminants in the UEFPC regime (DOE 2022).

Because of the abundance of surface water and its proximity to the points of use, very little groundwater is used in vicinity of Y-12. Industrial and drinking water supplies are taken primarily from surface water sources; however, single-family wells are common in adjacent rural areas not

served by the public water supply system. Most of the residential wells in vicinity of Y-12 are south of the Clinch River (NNSA 2011).

Building 9225-03 is located within the UEFPC Hydrogeologic Regime within the Maynardville Limestone. Groundwater in the vicinity of Building 9225-03 flows to the northeast (Figure 3-8) (DOE 2022). Building 9225-03 is located within the generalized groundwater plumes for VOCs and nitrate at Y-12.




Source: DOE 2022.

**Figure 3-8. Groundwater Elevation Contours and Flow Directions at Y-12**

The TDF is located about 0.75 miles to the northeast of the Y-12 boundary. Groundwater at the TDF is expected to generally flow northwest and west, following the topography towards a tributary of the EFPC (Figure 3-9). The TDF site is underlain by the Rome Formation, which consists of shale and siltstone with beds of fine-grained sandstone. There are no cleanup sites located within one-mile of the TDF, as mapped by the EPA Cleanups in My Community Map (EPA 2023c). There is no known groundwater contamination at the TDF site.

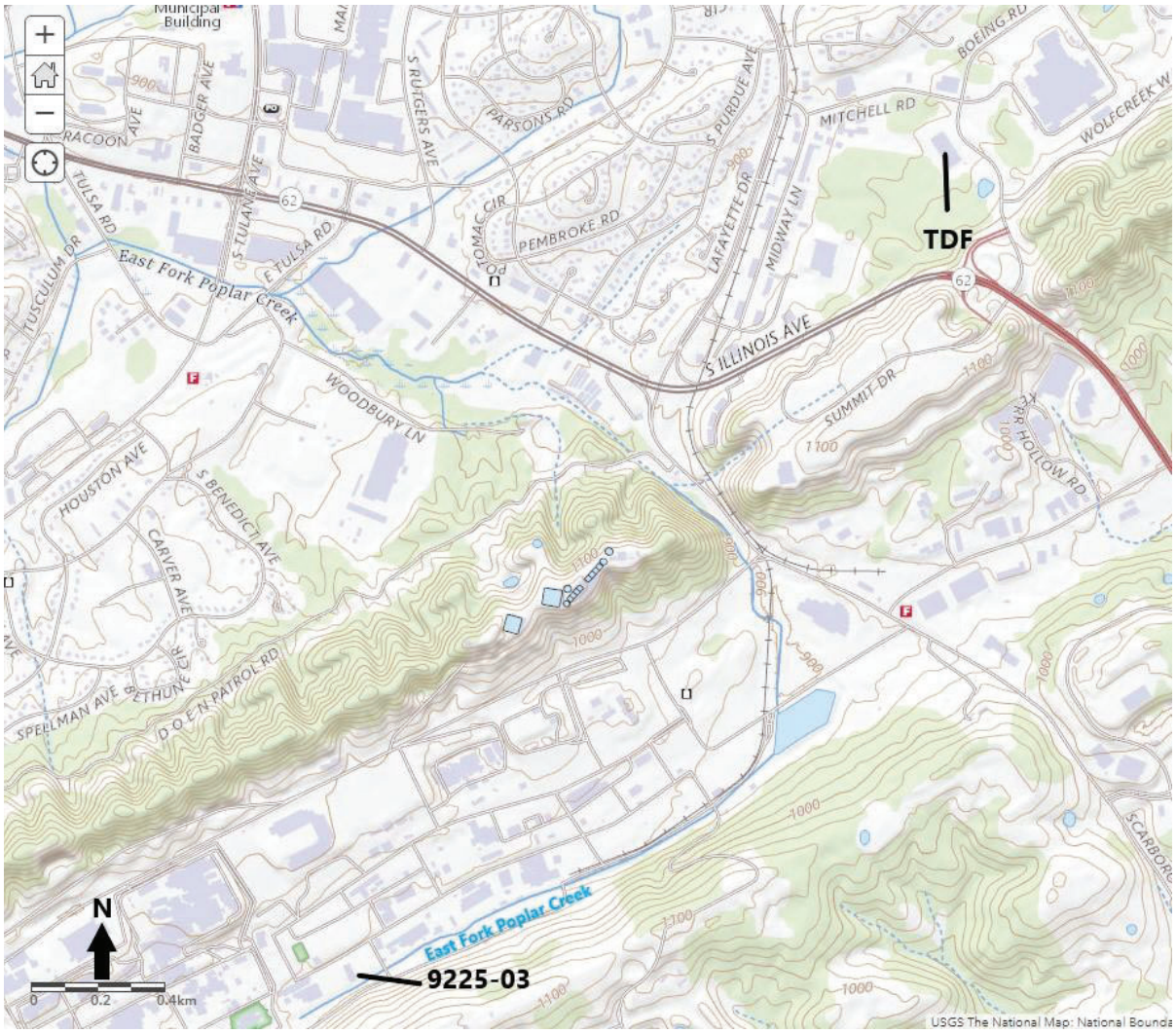
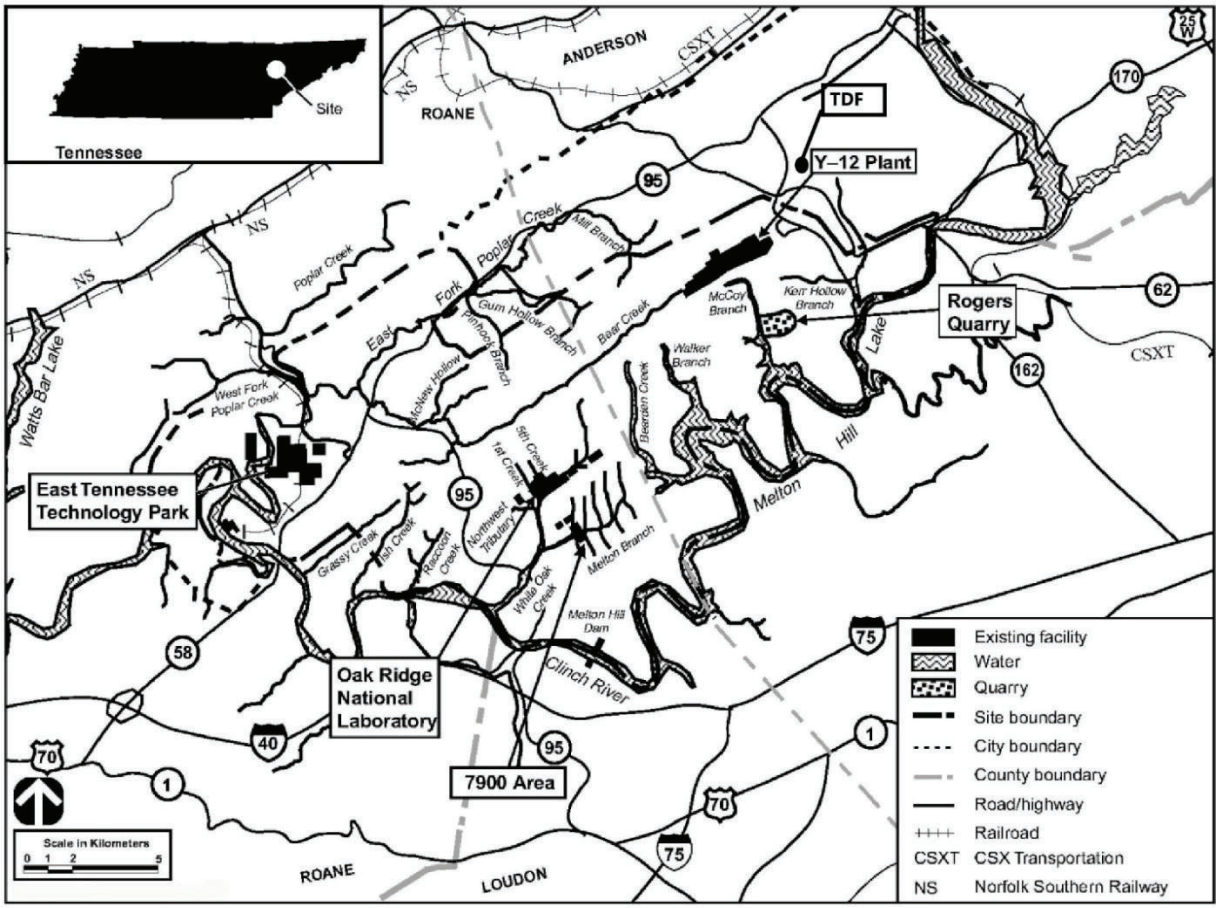



**Figure 3-9. East Fork Poplar Creek at Y-12**

**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 (Figure 3-10). The ORR lies within the Valley and Ridge Physiographic Province, which is composed of a series of drainage basins containing many small streams feeding the Clinch River. Surface water at each of the major facilities on the ORR drains into a tributary or series of tributaries, streams, or creeks within different watersheds. Each of these watersheds drains into the Clinch River. The largest of the drainage basins is that of Poplar Creek, which receives drainage from a 136-square mile area, including Y-12. It flows from northeast to southwest, approximately through the center of the ETTP, and discharges directly into the Clinch River (NNSA 2011).




Source: NNSA 2011.

**Figure 3-10. Surface Water Features in the Vicinity of Y-12**

The EFPC, which discharges into Poplar Creek east of the ETTP, originates within Y-12 just west of Building 9225-03 and flows northeast along the south side of Y-12 (Figure 3-9). Various Y-12 wastewater discharges to the upper reaches of EFPC from the late 1940s to the early 1980s left a legacy of contamination (e.g., mercury, PCBs, uranium) that has been the subject of water quality improvement initiatives over the past two decades. The water quality of surface streams in the vicinity of Y-12 is affected by current and historical legacy operations. Discharges from Y-12 processes flow into EFPC before the water exits Y-12. EFPC eventually flows through the City of Oak Ridge to Poplar Creek and into the Clinch River (DOE 2022). The Oak Ridge Office of Environmental Management (OREM) is constructing a water treatment facility at the Y-12 site. The treatment facility, which is scheduled to be operational in 2025, is a key component of the mercury remediation strategy at Y-12 and will help reduce mercury releases into the UEFPC. It will also serve as an important control measure during cleanup of the site (OREM 2023).

A new Y-12 NPDES permit (TN002968) was received from TDEC on August 5, 2022 and became effective on October 1, 2022. Under the new permit, 56 representative outfalls are monitored annually for total suspended solids, pH, and flow. Additionally, selected outfalls are sampled for pollutants (CNS 2023a). Currently, Y-12 has outfalls and monitoring points in the following water drainage areas: EFPC, Bear Creek, and several unnamed tributaries on the south side of Chestnut Ridge. These creeks and tributaries eventually drain to the Clinch River (DOE 2022).

Discharges to surface water allowed under the permit include storm drainage, cooling water, cooling tower blowdown, steam condensate, and treated process wastewaters, including effluents from wastewater treatment facilities. Groundwater inflow into sumps in building basements and infiltration to the storm drain system are also permitted for discharge to the creek. The monitoring data collected by the sampling and analysis of permitted discharges are compared with NPDES limits for parameters with existing limits. Some parameters, defined as "monitor only," have no specified limits (DOE 2022).

The NPDES permit requires regular monitoring and stormwater characterization. The effluent limitations contained in the permit are based on the protection of water quality in the receiving streams. The permit emphasizes storm water runoff and biological, toxicological, and radiological monitoring. Requirements of the NPDES permit for 2021 and 2022 were satisfied. The percentage of compliance with permit discharge limits for 2021 and 2022 was 100 percent (DOE 2022, CNS 2023a).

There are no streams located near the TDF (USFWS 2023). Current operations in the TDF do not result in the discharge of process water, and thus, do not require a NPDES permit. Cooling tower discharge is discharged to the sanitary sewer system as needed, which has been approved by the City of Oak Ridge.

The EFPC is located immediately south and within 100 feet of Building 9225-03. No operations are currently conducted in Building 9225-03. When PPtF operations were conducted, Building 9225-03 did not discharge any permitted wastewater. Incidental stormwater associated with a small dike at that location discharged to Outfall 113 to EFPC. The dike has since been demolished and the discharge pipe plugged.

**Wetlands**. Approximately 600 acres of wetlands exist on the ORR, with most classified as forested palustrine, scrub/shrub, and emergent wetlands (NNSA 2011). Wetlands occur across the ORR at lower elevations, primarily in the riparian zones of headwater streams and their receiving streams, as well as in the Clinch River embayments.

Wetlands are protected under Executive Order (EO) 11990 (42 FR 26961, May 24, 1977). A wetlands survey of the Y-12 area found palustrine, scrub/shrub, and emergent wetlands. An emergent wetland was found at the eastern end of Y-12, at a seep by a small tributary of EFPC, between New Hope Cemetery and Bear Creek Road. Eleven small wetlands have been identified north of Bear Creek Road in remnants of the UEFPC (NNSA 2011). There are no wetlands near building 9225-03. According to the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory Mapper, there are no wetlands near the TDF (USFWS 2023).

**Floodplains.** A floodplain is defined as the valley floor adjacent to a streambed or arroyo channel that may be inundated during high water. The Tennessee Valley Authority (TVA) conducted floodplain studies along the Clinch River, Bear Creek, and EFPC. Eastern Portions of Y-12 lie within the 100- and 500-year floodplains of EFPC (NNSA 2011). Building 9225-03 is not located within the floodplain. In the immediate vicinity of Building 9225-03, the 100- and 500-year floodplains for the EFPC do not extend beyond the existing channel (NNSA 2011). The TDF is

not located within floodplain. The TDF is located over 3,500 feet to the northeast of the 100- and 500-year floodplains associated with the EFPC (FEMA 2023).

### 3.6.2 Proposed Action Effects

**Construction and Operation.**

***Groundwater.*** No effects to groundwater are anticipated from construction activities or normal facility operations. During construction, any purged groundwater from excavation or trench de-watering would be containerized and treated at the appropriate Y-12 wastewater treatment facility. Groundwater would not be used as a water source. Potential effects to groundwater quality are not expected during the materials manufacturing process. No hazardous chemicals would be used and no hazardous wastes would be generated at either Building 9225-03 or TDF. Closed loop cooling systems would be used and no wastewater discharge is anticipated. Any spills would be contained and cleaned up in an appropriate manner under Y-12's spill prevention, control, and countermeasures (SPCC) Plan. As such, facility operations would not be expected to contaminate the groundwater.

***Surface Water.*** No effects to surface water are anticipated from construction activities or normal facility operations. During construction at Building 9225-03, Y-12's Stormwater Pollution Prevention Plan (SWPPP) would be implemented to protect the EFPC. SWPPP requirements include: (1) installation and maintenance of erosion controls (e.g., straw bales, silt fence, sandbags); (2) stabilization of bare soil areas within the work area (3) cleanup and removal of construction debris and sediment accumulation; and (4) management of stockpiled soils to minimize sediment transport. The area of soil disturbance at Building 9225-03 is expected to be less than one acre. Therefore, a construction stormwater NPDES permit for discharges of stormwater associated with construction activities is not required.

As shown on Figure 3-9, the EFPC is located immediately south and within 100 feet of Building 9225-03. During construction, soil erosion and sedimentation could increase due to increased soil exposure. However, the implementation of erosion controls would minimize potential transport of sediment offsite and to EFPC. Installing and maintaining erosion controls around the perimeter of the construction footprint would contain disturbed site soils and reduce potential for offsite transport of sediment. The potential for offsite sediment transport would exist until disturbed areas are stabilized and revegetation is established.

During construction at the TDF, there would be minor changes to the exterior walls to support equipment installation but there would be no land disturbance, and therefore no effects to stormwater or surface water would occur. During operations, no hazardous chemicals would be used, and no hazardous wastes or process water would be generated at either Building 9225-03 or TDF. Although there would be cooling tower blowdown to Outfall 113, which reaches EFPC, no water quality effects are expected from operations. However, Outfall 113 is not currently permitted for cooling tower blowdown and could require modification to the facility NPDES permit. Minimal quantities of makeup water for cooling systems would be required occasionally. Stormwater would be managed in accordance with existing stormwater pollution prevention plans.

**Wetlands.** There are no wetlands within or adjacent to either Building 9225-03 or TDF. There would be no effects to wetlands from construction and operations.

**Floodplains**. Building 9225-03 and TDF do not overlap with 100- and 500-year floodplains associated with the EFPC. In the immediate vicinity of Building 9225-03, the 100- and 500-year floodplains for the EFPC do not extend beyond the existing channel. The TDF is located over 3,500 feet to the northeast of the 100- and 500-year floodplains of the EFPC. There would be no effects from flooding nor floodplain disturbance during construction and operations.

### 3.6.3 No-Action Alternatives

Under the No-Action Alternative, NNSA would not perform materials manufacturing at either the TDF or Building 9225-03, and there would be no additional effects to water resources. Effects to water resources would continue as discussed in Section 3.6.1. Ongoing and planned cleanup activities would continue at Y-12.

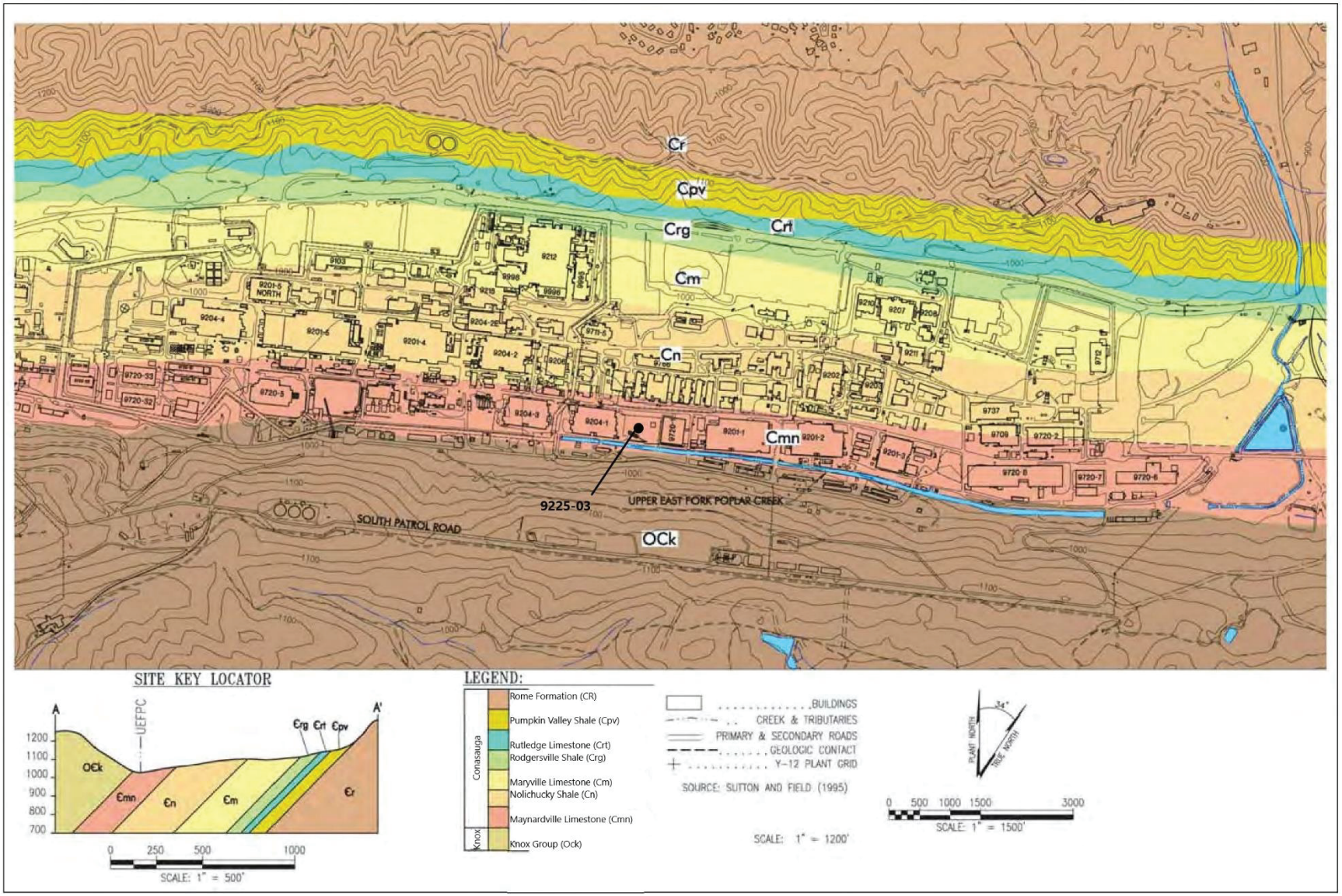
## 3.7 Geology and Soils

### 3.7.1 Affected Environment

**Geology.** The ORR lies in the Valley and Ridge Physiographic Province of eastern Tennessee, which is characterized by a series of parallel narrow, elongated ridges and valleys that follow a northeast-to-southwest trend. The Valley and Ridge Physiographic Province has developed on thick, folded beds of sedimentary rock deposited during the Paleozoic era. The long axes of the folded beds control the shapes and orientations of a series of long, narrow parallel ridges and intervening valleys (ORNL 2006). In general, the ridges consist of resistant siltstone, sandstone, and dolomite units, and the valleys, which resulted from stream erosion along fault traces, consist of less-resistant shales and shale-rich carbonates (NNSA 2011). Elevation within the ORR ranges from a low of 750 feet above mean sea level (AMSL) along the Clinch River to a high of 1,260 feet AMSL along Pine Ridge. Within the ORR, the relief between the valley floors and ridge crests is generally about 300 to 350 feet (NNSA 2011). Most of the ORR facilities are located in the valleys.

Several geologic formations are present in the ORR area. The Rome Formation, which is present north of Y-12 and forms Pine Ridge, consists of massive-to-thinly bedded sandstones interbedded with minor amounts of thinly bedded, silty mudstones, shales, and dolomites. The Conasauga Group, which underlies Bear Creek Valley and Y-12, consists primarily of calcareous shales, siltstone, and limestone. The Knox Group, which is present immediately south of Y-12, consists of dolomite and limestone and underlies Chestnut Ridge.

Y-12 is located within Bear Creek Valley, which is underlain by Middle to Late Cambrian strata of the Conasauga Group (Figure 3-11). The Conasauga Group consists primarily of highly fractured and jointed shale, siltstone, calcareous siltstone, and limestone. The upper part of the group is mainly limestone, while the lower part consists mostly of shale (NNSA 2011). This group can be divided into six discrete formations, which are, in ascending order, the Pumpkin Valley Shale, the Rutledge Limestone, the Rogersville Shale, the Maryville Limestone, the Nolichucky Shale, and the Maynardville Limestone. Within Y-12, Building 9225-03 is underlain by the




Source: NNSA 2011.

**Figure 3-11. Generalized Bedrock Map for Y-12**

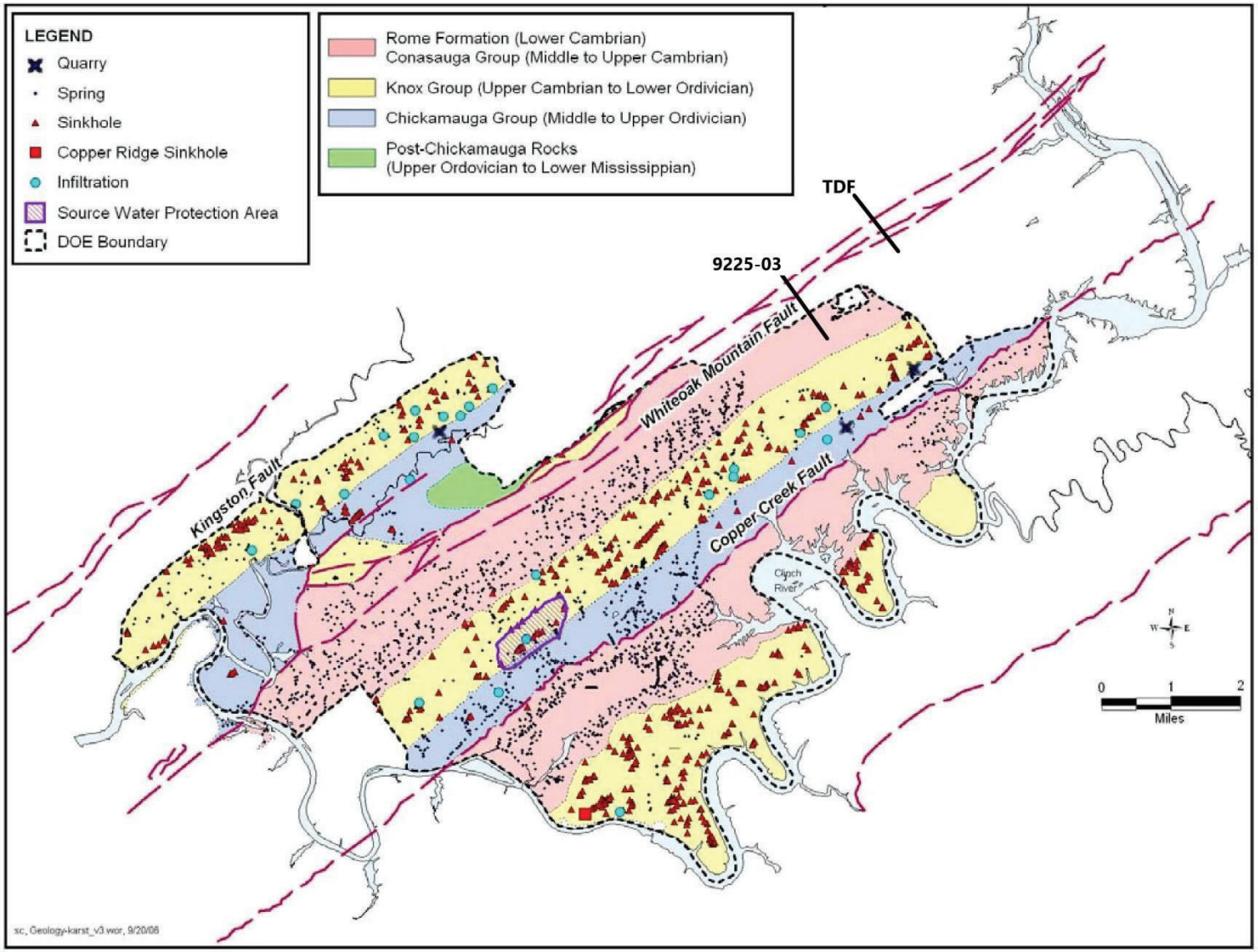
Maynardville Limestone formation. The TDF is located about one-mile northeast of Y-12 on the north side of Pine Ridge and is underlain by the Rome Formation. Unconsolidated materials overlying bedrock at Y-12 include alluvium (stream-laid deposits), colluvium (material transported downslope), man-made fill, fine-grained residuum from the weathering of the bedrock, saprolite (a transitional mixture of fine-grained residuum and bedrock remains), and weathered bedrock. The overall thickness of these materials in the Y-12 area is typically less than 40 feet.

The geology of the ORR is complex as a result of extensive thrust faults and folds. The White Oak Mountain Thrust Fault located north of Y-12, and other major faults in the vicinity are displayed in Figure 3-12. Although major thrust faults are numerous at the ORR, these faults are associated with mountain building episodes that ended more than 200 million years ago. These faults are no longer active, but stress stored up at depth in these rocks is periodically released as minor earthquakes. Since 1900, 210 earthquakes have been recorded within 62 miles of Y-12 with the highest magnitude of 4.7 (USGS 2023).

The U.S. Geological Survey (USGS) Earthquake Hazards Program's 2018 Long-term Model (USGS 2018) for the Conterminous United States shows earthquake ground motions for various probability levels across the United States. The USGS rates ground motions using peak ground acceleration, which is the maximum acceleration experienced during the course of an earthquake and is measured in units of acceleration due to gravity ("g"). The Long-Term Model indicates that the study area is located in an area with a moderate seismic hazard class rating: 0.34g peak horizontal ground acceleration with a 2 percent probability of exceedance in 50 years; and 0.11g peak horizontal ground acceleration with a 10 percent probability of exceedance in 50 years (*see* Figures 3-13 and 3-14). An earthquake generating 0.3g would produce very strong perceived shaking. Damage would be slight in specially designed structures. An earthquake generating 0.10g would be perceived by all, with minimal damage to well-built ordinary structures (USGS 2018, NNSA 2011, NNSA 2020a).

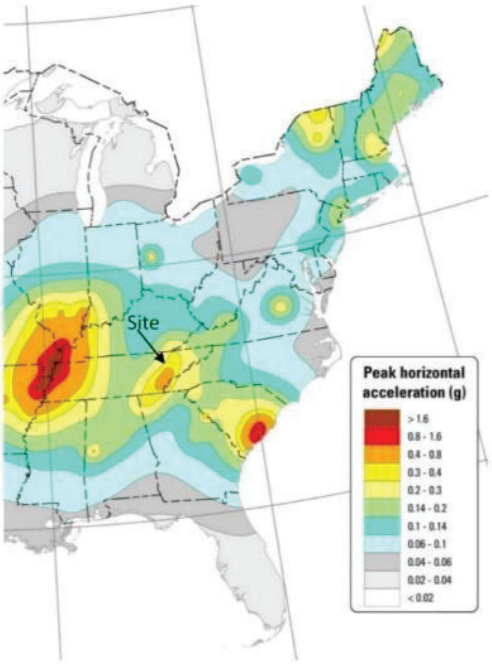
Karst features are dissolutional features occurring in carbonate bedrock. Numerous surface indications of karst development have been identified at the ORR (Figure 3-12). Surface evidence of karst development includes sinking streams (swallets) and overflow swallets, karst and overflow springs, accessible caves, and numerous sinkholes of varying size. Karst appears to be most developed in association with the Knox Group and adjacent Maynardville Limestone carbonate units. The highest density of sinkholes occurs in the Knox Group, and drilling data suggest that the largest solution cavities are associated with these formations (NNSA 2011). As shown in Figure 3-12, the density of karst features within or near Y-12 appears low.

**Soils.** Undisturbed soils within Bear Creek Valley consist of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskinghum associations. These soils are typically well- to moderately well-drained. Finer textured soils of the Armuchee-Montevallo-Hamblen association have been designated as prime farmland when drained (NNSA 2011). However, due to extensive cut-and-fill grading during the construction of Y-12, very few areas have a sequence of natural soil horizons, and developed portions of the valley are designated as urban land. Building 9225-03 is located on urban land soils within a level area, and therefore erosion potential would be low. Soils at Y-12 are generally acceptable for standard construction techniques (NNSA 2011). The TDF is located on the Salacoa silt loam with 5-12 percent slopes,



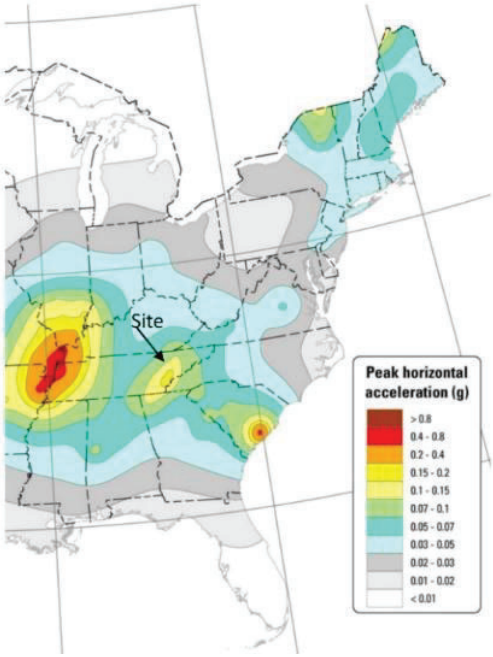

Source: ORNL 2006.

**Figure 3-12. Geology and Karst Features in Vicinity of Y-12**




Source: USGS 2018.

**Figure 3-13. 2018 National Seismic Hazard Model for the conterminous United States Peak horizontal acceleration with a 2% probability of exceedance in 50 years**




Source: USGS 2018.

**Figure 3-14. 2018 National Seismic Hazard Model for the conterminous United States Peak horizontal acceleration with a 10% probability of exceedance in 50 years**

characterized as well drained, not prone to flooding or ponding; the water table and restrictive layers are greater than 80 inches below grade (USDA 2023).

### 3.7.2 Proposed Action Effects

**Construction and Operation**. As discussed in Section 1.3, Building 9225-03 is a relatively new building at Y-12, having been commissioned in 2004. NNSA would repurpose Building 9225-03 at Y-12 as a long-term MMF. Repurposing Building 9225-03 would consist of internal building modifications, utility upgrades, installation of equipment, and a 3,000 square feet expansion of the building to accommodate utilities and additional capacity equipment.

Repurposing Building 9225-03 would cause minor effects to the existing geologic and soil conditions at the site. Beneath the existing partially paved area adjacent to Building 9225-03, the near surface geologic conditions and existing soil column would be disturbed by construction for utility upgrades and the building expansion. However, construction activity would occur on previously disturbed land, which was graded and compacted and paved during the original construction of Building 9225-03 in 2004. Grading, excavation, and other site development activities associated with Building 9225-03 would occur within a previously disturbed parcel, and less than 1 acre of previously disturbed land would be re-disturbed. Grading would temporarily disturb soils beneath the existing area, and site contours would be permanently changed from site grading to support equipment and building foundation (for the 3,000 square feet expansion) and for stormwater management (e.g. berms and swales). Because the area to be disturbed currently is partially paved, the potential for increased soil erosion due to stormwater runoff and wind is minimal. Additionally, the site is generally level, which would reduce potential stormwater velocity and any sediment transport.

In general, potential effects from erosion at Building 9225-03 would be minimized through the implementation of Y-12's SWPPP, which includes: (1) installation and maintenance of erosion controls (e.g., straw bales, silt fence, sandbags); (2) stabilization of bare soil areas within the work area (3) cleanup and removal of construction debris and sediment accumulation; (4) management of stockpiled soils to minimize sediment transport; and (5) the implementation of a revegetation plan for areas disturbed by construction. With implementation of the above measures, effects to geology and soils during construction would be minimized.

During construction at the TDF, there would be minor changes to the exterior walls of the TDF to support equipment installation but there would be no additional land disturbance, and therefore no effects to soils and geology would occur.

For both sites, no viable geologic or soil resources would be lost from construction activities. Hazards posed by geological conditions are expected to be minor. The earthquake risk for the project area is considered moderate due to the presence of historic thrust faults (USGS 2018). There are no quaternary faults (i.e., faults less than 1.6 million years old) near the site. Although only applicable to Building 9225-03, DOE policy is to design, construct, and operate its facilities so that workers, the general public, and the environment are protected from the effects of natural phenomena hazards (including seismic events) in accordance with applicable DOE orders and

standards, including DOE Order 420.1C (Facility Safety), and DOE-STD-1020-2016 (Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities).

Due to the mixture of soil types (i.e. range in soil grain-size) and shallow depth to bedrock the subsurface conditions are not susceptible to liquefaction from a seismic event. Other potential hazards such as subsidence from karst and landslides are low risk. Surface karst features were not discovered in the vicinity of the sites. Landslide risk is low because the sites are flat or gently sloping. Once construction is complete, areas used for laydown would be restored to pre-construction conditions. Although erosion from stormwater runoff and wind action would occur occasionally during operation in the areas around Building 9225-03, it is anticipated to be minimal.

### 3.7.3 No-Action Alternative Effects

Under the No-Action Alternative, NNSA would not perform materials manufacturing at either Building 9225-03 or the TDF, and there would be no effects to geology and soils.

## 3.8 Biological Resources

### 3.8.1 Affected Environment

This section describes the biological resources within the ORR (which includes Y-12) and the TDF and the surrounding area. This section is intended to provide a baseline characterization of the ecology prior to any disturbances associated with the Proposed Action and the No-Action Alternative.

**Vegetation and Habitat.** The project area is situated in the Great Valley of East Tennessee between the Cumberland and Great Smoky Mountains (DOE 2022). At approximately 35,000 acres, the ORR is the largest contiguous and protected land ownership in the southern Valley and Ridge Physiographic Province of East Tennessee. The ORR contains approximately 25,000 acres of forestland. The ORR's natural resources are managed for DOE by the ORNL Natural Resources Management Program.

More than 1,100 vascular plant species have been identified at the ORR (Mann et al. 1996). Of the 168 non-native plant species on the ORR, 54 are considered severe or significant threats to natural areas or the ORR mission. The Invasive Plant Management Plan for the ORR addresses the effects of invasive plants on facility operations and natural areas (ORNL 2017). The overall goals of wildlife management on the ORR are directed toward preserving populations and habitat, maintaining and enhancing biodiversity, integrating multiple use objectives, and minimizing wildlife damage to property and public safety (ORNL 2007).

Y-12 occupies a highly-industrialized area of 811 acres in the east end of Bear Creek Valley between Pine Ridge to the north and Chestnut Ridge to the south. Approximately 600 acres are presently enclosed by a perimeter fence. Within the Y-12 fenced boundary, there are no wetlands and limited forested areas. 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. Grass and unvegetated areas surround the entire facility for security purposes. The eastern portion of Y-12 is occupied by Lake Reality and the former New Hope Pond (now closed),

maintenance facilities, office space, training facilities, change houses, and former ORNL Biology Division facilities. The far western portion consists primarily of waste management facilities and construction contractor support areas. The central and west-central portions encompass the high-security portion, which supports the core NNSA missions.

Building 9225-03 is approximately 6,000 square feet in size and is sited in the central portion of Y-12 (*see* Figure 1-2). No operations are currently conducted in Building 9225-03. The site is an industrialized and developed area of the Y-12 Complex.

The TDF is located offsite and to the north of the ORR, less than one mile from the ORR boundary in an industrial area (*see* Figure 1-2). The existing facility is 51,000 square-feet in size. Vegetation adjacent to the TDF site is consistent with vegetation types in the ORR and consists of areas of mixed pine-hardwood forests, second-growth loblolly pine forests. The TDF is not within a designated natural area classified primarily on the basis of the presence of listed species.

**Wildlife.** The eastern deciduous hardwood forest on the ORR provides habitat for numerous wildlife species. The diversity of wildlife species ranges from common species found in urban and suburban environments to more specialized species such as interior forest bird species. Birds, fish, reptiles and amphibians, and aquatic invertebrates are the most thoroughly surveys animal groups on ORR. The ORR hosts more than 70 species of fish; about 71 species of reptiles and amphibians (68 species confirmed); 232 species of migratory, transient, and resident birds; and 49 species of mammals, as well as many invertebrate species (NERP 2020, DOE 2022). In addition, the Bald Eagle may also be present and is protected under both the *Migratory Bird Treaty Act* and the *Bald and Golden Eagle Protection Act* (USFWS 2021).

While the ORR provides habitat for several species, there is limited natural habitat available to support wildlife on the Y-12 Complex. Building 9225-03 is in an industrialized and developed area of the Y-12 Complex with limited vegetation or natural habitat for species.

The TDF is located in a developed and industrial area. The TDF is not within a designated natural area classified primarily on the basis of the presence of listed species. The area adjacent to the TDF site consists of areas of mixed pine-hardwood forests, second-growth loblolly pine forests. Wildlife species consists of common species found in urban and suburban environments.

**Threatened, Endangered, or Sensitive Species.** Federally listed species are protected under the *Endangered Species Act of 1973* (16 U.S.C. 1531-1534). Species listed in the State of Tennessee are protected under the *Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act of 1974* (TCA § 70-8-101 – 112) and the *Rare Plant Protection and Conservation Act of 1985* (TCA §§70-8-301 – 314).

State and federally listed species of concern known to have occurred on the ORR are listed in Table 3-10. Some of these species, such as the hellbender (*Crytobranchus alleganiensis*), have been seen only once or a few times; others, including the wood thrush (*Hylocichla mustelina*), are comparatively common and widespread on the ORR. The only federally listed animal species observed on the ORR in recent years are mammals. Of particular interest is the potential presence of forest-dwelling bats that may inhabit developed areas during significant portions of the year.

Two of the federally listed bat species, Indiana bat (*Myotis sodalist*) and northern long-eared bat (*Myotis septentrionalis*) roost in trees. The other federally listed bat species, the gray bat (*Myotis grisescens*), may use the area as foraging habitat. Additionally, two state listed bat species, little brown bat (*Myotis lucifugus*) and tricolored bat (*Perimyotis subflavus*), may roost in trees to some extent and forage throughout the area. Both species are under federal review for listing. Any trees, either dead or alive, with exfoliating bark, cracks or crevices can provide potential roosting habitat.

**Table 3-10. Threatened, Endangered, or Sensitive Animal Species with Potential to Occur within the Y-12 Complex**

| Scientific name | Common Name | Status[a] | | |
|---|---|---|---|---|
| | | Federal | State | PIF |
| **Fish** | | | | |
| *Phoxinus tennesseensis* | Tennessee dace | | NM | |
| **Amphibians and Reptiles** | | | | |
| *Crytobranchus alleganiensis* | Hellbender | | T | |
| *Hemidactylium scutatum* | Four-toed salamander | | NM | |
| **Birds** | | | | |
| *Branta canadensis* | Canada goose | BMC, OB | | |
| *Aix sponsa* | Wood duck | BMC | | |
| *Aix strepera* | Gadwall | BMC | | |
| *Anas americana* | American wigeon | BMC | | |
| *Anas rubripes* | American black duck | BMC | | RC |
| *Anas platyrhynchos* | Mallard | BMC | | |
| *Anas discors* | Blue-winged teal | BMC | | |
| *Anas crecca* | Green-winged teal | BMC | | |
| *Anal clypeata* | Northern shovler | BMC | | |
| *Anas acuta* | Northern pintail | BMC | | |
| *Aythya valisineria* | Canvasback | BMC | | |
| *Aythya americana* | Redhead | BMC | | |
| *Aythya collaris* | Ring-necked duck | BMC | | |
| *Aythya affinis* | Lesser scaup | BMC | | |
| *Podilymbus Podiceps* | Pied-billed grebe | BMC | | |
| *Phalacrocorax auratus* | Double-crested cormorant | BMC | | |
| *Ixobrychus exilis* | Least bittern | | NM | |
| *Egretta caerulea* | Little blue heron | | NM | |
| *Nycticorax* | Black-crowned night heron | | NM | |
| *Butorides virescens* | Green heron | | | CBSD |
| *Mycteria americana* | Wood stork | T | | |
| *Haliaeetus leucocephalus* | Bald eagle | BMC | | |
| *Chordeiles minor* | Common nighthawk | BCC | | CBSD |
| *Rallus limicola* | Virginia rail | BMC | | |
| *Porzana Carolina* | Sora | BMC | | |
| *Fulica americana* | American coot | BMC | | |
| *Tringa solitaria* | Solitary sandpiper | BMC, BCC | | |
| *Tringa flavipes* | Lesser yellowlegs | BMC, BCC | | |
| *Scolopax minor* | American woodcock | BMC | | RC |
| *Colinus virginianus* | Northern bobwhite | | | CBSD |
| *Zenaida macroura* | Mourning dove | BMC | | |

| Scientific name | Common Name | Status[a] | | |
|---|---|---|---|---|
| | | Federal | State | PIF |
| *Coccyzus americaus* | Yellow-billed cuckoo | T | | CBSD |
| *Caprimulgus carolinensis* | Chuck-will's-widow | BMC, BCC | | CBSD |
| *Caprimulgus vociferus* | Eastern whip-poor-will | BMC, BCC | | RC |
| *Chordeiles minor* | Common nighthawk | BCC | | CBSD |
| *Chaetura pelagica* | Chimney swift | BCC | | RC |
| *Megaceryle alcyon* | Belted kingfisher | BCC | | RC |
| *Melanerpes erythrocephalus* | Red-headed woodpecker | BMC, BCC | | RC |
| *Colaptes auratus* | Northern flicker | MC | | RC |
| *Contopus virens* | Eastern wood-pewee | | | RC |
| *Empidonax virescens* | Acadian flycatcher | | | RC |
| *Contopus cooperi* | Olive-sided flycatcher | BMC, BCC | | |
| *Empidonax trailii* | Willow flycatcher | BMC | | |
| *Progne subis* | Purple martin | | | RC |
| *Hirundo rustica* | Barn swallow | | | RC |
| *Hylocichla mustelina* | Wood thrush | BMC, BCC | NM | RC |
| *Lanius ludovicianus* | Loggerhead shrike | BMC, BCC | NM | |
| *Vermivora chrysoptera* | Golden-winged warbler | BMC, BCC | T | RC |
| *Setophaga cerulea* | Cerulean warbler | BMC, BCC | NM | RC |
| *Setophaga discolor* | Prairie warbler | BMC, BCC | | RC |
| *Mniotilta varia* | Black-and-white warbler | | | RC |
| *Protonotaria citrea* | Prothonotary warbler | BMC, BCC | | RC |
| *Geothlypis formosa* | Kentucky warbler | BMC, BCC | | RC |
| *Cardellina canadensis* | Canada warbler | BMC, BCC | | RC |
| *Icteria virens* | Yellow-breasted chat | BCC | | RC |
| *Piranga rubra* | Summer tanager | BMC | | RC |
| *Pipilo erythrophthalmus* | Eastern towhee | | | RC |
| *Spizella pusilla* | Field sparrow | BMC, BCC | | CBSD |
| *Ammodramus savannarum* | Grasshopper sparrow | BMC, BCC | | CBSD |
| *Ammodramus henslowii* | Henslow's sparrow | BMC, TCC | T | RC |
| *Melospiza Georgiana* | Swamp sparrow | | | RC |
| *Spinus tristis* | American goldfinch | | | RC |
| **Bats** | | | | |
| *Myotis grisescens* | Gray bat | E | E | |
| *Myotis lucifugus* | Little brown bat | | T | |
| *Myotis sodalist* | Indiana bat | | E | |
| *Myotis septentrionalis* | Northern long-eared bat | | T | |
| *Myotis leibii* | Eastern small-footed bat | | NM | |
| *Perimyotis subflavus* | Tri-colored bat | | T | |
| *Corynorhinus rafinesquii* | Rafinesque's Big-eared bat | | NM | |
| *Sorex dispar* | Long-tailed shrew | | NM | |

E=Endangered; T=Threatened; BMC=Birds of management concern; BCC=Birds of conservation concern; NM=in need of management; OB=Overly Abundant; RC = Regional Concern; CBSD=Common Bird in Steep Decline
Source: DOE 2022.

Aquatic resources on the ORR include perennial streams, wet weather conveyance (potential streams that will require hydrologic determination), and seeps/springs (see Section 3.6). All streams contain contemporary observations of the state listed species In Need of Management

Tennessee dace (*Chrosomus tennesseensis*), which represents an ORNL Focal Species for management and ongoing research. The ORNL Natural Resources Program also expects that the wetlands within the western portion of the ORR support the state-listed species In Need of Management, four-toed salamander (*Hemidactylium scutatum* – also an ORNL focal species). Importantly, the Tennessee dace and both state-listed salamanders rely on ephemeral (in addition to perennial) aquatic resources as core habitat during important life history events.

Four plant species known to be on the ORR (spreading false foxglove, Appalachian bugbane, tall larkspur, and butternut) have been under review for listing at the federal level and were previously listed under the C2 candidate designation. The USFWS now informally refers to these as special concern species. The State of Tennessee lists 16 plant species potentially occurring on the ORR as endangered, threatened, or of special concern. An additional 10 threatened, endangered, or special concern species occur in the area and may be present on the ORR, although currently unconfirmed (DOE 2022). Vascular plant species are included in Table 3-11.

**Table 3-11. Threatened, Endangered, or Sensitive Plant Species with Potential to Occur within the Y-12 Complex**

| Scientific name | Common Name | Habitat on the ORR | Status | |
|---|---|---|---|---|
| | | | Federal | State |
| *Aureolaria patula* | Spreading false foxglove | River bluff | SC | SC |
| *Berberis canadensis* | American barberry | Rocky bluff | | SC |
| *Bolboschoenus fluviatilis* | River bulrush | Wetland | | SC |
| *Delphinium exaltatum* | Tall larkspur | Barrens and woodlands | | E |
| *Diervilla lonicera* | Northern bush-honeysuckle | Rocky river bluff | | T |
| *Draba ramosissima* | Branching whitlow-grass | Limestone cliff | | SC |
| *Elodea nuttallii* | Nuttall waterweed | Pond, embayment | | SC |
| *Eupatorium godfreyanum* | Godfrey's thoroughwort | Dry woods edge | | SC |
| *Fothergilla major* | Mountain witch-alder | Woods | | T |
| *Helianthus occidentalis* | Naked-stem sunflower | Barrens | | SC |
| *Juglans cinereal* | Butternut | Lake shore | | T |
| *Juncus brachycephalus* | Small-head rush | Open wetland | | SC |
| *Liparis loeselii* | Fen orchid | Forested wetland | | T |
| *Panax quinquifolius* | American ginseng | Rich woods | | SC, CE |
| *Platanthera flava var. herbiola* | Tuberculed rein-orchid | Forested wetland | | T |
| *Spiranthes lucida* | Shining ladies'-tresses | Boggy wetland | | T |
| *Agalinis auriculata* | Earleaf false foxglove | Calcareous barren | | E |
| *Allium burdickii* | Narrow-leaf Ramps | Moist woods | | T, CE |
| *Allium tricoccom* | Ramps | Moist woods | | SC, CE |
| *Lathyrus palustris* | Marsh pea | Moist meadows | | SC |
| *Liatris cylindracea* | Slender blazing star | Calcareous barren | | T |

SC = concern; E=Endangered; T=Threatened; CE = critically endangered.
Source: DOE 2022.

Federally listed plant and animal species are considered unlikely within Y-12. No critical habitat for threatened or endangered species, as defined in the *Endangered Species Act,* exists on the ORR or Y-12.

The USFWS Information for Planning and Consultation (IPaC) online system was accessed to request an *Official Species List* to identify species protected under Sect. 7(c) of the ESA that could occur within the TDF. IPaC identified 10 endangered species and 9 migratory birds with the potential to occur in the vicinity of the TDF. Endangered species included four mammals, one bird, one fish, two clams, one snail, and one insect (USFWS 2023). Species identified by IPaC are included in Table 3-12. Two of the federally listed bat species, Indiana bat (*Myotis sodalist*) and northern long-eared bat (*Myotis septentrionalis*) occurs within mixed pine-hardwood forests and second-growth loblolly pine forest. No critical habitat for threatened or endangered species, as defined in the *Endangered Species Act,* exists on or near the TDF.

**Table 3-12. Threatened, Endangered, or Sensitive Animal Species with Potential to Occur in the Vicinity of the TDF**

| Scientific name | Common Name | Federal Status |
|---|---|---|
| *Myotis grisescens* | Gray bat | E |
| *Myotis sodalist* | Indiana bat | |
| *Myotis septentrionalis* | Northern long-eared bat | |
| *Perimyotis subflavus* | Tri-colored bat | |
| *Grus americana* | Whooping crane | EXPN |
| *Erimonax monachus* | Spotfin chub | T |
| *Fusconaia cunelous* | Finerayed pigtoe | E |
| *Fusconaia cor* | Shiny pigtoe | E |
| *Athearnia anthonyi* | Anthony's riversnail | EXPN |
| *Danaus plexippus* | Monarch butterfly | C |

C=Candidate; E=Endangered; T=Threatened; EXPN=Experimental population, Non-essential
Source: USFWS 2021.

## 3.8.2 Proposed Action Effects

Potential effects to biological resources are evaluated based on the degree to which various habitats or species could be affected by the Proposed Action and No-Action Alternative. Effects to wildlife are evaluated in terms of disturbance, displacement, or loss of wildlife.

**Construction.** Under the Proposed Action, Building 9225-03 would be repurposed with internal modification, utility upgrades, installation of equipment, and a 3,000 square feet expansion to accommodate utilities and additional capacity equipment. Exterior modifications would include installation of a roll-up door, foundation improvements, and installation of concrete slabs. Less than 1 acre of previously disturbed land could be re-disturbed. A backup diesel generator would be installed alongside the facility in previously disturbed areas. There would be some disturbance to terrestrial biotic resources due to expansion of the building and site access by construction vehicles. Some dislocation of small urban type species (i.e., rodents) could be expected. Large animals would be largely excluded from controlled areas. Because the area on which Building 9225-05 would be constructed is developed and paved, there would be minimal terrestrial biotic effects.

Construction activities at the TDF would consist of internal modifications including the installation of government-furnished equipment and utility upgrades. A backup diesel generator would be

installed alongside the facility in previously disturbed areas. With the exception of those actions, there would be no change to the constructed footprint, exterior wall structure, or outside appearance of the building; therefore, there would be minimal terrestrial biotic effects. Because there would be no notable exterior construction, effects to threatened and endangered or special status species would be minimal.

**Operation.** Effects to biological resources to support the materials manufacturing operations would be similar to currently observed industrial operations within ORR. The Biological Monitoring and Abatement Program (BMAP), which monitors the health of East Fork Poplar Creek, would continue and would be used to ascertain any effects from materials manufacturing operations on local biota. Effects to biological resources at the TDF would be similar to currently observed industrial operations within the surrounding area. Monitoring to assure that there are no negative effects to threatened and endangered or special status species would occur at Y-12 and the TDF.

### 3.8.3 No-Action Alternative Effects

Under the No-Action Alternative, NNSA would not perform materials manufacturing at either the TDF or Building 9225-03 and facilities would not be upgraded or repurposed. Biological resources would remain unchanged when compared to existing conditions.

## 3.9 Cultural Resources

Cultural resources are physical manifestations of culture, specifically archaeological sites, architectural properties, ethnographic resources, and other historical resources relating to human activities, society, and cultural institutions that define communities and link them to their surroundings. They include expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, buildings, structures, objects, and districts. The National Register of Historic Places (NRHP) is a listing maintained by the National Park Service which consists of prehistoric, historic, and ethnographic buildings, structures, sites, districts, and objects that are considered significant at a national, state, or local level. Cultural resources listed on the NRHP, or determined eligible for listing, have been documented and evaluated according to uniform standards, found in 36 CFR 60.4, and, regardless of age, are called *historic properties*.

### 3.9.1 Affected Environment

**Regulatory Setting.** Several federal laws, regulations, and EOs addressing cultural resources and federal responsibilities regarding them are applicable to the ORR. Foremost among these statutory provisions, and most relevant to the current analysis, is the *National Historic Preservation Act* (NHPA) (54 U.S.C. 300101 et seq.). Section 106 of the NHPA and its implementing regulations at 36 CFR Part 800 require federal agencies to take into account the effects of their undertakings on historic properties and to consult to find ways to avoid, minimize, or mitigate any adverse effects. As part of the Section 106 process, agencies are required to consult with the SHPO when actions may affect historic properties. The Tennessee Historical Commission (THC) serves as the SHPO.

**Cultural Resource Management at Y-12.** The *Cultural Resource Management Plan, DOE Oak Ridge Reservation, Anderson and Roane Counties* (DOE 2001) addresses DOE compliance with cultural resource statutes, ensures that cultural resources are addressed early in the planning process of proposed undertakings, and ensures needed protection is provided or appropriate documentation is prepared before an undertaking is initiated. Two site-wide Programmatic Agreements (PAs) among the DOE, SHPO, and the President's Advisory Council on Historic Preservation were executed for the ORNL and Y-12 (DOE 2022). In addition, to better fulfill the requirements of the NHPA, DOE developed a historic preservation plan (HPP) for each site. These HPPs ensure compliance with Section 106 of the NHPA and provides for more efficient and effective review of DOE undertakings having the potential to effect historic properties. The PAs and HPPs provide for the systematic management of all archeological and historic resources at the sites under these documents. The Cultural Resource Management program ensures compliance with all applicable state and federal requirements. During the latest review of the HPP, it was determined that the HPP and PA require updating to accurately reflect the changes at Y-12 since 2003. Y-12 is continuing the completion of an updated Cultural Resources Survey which will evaluate DOE-owned Y-12 facilities constructed through 1992 to determine their eligibility for the NRHP and inclusion within the redrawn boundaries of the Y-12 Historic District (DOE 2022).

**Cultural Resources at the ORR and Y-12.** The ORR had 168 facilities that were eligible for inclusion on the NRHP. The ORR contains more than 44 known prehistoric sites (primarily burial mounds and archaeological evidence of former structures), more than 254 historic pre-World War II structures, 32 cemeteries, and several historically significant structures from the Manhattan Project era. Seven historic ORR properties are currently listed individually in the NRHP (DOE 2022). The Manhattan Project National Historical Park commemorates the history of the Manhattan Project and protects many structures associated with the Manhattan Project. The park includes facilities located on the ORR including the X-10 Graphite Reactor at ORNL; Buildings 9731 and 9204-3 at Y-12; and the K-25 Building Site at the ETTP.

Y-12 currently has a proposed National Register Historic District (Figure 3-15) of historic buildings associated with the Manhattan Project that are eligible for listing in the NRHP (NNSA 2011). The district and its contributing properties are eligible under Criterion A for its historical associations with the Manhattan Project, development as a nuclear weapons component plant within the post-World War II scientific movement, and early nuclear activities. The historic district is also eligible under Criterion C for the engineering merits of many of the properties and their contributions to science (NNSA 2011). Within the proposed district, buildings 9731 and 9204-3 are part of the Manhattan Project National Historical Park. At present, neither is available for regular public access. Limited public access to both facilities occurred in 2015, when DOE facilitated public tours of both buildings to celebrate the establishment of the park (DOE 2022).

**Cultural Resources at the TDF.** The survey of historic resources is ongoing by the THC. According to THC's Historical Architectural Survey GIS System, no archaeological sites or historic resources were identified within the vicinity of the TDF (THC 2023).


**Figure 3-15. Y-12 Proposed Historic District**

### 3.9.2 Proposed Action Effects

Potential effects to cultural resources are assessed by applying the criteria of adverse effect as defined in 36 CFR Part 800.5[a]. An adverse effect is found when an action may alter the characteristics of a historic property that qualifies it for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, workmanship, feeling, or association.

**Construction.** Construction-related activities and ground disturbance conducted for repurposing Building 9225-03 and related utilities would occur on previously disturbed lands. To ensure construction activities would not have an adverse effect on facilities within the Y-12 Historic District, exterior modifications would be designed to be compatible with existing historic properties. Unanticipated discoveries of archaeological materials during construction would be evaluated and, if needed, mitigated in accordance with the PAs. Therefore, no notable effects to archaeological resources are anticipated.

Construction activities at the TDF would consist of internal modifications including the installation of government-furnished equipment and utility upgrades. There would be no notable change to

the constructed footprint, exterior wall structure, or outside appearance of the building; therefore there would be no effects to cultural resources. Unanticipated discoveries of archaeological materials during construction, although unlikely to occur, would be evaluated and, if needed, mitigated in accordance with the PAs. Therefore, no notable effects to archaeological resources are anticipated.

**Operation.** Operational activities are not expected to have an effect on cultural resources, as all operations under the Proposed Action would be similar to existing operations at Y-12 and to currently observed industrial operations in the vicinity of the TDF.

### 3.9.3 No-Action Alternative Effects

Under the No-Action Alternative, NNSA would not perform materials manufacturing at either the TDF or Building 9225-03 and facilities would not be upgraded or repurposed. There would be no effects to cultural resources under this alternative.

## 3.10 Socioeconomic Resources and Environmental Justice

This section discusses the existing socioeconomic resources and environmental justice conditions within Building 9225-05 and the TDF ROI and the effects associated with the Proposed Action and No-Action Alternative.

### 3.10.1 Affected Environment

**Socioeconomic Resources.** Socioeconomics considers the attributes of human social and economic interactions associated with the materials manufacturing process proposed construction and operations and the effects that such action may have on the ROI. The ROI is a four-county area in Tennessee comprised of Anderson, Knox, Loudon, and Roane counties where a majority of the Y-12 workforce resides. Figure 3-16 shows the location of Building 9225-03 and the TDF and surrounding counties. Socioeconomic areas of discussion include the regional and local economy, local demographics, local housing, and community services. Socioeconomic effects may be defined as the environmental consequences of a proposed action in terms of potential demographic and economic changes.

From 2010 through 2021, the labor force in the ROI increased 5.6 percent to 328,955 persons. During the same time period, employment in the ROI increased by 10.7 percent to 317,203 persons, and the number of unemployed decreased by 53.1percent. Over that same period, the unemployment rate declined from 8.0 percent to 3.6 percent. Tennessee experienced similar trends in unemployment rates, decreasing from 9.8 percent to 4.5 percent in 2019 (BLS 2023). Table 3-13 presents the employment profile in the ROI and Tennessee for 2010 and 2021.

Building 9225-03 and the TDF are located in Anderson County. Anderson County had a per capita personal income of $50,901 and ranked 17th in the state in 2021. In 2011, the per capita was $36,390. The 2011-2021 compound annual growth rate of the per capita personal income reflected was 3.4 (BEA 2023a). The median family income in Anderson County was $70,785 in 2021 (USCB 2021a). Anderson County had a total of 1,573 business establishments in 2021, with a combined annual payroll of over 3 billion (USCB 2022).

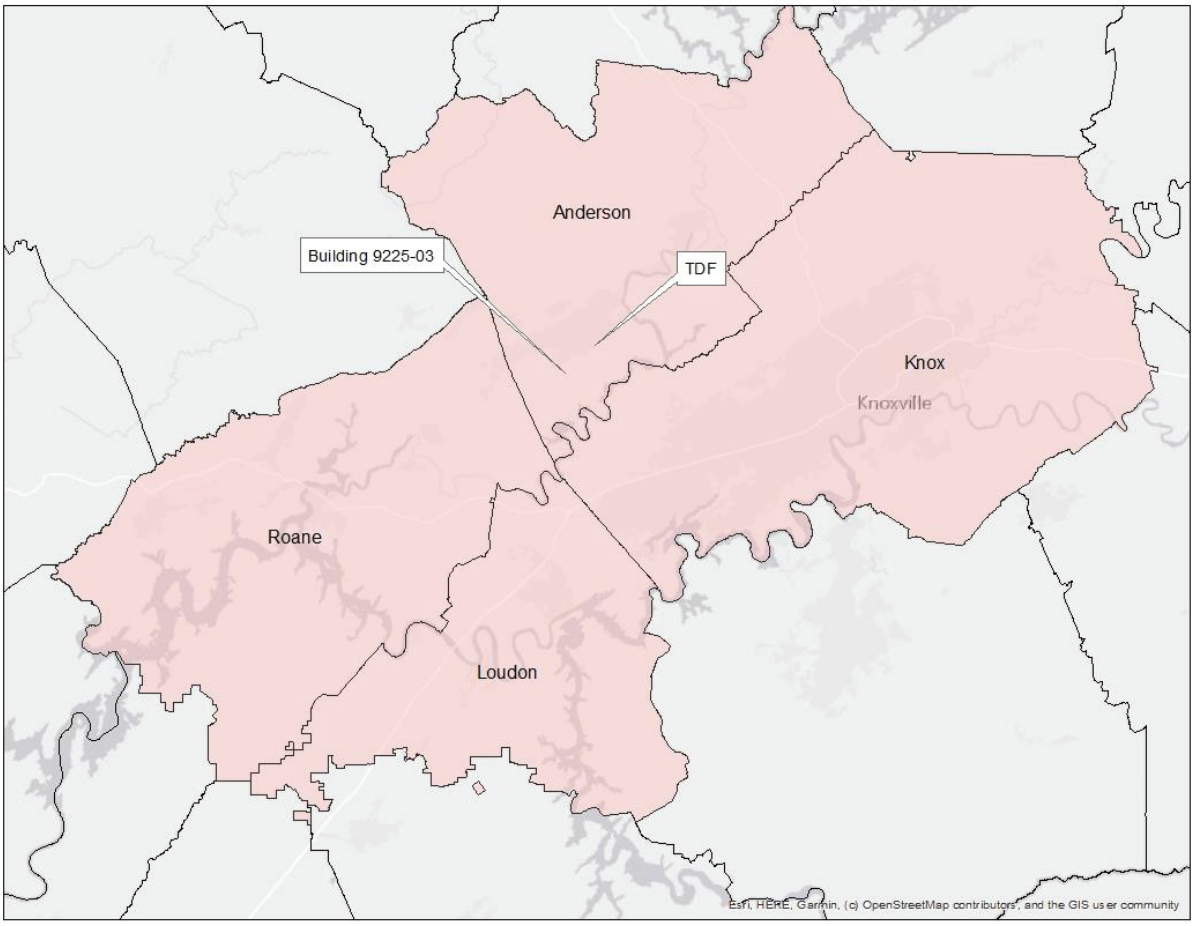



**Figure 3-16. Location of Building 9225-03, TDF, and Region of Influence**

**Table 3-13. ROI Employment Profile**

| Area | Labor Force | | Employed | | Unemployed | | Percent Unemployed | |
|---|---|---|---|---|---|---|---|---|
| | 2010 | 2021 | 2010 | 2021 | 2010 | 2021 | 2010 | 2021 |
| Anderson | 34,950 | 34,770 | 31,642 | 33,362 | 3,308 | 1,408 | 9.5% | 4.0% |
| Knox | 229,895 | 246,907 | 212,529 | 238,402 | 17,366 | 8,505 | 7.6% | 3.4% |
| Loudon | 22,372 | 23,933 | 20,259 | 23,070 | 2,113 | 863 | 9.4% | 3.6% |
| Roane | 24,340 | 23,345 | 22,065 | 22,369 | 2,275 | 976 | 9.3% | 4.2% |
| ROI | 311,557 | 328,955 | 286,495 | 317,203 | 25,062 | 11,752 | 8.0% | 3.6% |
| Tennessee | 3,093,118 | 3,323,545 | 2,789,056 | 3,174,135 | 304,062 | 149,410 | 9.8% | 4.5% |

Source: BLS 2023.

Major employment sectors in the ROI and Tennessee are presented in Figure 3-17. In Anderson County, the manufacturing sector accounted for approximately 25.5 percent of the total employment in the county. Government and government enterprises accounted for approximately 9.9 percent, with professional, scientific, and technical services accounting for 9.7 percent of total employment in Anderson County (BEA 2023b). In Tennessee, government enterprises were the

largest employer, accounting for approximately 10.6 percent of total employment, followed by health care accounting for 10.3 percent and retail trade accounting for 10.0 percent of total employment (BEA 2023a).

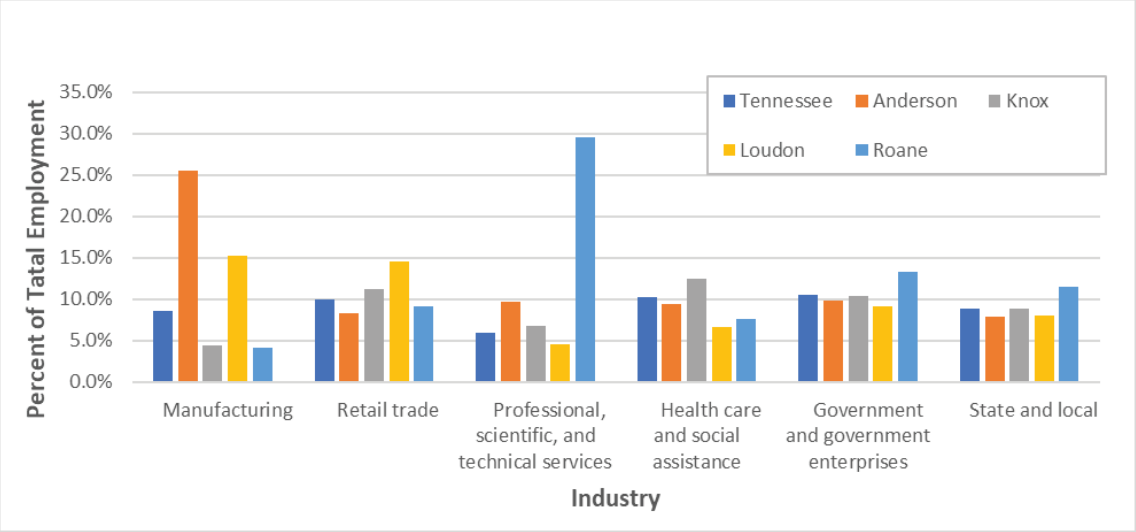



**Figure 3-17. Major Employment Sector Distribution**

In 2021, the population in the ROI was estimated to be 76,683 (USCB 2021b). From 2010 to 2021, the total population in the ROI increased 4.3 percent, which was lower than the growth rate in Tennessee (USCB 2021b). Between 2021 and 2028, the population of the ROI is projected to steadily increase. In 2028 the population in the ROI is projected to be 704,586 (Boyd Center 2022). Table 3-14 presents the historic and projected population of the ROI and Tennessee.

**Table 3-14. County and State Historic and Projected Population**

| Area | 2010 | 2015 | 2018 | 2020 | 2025 | 2028 |
|---|---|---|---|---|---|---|
| Anderson | 75,129 | 75,430 | 75,775 | 77,123 | 79,165 | 79,863 |
| Knox | 432,226 | 444,348 | 456,185 | 478,971 | 497,923 | 510,323 |
| Loudon | 48,556 | 50,229 | 51,610 | 54,886 | 58,579 | 60,507 |
| Roane | 54,181 | 53,162 | 52,897 | 53,404 | 54,003 | 53,893 |
| ROI | 610,092 | 623,169 | 636,467 | 664,384 | 689,670 | 704,586 |
| Tennessee | 6,346,105 | 6,499,615 | 6,651,089 | 6,910,840 | 7,179,307 | 7,331,859 |

Source: USCB 2010, 2015, 2020, Boyd Center 2022.

As of 2021, the ROI had 294,321 housing units of which 9.4 percent were vacant. Of the estimated 27,697 vacant units, 10,585 were estimated to be vacant rental units, or 3.6 percent of the housing stock (USCB 2021c, USCB 2021d). Temporary housing is available in the form of daily, weekly, and monthly rentals in motels, hotels, and campgrounds, and recreational vehicle parks. The demand for temporary housing in the Project area is generally greatest during the summer months when tourism is at its highest.

Community services within the ROI include public schools, hospitals, and public safety. The ROI has seven school districts with a total of 158 schools serving a student population of 86,254 during

the 2021-2022 school year (NCES 2023). There are 11 hospitals serving the ROI with the majority located in Knox County. There are 29 fire departments in the ROI made up of career and volunteer firefighters. Fire protection would likely be provided by the professionally- staffed City of Oak Ridge Fire Department. County Sheriff's Offices provide police protection services in cooperation with Tennessee Highway Patrol. In 2021, there were 1,167 total law enforcement officers (FBI 2023). The police protection service with primary responsibility would be the Oak Ridge Police Department.

**Environmental Justice.** Under EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," federal agencies are responsible for identifying and addressing the possibility of disproportionate and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands. In January 2021, EO 14008, "Tackling the Climate Crisis at Home and Abroad" was issued. The order formalizes the commitment to make environmental justice a part of the mission of federal agencies to develop programs, policies, and activities to address the disproportionate health, environmental, economic, and climate effects on disadvantaged communities and required federal agencies to "make achieving environmental justice part of their missions." In April 2023, EO 14096, "Revitalizing Our Nation's Commitment to Environmental Justice for All," was issued and builds on the initiatives of EO 12898, strengthening the role of scientific, data-based research and analysis, along with the integration of environmental considerations within administrative functions. Minority populations refer to persons of any race self-designated as Asian, Black, Native American, or Hispanic. Low-income populations refer to households with incomes below the federal poverty thresholds.

Environmental justice concerns the environmental effects that proposed actions may have on minority and low-income populations, and whether such effects are disproportionate to those on the population as a whole in the potentially affected area. The threshold used for identifying minority populations surrounding specific sites was developed consistent with CEQ guidance (CEQ 1997) for identifying minority populations using either the 50 percent threshold or another percentage deemed "meaningfully greater" than the percentage of minority individuals in the general population. CEQ guidance does not provide a numerical definition of the term "meaningfully greater." CEQ guidance was supplemented using the *Community Guide to Environmental Justice and NEPA Methods* (EJ IWG 2019) and provides guidance using "meaningfully greater" analysis.

For this analysis, meaningfully greater is defined as 20 percentage points above the population percentage in the general population. The significance thresholds for environmental justice concerns were established at the state level. The potentially affected area considered is the area within a 50-mile radius of Y-12 with a focus on the four-county ROI. The state of Tennessee was used as the reference community to determine "meaningfully greater" thresholds. Areas are assumed to contain disproportionately high percentages of minority populations if the percentage of minority persons in the area significantly exceeds the state average or if the percentage of minority population exceeds 50 percent of the population. Meaningfully greater low-income populations are identified using the same methodology described above for identification of minority populations. Table 3-15 presents the state thresholds used for the analysis.

**Table 3-15. Thresholds for Identification of Minority and Low-Income Communities (percentage)**

| Area | Minority Population | Low-Income Population |
|---|---|---|
| Tennessee | 47.1% | 34.1% |

The analysis used estimates from the U.S. Census Bureau's 2017-2021 American Community Survey 5-Year estimates to identify minority and low-income populations. There are 429 census block groups in the four-county ROI. Of the 429 census block groups, 55 exceed the thresholds for minority and/or low-income populations. Census block groups that exceed minority and/or low-income thresholds are predominantly located in the Knoxville area, approximately 15 miles from the proposed project site. The project sites are located in Anderson County. No census block groups immediately surrounding the proposed project sites exceed the thresholds for minority and/or low-income populations. Table 3-16 summarizes the demographic composition of the four-county ROI. Figures 3-18 and 3-19 show the geographic distribution of minority and low-income populations within the 50-mile radius of Y-12.

## 3.10.2 Proposed Action Effects

### 3.10.2.1 Socioeconomic Resources

**Construction.** Repurposing Building 9225-03 would require approximately 30 construction workers (at peak construction), with construction activities expected to be completed in 18 months. Initial operations would begin by 2027, with full-scale operations expected to be achieved in 2028. Repurposing the TDF would also require approximately 30 construction workers at the peak, with construction activities expected to be completed in 18 months. It is anticipated that some portion of construction materials would be purchased locally. Payroll and materials expenditures would have a positive effect on the local economy. Estimated direct construction jobs may result in additional indirect jobs providing increased local revenue. Most construction materials and temporary construction workers would most likely be drawn from the local community. As a result, permanent increases in population would not occur and housing and community services would not be permanently impacted. Because the peak construction workforce (30 persons) would be negligible compared to the projected population in the ROI, socioeconomic effects during construction, although beneficial, are expected to be negligible. The increase in economic activity would be temporary and would subside when construction is completed.

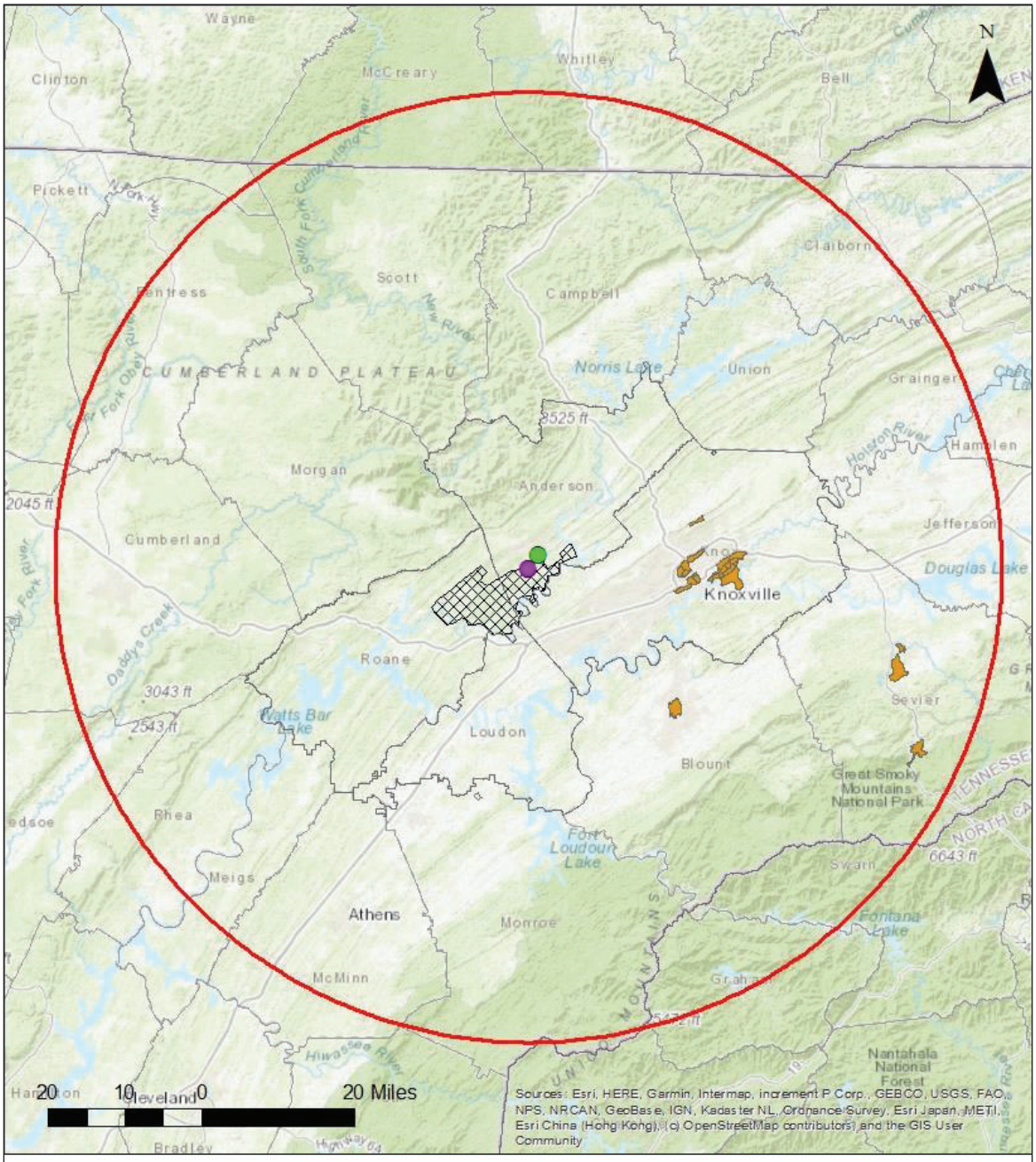
**Operation.** Future operations would have a positive effect on regional economics. Materials manufacturing operations would require up to 5 TBE workers at TDF and 10 Y-12 workers at Building 9225-03. In terms of other operational effects:

- Population. Based on the estimated number of new direct jobs and the assumption that existing workers would fill direct jobs and local workers in the ROI would fill indirect jobs, effects to population would be negligible.
- Housing. Based on the estimated number of jobs and the assumption that existing workers would fill direct jobs and local workers in the ROI would fill indirect jobs, there would be

**Table 3-16. Demographic Composition of the Four-County ROI**

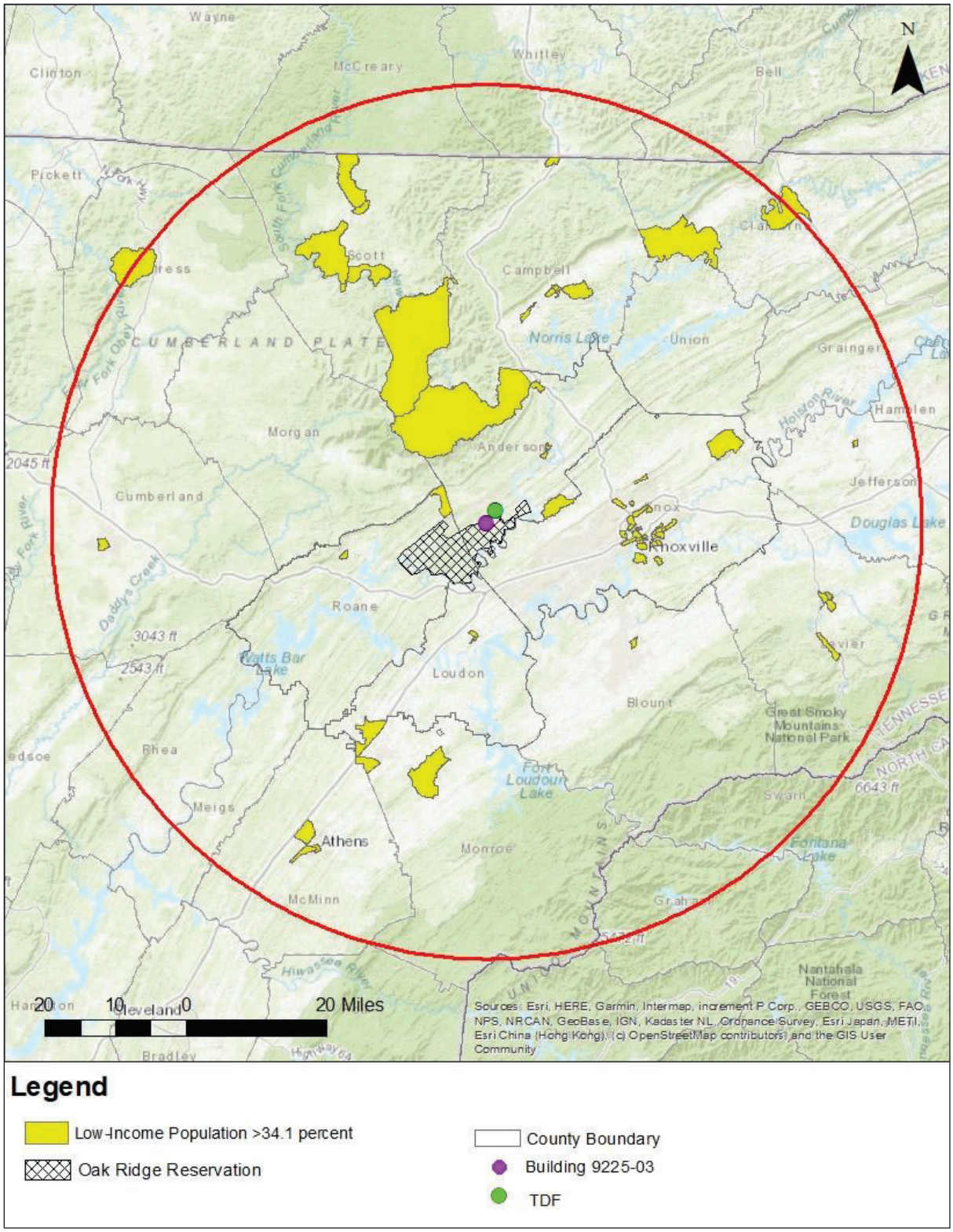
| Population Group | Anderson | | Knox | | Loudon | | Roane | | Tennessee | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Population | % of Total | Population | % of Total | Population | % of Total | Population | % of Total | Population | % of Total |
| Nonminority | 67,575 | 88.1% | 387,046 | 81.4% | 47,084 | 86.6% | 49,191 | 94.2% | 5,002,855 | 72.9% |
| Hispanic | 2,492 | 3.2% | 21,823 | 4.6% | 5,084 | 9.4% | | 0.0% | 395,967 | 5.8% |
| Black or African American | 2,395 | 3.1% | 39,875 | 8.4% | 640 | 1.2% | 1,586 | 3.0% | 1,120,548 | 16.3% |
| American Indian or Alaska Native | 215 | 0.3% | 497 | 0.1% | 42 | 0.1% | 188 | 0.4% | 10,292 | 0.2% |
| Asian | 1,069 | 1.4% | 10,741 | 2.3% | 461 | 0.8% | 385 | 0.7% | 124,495 | 1.8% |
| Pacific Islander | 57 | 0.1% | 233 | 0.0% | 0 | 0.0% | 19 | 0.0% | 3,518 | 0.1% |
| Other Race | 323 | 0.4% | 1,614 | 0.3% | 223 | 0.4% | 52 | 0.1% | 19,258 | 0.3% |
| Two or More Races | 2,557 | 3.3% | 13,457 | 2.8% | 815 | 1.5% | 785 | 1.5% | 182,564 | 2.7% |
| **Total Minority** | 9,108 | 11.9% | 88,240 | 18.6% | 7,265 | 13.4% | 3,015 | 5.8% | 1,856,642 | 27.1% |
| **Total Population** | 76,683 | 100.0% | 475,286 | 100.0% | 54,349 | 100.0% | 52,206 | 100.0% | 6,859,497 | 100.0% |
| **% Below Poverty Level** | 15.7% | | 12.8% | | 12.0% | | 14.7% | | 14.1% | |

Source: USCB 2021b, USCB 2021e.




Source: USCB 2021b.

**Figure 3-18. Minority Populations within a 50-Mile Radius of the Proposed Facilities**




Source: USCB 2021e

**Figure 3-19. Low-income Populations within a 50-Mile Radius of the Proposed Facilities**

no need for additional housing. Local personnel would not require temporary housing and, thus, would have neither adverse nor beneficial effects on temporary housing. If there was a need for temporary housing, the current market would be able to meet that need.

- Community Services. Based on the number of estimated jobs created and the assumption that existing workers would fill direct jobs and local workers in the ROI would fill indirect jobs, there would be minimal effect on public schools, law enforcement, or firefighting capabilities.

#### 3.10.2.2 Environmental Justice

**Construction and Operation**. Environmental effects from most projects tend to be highly concentrated at the actual project site and tend to decrease as distance from the project site is increased. There are 55 census block group that meet the definition of minority and/or low-income populations. During construction and operation related activities, it is anticipated that environmental and health effects would be minimal, temporary, and confined to the Y-12 Complex and the TDF area (*see* Section 3.11). Based on the effects analysis for resource areas, no notable adverse effects are expected from construction and materials manufacturing operations at the Y-12 Complex or the TDF. For effects that would occur, it is expected that effects would affect all populations in the area equally. There would be no discernable adverse effects to any populations, land uses, visual resources, noise, water, air quality, geology and soils, biological resources, socioeconomic resources, or cultural resources.

NNSA acknowledges the existence of low-income and minority populations in the Scarboro and Woodland communities (which are approximately 1.3 miles north of the Y-12 Complex). However, it is anticipated that any effects would be small to the Scarboro and Woodland communities, as well as to all other members of the population; consequently, there would be no disproportionate and adverse human health effects on minority populations and low-income populations from the Proposed Action.

### 3.10.3 No-Action Alternative Effects

Under the No-Action Alternative, NNSA would not perform materials manufacturing at either the TDF or Building 9225-03 and facilities would not be upgraded or repurposed. There would be no additional socioeconomic or environmental justice effects.

## 3.11 Health and Safety, Accidents, and Intentional Destructive Acts

### 3.11.1 Affected Environment

The Proposed Action would not utilize hazardous chemicals or radiological materials. Consequently, the discussions related to human health and potential accident effects are focused on occupational injuries/risks to the construction and operating workforce. During the 18 month construction period at either TDF or Building 9225-03, the construction workforce is expected to be a maximum of approximately 30 personnel. Once operational, there would be approximately 5 workers at the TDF and 10 workers at Building 9225-03. With regard to the public, the analysis focuses on whether materials manufacturing operations could cause offsite adverse health effects.

### 3.11.2 Proposed Action Effects

**Construction**. Potential effects to workers were evaluated using Bureau of Labor Statistics (BLS) occupational injury/illness and fatality rates. The potential risk of occupational injuries/illnesses and fatalities to workers involved in construction activities at the TDF or Building 9225-03 are assumed to be represented by injury/illness and fatality rates for general industrial construction.[9] Table 3-17 lists the potential estimates of injuries/illnesses and fatalities estimated for construction. Over the construction period, a total of 2.8 days of lost work from illness/injury and zero (0.01) fatalities would be expected from construction activities at both the TDF and Building 9225-03.

**Table 3-17. Occupational Injury/Illness and Fatality Estimates for Construction**

| Injury, Illness, and Fatality Categories | TDF | Building 9225-03 | Total |
|---|---|---|---|
| **Total Construction (18 months)** | | | |
| Total construction worker-years | 45[a] | 45[a] | 90 |
| Lost days due to injury/illness | 1.4 | 1.4 | 2.8 |
| Number of fatalities | 0.005 | 0.005 | 0.01 |

a. Conservatively assumes the peak construction workforce of 30 workers lasts the entire 18-month construction period.
Sources: CNS 2023a, BLS 2023.

**Operation**. Occupational effects would involve approximately 5 personnel at the TDF and 10 personnel at Building 9225-03. The potential risk of occupational injuries/illnesses and fatalities to workers during operations would be expected to be similar to the general injury and fatality rates for manufacturing. Table 3-18 presents the potential estimates of injuries/illnesses and fatalities for the average year of operations at both the TDF and Building 9225-03. In an average year, a total of one (0.6) day of lost work from illness/injury and zero (0.0003) fatalities would be expected from concurrent operations at the TDF and Building 9225-03.

**Table 3-18. Occupational Injury/Illness and Fatality Estimates for Operations**

| Injury, Illness, and Fatality Categories | TDF | Building 9225-03 | Total |
|---|---|---|---|
| Operational workforce (persons) | 5 | 10 | 15 |
| Lost days due to injury/illness | 0.2 | 0.4 | 0.6 |
| Number of fatalities | 0.0001 | 0.0002 | 0.0003 |

a. Results reflect average annual effects.
Sources: CNS 2023a, BLS 2023.

With regard to construction at Building 9225-03, work control processes would be implemented utilizing Integrated Safety Management Systems (ISMS) in accordance with DOE Policy 450.4, *Safety Management System Policy*. The core functions of ISMS include defining the scope of work, analyzing the hazards and risks, developing and implementing hazard controls, performing work within controls and providing feedback and continuous improvement. DOE's Worker Safety and Health Program, 10 CFR Part 851, regulates the health and safety of workers at all NNSA

[9] For Building 9225-03 construction activities, which would be performed by NNSA's management and operating contractor with NNSA oversight, this assumption is considered conservative because NNSA/NNSA contractor values are historically lower than BLS values due to the increased focus on safety fostered by integrated safety management and the voluntary protection program. Because TDF construction would be performed by TBE, the BLS values are considered representative.

sites. This comprehensive standard directs NNSA contractors to establish the framework for an effective worker protection program that will reduce or prevent injuries, illnesses, and accidental losses by providing NNSA federal and contractor workers with a safe workplace.

***Accidents.*** Because there would be no hazardous chemicals or radiological materials utilized during materials manufacturing, NNSA did not identify any potential hazards to the public that would require preparation of a detailed accident analysis. The materials that would be used for manufacturing are low toxicity and are non-carcinogenic and non-reactive at normal temperatures and pressures. The materials passed burning and explosibility tests and are classified as "not explosive or readily combustible" (CNS 2023a). Workers are adequately protected by use of personnel protective equipment such as gloves and eye protection, and no short- or long-term adverse effects are expected.

***Intentional Destructive Acts***. NNSA is required to consider intentional destructive acts, such as sabotage and terrorism, in the NEPA documents it prepares. As at any location, the possibility exists for random acts of violence and vandalism. The risk of terrorist acts associated with the Proposed Action are considered minimal given that there would be no hazardous or radiological materials at either the TDF or Building 9225-03. It is also anticipated that security measures (e.g., gates and fences) would serve as an impediment to assault by trucks or other vehicles at Building 9225-03.

### 3.11.3 No-Action Alternative Effects

Under the No-Action Alternative, there would be no construction activities or materials manufacturing operations. Consequently, the potential occupational injuries discussed in Section 3.11.2 would not occur.

## 3.12 Waste Management

### 3.12.1 Affected Environment

DOE operates and maintains solid waste disposal facilities located near Y-12, called the ORR Landfills, three of which are active (Table 3-19). The TDEC Division of Solid Waste Management regulates the management of waste streams under the *Tennessee Solid Waste Management Act* (TSWMA). TDEC performs a monthly audit of DOE's landfills on the ORR. TDEC also reviews DOE practices to ensure that radioactive waste is not disposed of in these landfills. Each landfill has established criteria to determine whether waste is acceptable for disposal. In general, the wastes must be non-hazardous, non-radioactive, and non-*Resource Conservation and Recovery Act* (RCRA)-regulated. DOE must use approved operations in receiving, compacting, and covering waste.

**Table 3-19. Active Landfills at the ORR**

| Waste Disposal Facility | Type | Waste Received | Statistics |
|---|---|---|---|
| Construction /Demolition Landfill VII | TDEC Permit | Construction/ demolition debris | • 30.4-acre site, opened in 2001<br>• Total capacity of 2.08 million $yd^3$<br>• Remaining years of use as of 2022: 48.5<br>• Constructed airspace: 1.1 million $yd^3$ |
| Industrial Landfill IV | TDEC Permit | Sanitary/industrial waste (including office waste, equipment, construction/ demolition debris) | • 4.2-acre landfill, opened in 1989<br>• Permitted total capacity of 89,000 $yd^3$<br>• Remaining years of use as of 2022: 81.7<br>• Constructed airspace: 71,000 $yd^3$ |
| Industrial Landfill V | TDEC Permit | Sanitary/industrial waste (including office/cafeteria waste, equipment, construction/demolition debris) | • 25.9-acre landfill, opened in 1994<br>• Total capacity of 2.1 million $yd^3$<br>• Remaining years of use as of 2022: 14.3<br>• Constructed airspace: 1.3 million $yd^3$ |

Note: In addition to the three active landfills, there are other CERCLA-related waste disposal facilities at the ORR, including the Environmental Management Waste Management Facility (EMWMF), which is a 28-acre disposal facility used for low-level radiological and/or hazardous waste from CERCLA cleanup of the ORR and associated sites; and the proposed Environmental Management Disposal Facility (EMDF), also for CERCLA cleanup. The final ROD for EMDF was issued on September 30, 2022.
Source: DOE 2017, DOE 2021, UCOR 2022.

Landfills IV and V can also dispose of approved special waste. Approved special wastes have included asbestos materials, empty aerosol cans, materials contaminated with beryllium, glass, fly ash, coal pile runoff sludge, empty pesticide containers, and Steam Plant Wastewater Treatment Facility sludge. Disposal of special waste is approved on a case-by-case basis by the State of Tennessee. In 2022, approximately 155,034 cubic yards ($yd^3$) of waste were disposed in the landfills. Between 2017 and 2020, approximately 297,722 $yd^3$ of waste in total were disposed in the landfills (DOE 2022).[10]

## 3.12.2 Proposed Action Effects

**Construction**. At the TDF, there would be no effects from construction. Construction would be limited to minor changes to the exterior walls of the TDF to support equipment installation, and there would be no land disturbance. No notable quantities of nonhazardous waste would be generated during construction.

At Building 9225-03, although construction debris would be generated, no notable quantities of nonhazardous waste would be generated during construction. To the extent practicable, NNSA would implement pollution prevention/recycling measures to minimize waste generation and disposal requirements. During construction, there is the possibility that legacy waste or contaminated materials may be encountered during excavation for building foundation or utility work. Prior to construction, NNSA would perform soil sampling, as required, and develop and implement a waste handling plan for Building 9225-03 which would detail how NNSA would manage any such wastes or contaminants. Given that Building 9225-03 was constructed relatively recently (in 2004), small construction footprint (3,000 square feet expansion), limited area of soil

[10] Manufacturing would not generate any RCRA hazardous wastes; however, minimal quantities of waste (such as consumable air filters) could contain toxic materials and would be managed as special wastes.

disturbance (less than one acre), and lack of identified legacy source areas at the site, gross soil contamination is not expected to be encountered during construction.

**Operation**. During operations, approximately 2.4 tons of nonhazardous waste would be generated at the TDF annually. At a typical density of 250 pounds per cubic yard of municipal waste, 2.4 tons equates to approximately 19 cubic yards of nonhazardous waste that would be generated annually by materials manufacturing. Compared to the 155,034 cubic yards of nonhazardous waste that was disposed of in the ORR landfills in 2022, TDF materials manufacturing would increase wastes by 0.012 percent. Minimal quantities of waste (such as consumable air filters) could be managed as special wastes and disposed of in Landfills IV and V. During operations at Building 9225-03, approximately 4.8 tons of nonhazardous waste equates to approximately 38 cubic yards of nonhazardous waste would be generated annually, which would increase wastes disposed in the ORR landfills by 0.025 percent. All wastes generated would be evaluated and managed in accordance with the TSWMA. Manufacturing would not generate any RCRA hazardous wastes or radiological wastes.

### 3.12.3 No-Action Alternative Effects

Under the No-Action Alternative, materials manufacturing would not be conducted at either the TDF or Building 9225-03, and there would be no changes to the existing waste management operations discussed in Section 3.12.1.

## 3.13 Transportation

### 3.13.1 Affected Environment

Y-12 is located within 50 miles of three interstate highways: I-40, I-75, and I-81. As shown on Figure 3-20, collector roads serving Y-12 include S. Illinois Avenue, the Oak Ridge Turnpike, Bethel Valley Road, Bear Creek Road, Union Valley Road, and Scarboro Road. Bear Creek Road has restricted access around Y-12 and is not a public thoroughfare. Bethel Valley Road is also closed to public access. The daily traffic counts for various roads in the vicinity of Y-12 are provided in Table 3-20. In the vicinity of the site, the collector roads have traffic speed limits of between 25 and 40 miles per hour.

**Table 3-20. Average Daily Traffic Counts on Roads in Vicinity of Y-12**

| Pointer on Figure 3-20 | Road | 2022 | 2021 | 2020 | Highest Traffic Count in Past 10 Years/(Year) |
|---|---|---|---|---|---|
| A | Oak Ridge Turnpike (near downtown Oak Ridge) | 21,750 | 19,523 | 23,794 | 25,151/(2019) |
| B | S. Illinois Avenue (near Bethel Valley Road intersection) | 33,111 | 30,667 | 42,528 | 42,528/(2020) |
| C | Scarboro Road (near Y-12 entrance) | 10,470 | 9,557 | 13,889 | 13,889/(2020) |
| D | Bethel Valley Road (near Scarboro Road intersection) | 10,649 | 8,211 | 12,001 | 12,001/(2020) |
| E | Lafayette Drive (near Emory Valley Road intersection) | 16,402 | 15,995 | 22,321 | 22,321/(2020) |

Source: TDOT 2023.

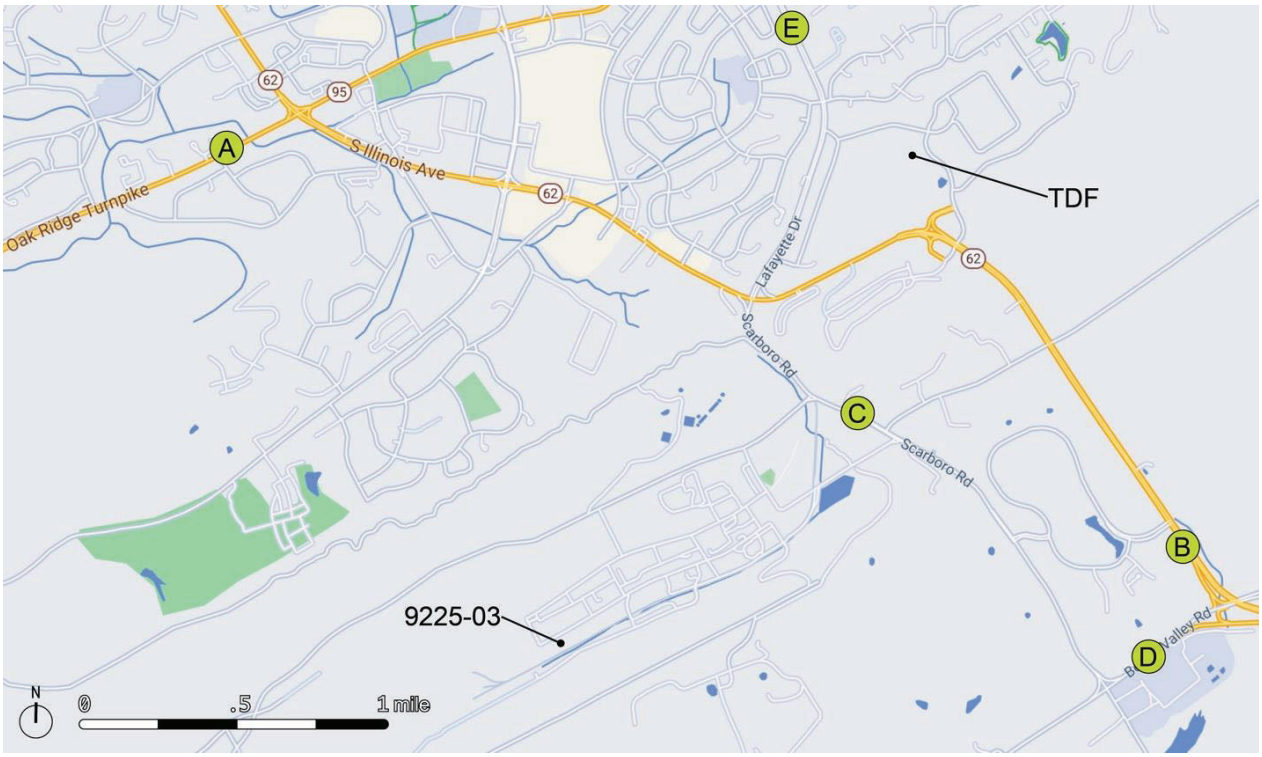



**Figure 3-20. Roads in the Vicinity of Y-12**

## 3.13.2 Proposed Action Effects

**Construction and Operation**. As shown in Table 3-21, roads in the vicinity of Y-12 have handled more traffic in the past than current traffic. This, along with the existing road condition, suggests that no significant modifications would be required to support the Proposed Action construction. During construction, the addition of 30 vehicles to daily traffic counts of the Oak Ridge Turnpike, S. Illinois Avenue, and Scarboro Road would not change traffic counts. The addition of 30 construction workers would represent much less than a one percent increase in the Anderson County employment, which also suggests that area traffic would not be adversely affected. Consequently, it is not expected that traffic associated with construction would adversely affect traffic in the vicinity of Y-12. During operations, there would be no effect on area roads because the same employees who currently work at Y-12 would work at the TDF and Building 9225-03. The transportation of additional materials and parts during operation are not expected to increase overall traffic, as transportation will occur within the currently executed TDF to Y-12 transportation strategy. There are regularly scheduled deliveries between TDF and Y-12 and activities will be batched to fit within these already occurring transportations.

## 3.13.3 No-Action Alternative Effects

Under the No-Action Alternative, the Proposed Action would not occur and there would be no additional effects to transportation or traffic on area roads.

## 3.14 Site Infrastructure

### 3.14.1 Affected Environment

Site infrastructure includes those basic resources and services required to support the construction and operation at Y-12 and offsite at the TDF. For the purposes of this EA, infrastructure is defined as electricity, natural gas, water, wastewater, chilled water, and industrial gases.

The proposed action includes both an on-site and off-site component-- Building 9225-03 and the TDF. Both are existing buildings tied into existing infrastructure. The development of this project would include interior retrofits to both facilities to support the manufacturing requirements. The following section outlines the availability and capacity of the existing facilities and the anticipated materials manufacturing future infrastructure needs. Projected utility usage is discussed in Section 3.14.2. Table 3-21 identifies the utility providers and size of infrastructure available at Y-12.

**Table 3-21. Y-12 Primary Utilities**

| Utility | Provider | Service Size | Notes |
|---|---|---|---|
| Electrical | TVA | TVA distribution to Y-12 is 161kV; Local distribution at Y-12 is via 13.8-kV systems | 430 megawatts (capacity) from TVA; Y-12 capacity is capped at 70 MVA based on the Pine Ridge Substation |
| Natural Gas | Sigcorp Energy Services | 14-inch, 125-pounds per square inch gauge | 1,729,000 million British Thermal Units (annual consumption) |
| Water (Raw) | City of Oak Ridge | 18-inch main, 16-inch main | obtained from Clinch River |
| Water (Treated) | City of Oak Ridge | 24-in main (1), 16-inch main (2) | 24 million gallons per day (capacity) |
| Wastewater | City of Oak Ridge | 18-inch main line | 1.5 million gallons per day (capacity) |

***Electricity*.** TVA generates electric power for the region. At Y-12, the existing 161-kV electrical distribution system was phased out and the new 13.8 kV Pine Ridge substation was placed online in 2019, along with completing a new medium voltage distribution system in 2022. This new substation was constructed as part of the UPF project and addresses the need for a modernized and reliable utility infrastructure that will meet mission requirements (CNS 2023b). At Y-12, the average monthly power usage is approximately 15-18 MW. The maximum power usage in recent years has been approximately 28.5 MW (CNS 2023a). The available capacity of 70 MVA at Y-12 is limited by the 161 kV to 13.8 kV Pine Ridge Substation and a single transformer being able to carry the entire plant load.

Previous projections for a general reduction of electrical usage are being challenged as mission work at the site is expected to increase and planned construction for new facilities, in addition to completion of UPF, adds additional electrical loads. The medium voltage infrastructure to the East end of the plant is especially strained and requires the installation of additional switchgears to maximize use of the Pine Ridge substation. Building 9225-03 will require the switchgears to be operational before full operations can start in the building.

Y-12 also has a significant emergency and standby power generator system to provide backup power to critical safety-related facilities. The emergency and standby power generator system is composed of 37 fixed generator systems and 11 portable generator systems. The combined capacity of the emergency and standby power generator system is 2.6 MWe (NNSA 2011). The TDF also features generators for back-up power supply during electrical outages.

***Natural Gas.*** Sigcorp Energy Services supplies natural gas to the ORR and Y-12. Natural gas, which is used for Y-12 steam plant and facilities, is supplied via a pipeline from the East Tennessee Natural Gas Company at "C" Station located south of Bethel Valley Road near the eastern end of Y-12. A 14-inch, 125-pounds per square inch gauge (psig) line is routed from "C" Station to the southwest corner of the Y-12 perimeter fence. From this point, an 8-inch line feeds the steam plant and a 6-inch branch line serves the facilities near Building 9225-03 (NNSA 2011). The Oak Ridge Utility District (ORUD) supplies natural gas to the TDF. ORUD is an independent non-profit utility supplying natural gas to 15,000 customers in Anderson and Roane Counties, Tennessee (ORUD 2023).

***Water.*** Raw water for the ORR and TDF is captured from the Clinch River south of Y-12 and pumped to the water treatment plant located on Pine Ridge northeast of Y-12. Ownership and operation of the treated water system was transferred to the City of Oak Ridge from DOE in April 2000. The potable water supply is delivered to two Y-12 elevated storage tanks by two independent feeds. The two water tanks have a total capacity of 4 million gallons. Of this capacity, 1 million gallons are reserved as emergency water storage for on-site fire-fighting activities (CNS 2023b).

Y-12's potable water system supplies sanitary water to numerous Y-12 facilities. The potable water system supports:

- Fire protection systems, including sprinkler systems, fire hydrants, and emergency fire-fighting water storage;
- Sanitary water systems, including emergency showers and eyewash stations, personnel decontamination facilities, drinking fountains, rest rooms, change houses, and the cafeteria;
- Process water systems, including feed water for the steam plant and demineralizer, makeup water for cooling towers, process cooling, cleaning and decontamination systems, chemical makeup systems, laboratories, and other miscellaneous needs; and
- The 16-inch emergency backup water feed for ORNL (CNS 2023b).

Most potable water is not metered at the point of use at Y-12, but an evaluation based on known data, facility usage, and other factors provides an estimated assessment of the usage by type. In 2022, potable water usage at Y-12 was estimated at 517 million gallons (CNS 2023b).

In 2019, the City of Oak Ridge secured a *Water Infrastructure Finance and Innovation Act* loan from the EPA to help finance a new drinking water treatment plant. This loan will enable Oak Ridge to replace the existing 80-year-old conventional plant with a new ultrafiltration membrane plant. In addition to the modern treatment plant, the project will also modernize or replace ancillary infrastructure including the intake pumps, traveling screens, finished water pump station, pipelines, and water tanks. This new facility will ensure that Oak Ridge will continue to reliably

deliver high-quality water to ORR and the greater Oak Ridge community (EPA 2019). Groundbreaking for the $78 million facility occurred in October 2022, and the plant is projected to come online in Spring 2025 (OAKRIDGER 2023).

***Wastewater.*** The Y-12 Site's sanitary sewer system was first installed in 1943 and expanded as the plant grew. Sewage from most buildings flows to an 18-inch sewer main that leaves the east end of the plant near Lake Reality and connects to the city main near the intersection of Bear Creek Road and Scarboro Road. The current system capacity is approximately 1.5 million gallons per day. The average daily flow has been approximately 400,000 gallons per day (CNS 2023a). Y-12 has a sanitary sewer users permit, issued by the City of Oak Ridge, which regulates water discharges. The TDF is connected to the City of Oak Ridge's public wastewater infrastructure.

***Chilled Water.*** Y-12 has many functional needs for chilled water, including air conditioning and dehumidification systems required for maintaining environmental conditions (i.e., temperatures and humidity) within production facilities, including precision machine shops, low-humidity areas, inspection areas, and general manufacturing facilities; and conventional air conditioning for offices, laboratories, and other support facilities. The chilled water systems were renovated and upgraded during the mid-1990s. Most chillers that were more than 20 years old were replaced, and the newer chillers were inspected and renovated to eliminate the use of chlorofluorocarbons and to restore the chillers to optimal mechanical condition (NNSA 2011).

***Industrial Gases.*** Industrial gases primarily utilized in the materials manufacturing process are nitrogen, argon, and helium. As such, the discussion below focuses on those three gases.

Liquid nitrogen is normally delivered to Y-12 by trailer truck. The Y-12 nitrogen supply system consists of four low-pressure and one high-pressure liquid-nitrogen storage tanks, a bank of atmospheric vaporizers, and a steam vaporizer. Nitrogen is delivered to all production facilities and laboratories at 90 psig through a network of 2-inch, 3-inch, and 4-inch pipes. Y-12 uses approximately 190 million standard cubic feet of nitrogen annually (NNSA 2011).

Liquid argon also is delivered to Y-12 by trailer truck. The Y-12 argon system consists of five vacuum-insulated liquid storage tanks and 12 atmospheric fin-type vaporizers. The storage tanks have a combined capacity of 30,737 gallons equivalent to approximately 3.4 million standard cubic feet of gas. Gas is distributed to production areas and laboratories through a network of 2-inch and 3-inch pipes. Y-12 uses approximately 30 million standard cubic feet of argon annually (NNSA 2011).

Y-12 receives and stores high-purity helium at 3,000 psig in a jumbo tube trailer with a capacity of 160,000 standard cubic feet. Helium gas is distributed throughout Y-12 at 90 psig through a 2-inch overhead pipeline to Y-12 facilities. Y-12 uses approximately 1.6 million standard cubic feet of helium annually (NNSA 2011).

Industrial gases for the TDF are delivered by trailer-truck and distributed within the facility through existing connections and facility pipelines.

### 3.14.2 Proposed Action Effects

**Construction and Operation**. Existing underground utilities that traverse Y-12 include stormwater drains, firewater, electrical conduits and duct banks, communications, sanitary sewer, domestic water, natural gas, compressed air, instrument air, chilled water, cooling tower water, nitrogen, argon, and helium. Building 9225-03 is connected to the existing Y-12 infrastructure for the following utilities: electricity, natural gas, steam, water (potable/firewater), wastewater (sanitary sewer), and communications. Due to their close proximity, the TDF is served by the same utility providers with the exception of natural gas, which is supplied to the TDF by ORUD. Any additional utility demands would be supplied by NNSA or by vendor-delivery to the facility. Utility work at Building 9225-03 would include upgrades to support these inert gas connections/supplies. The TDF has existing connections/supplies for these gases. Because Building 9225-03 and the TDF have established utility connections, the Proposed Action is not expected to result in notable effects, as discussed below.

***Electricity.*** The TVA electrical system has sufficient capacity to support the Proposed Action. TVA plants have a combined generating capacity of more than 34 gigawatts (EIA 2023). Peak demand at the TDF would be 3.5 megawatts with an average electrical demand of 2.5 megawatts. Peak demand at Building 9225-03 would be 7 megawatts with an average electrical demand of 4.9 megawatts. The electricity demands of the Proposed Action would be minimal compared to the existing TVA electricity generating capacity. At Y-12, the Building 9225-03 electrical demand will require the installation of additional switchgear on the medium voltage distribution system on the East end of Y-12, in order to maximize the use of the Pine Ridge substation. Both facilities would be equipped with an outdoor emergency diesel-engine generators system to provide backup power in the event of a utility power outage.

***Natural Gas.*** Natural gas would be used for heating Building 9225-03 and the TDF, and supplying the vacuum furnaces. Sigcorp Energy Services and ORUD have sufficient supply capacity to support the natural gas demands of the Proposed Action.

***Water.*** Water demands from materials manufacturing would be negligible during both construction and operations. Construction activities would require no more than 30 total workers and operations would require no more than 15 workers at both sites. Potable water use by workers would be less than historical usages at each site.

***Wastewater.*** Wastewater collection for both the TDF and Building 9225-03 would be serviced by the City of Oak Ridge. There is an 18-inch sewer main that leaves the east end of Y-12 near Lake Reality and connects to the city main near the intersection of Bear Creek Road and Scarboro Road. Wastewater generation based on a calculation of 25 gallons/person/day and a total of 15 workers (10 workers at Y-12 and 5 workers at TDF) is estimated at 375 gallons/day. This quantity would be minimal compared to the average flow of approximately 400,000 gallons per day at Y-12. At TDF, the wastewater increases would be minimal.

***Chilled Water.*** During operations, the only portion of materials manufacturing that requires water is a closed water loop for process cooling. As it is a closed system, water demands would be limited to initial startup activities and makeup water, which is expected to be minimal.

***Industrial Gases.*** Industrial gas demands for the Proposed Action would be minimal compared to the existing demands at both Y-12 and TDF.

### 3.14.3 No-Action Alternative Effects

Under the No-Action Alternative, NNSA would not perform materials manufacturing at either the TDF or Building 9225-03 and there would be no additional infrastructure demands.

# 4 CUMULATIVE EFFECTS

## 4.1 Evaluation of Past, Present, and Reasonably Foreseeable Future Actions

Construction activities at the TDF would occur in 2024, with operations beginning in 2025. Construction activities at Building 9225-03 would occur in 2025, with operations beginning in 2027. Because operations are expected for approximately 50 years, cumulative effects associated with operations could occur until approximately the year 2077. The cumulative analysis in this EA focuses on actions and effects that could occur during the construction periods and initial operations, as forecasts beyond that time period become more speculative and less meaningful. Past operations, and continued operations of existing facilities within Y-12 and the project area, are included in the affected environment section and thus, are already considered in this EA. Consequently, this cumulative analysis focuses on identifying reasonably foreseeable actions.

In preparing this cumulative effect analysis, NNSA considered the inclusion of several future projects that could be located offsite of the ORR. Three such projects are: (1) the construction and operation of the General Aviation Airport; (2) a proposal to increase the allowable land uses in the Horizon Center Industrial Park (Parcel ED-1) to include hotels, a vehicle test facility, residential development, an amphitheater, and a Commercial Advanced Reactor Fuel Fabrication Facility; and (3) offsite housing of the Y-12 development organization at 103 Palladium Way at the Horizon Center Industrial Park in Oak Ridge, Tennessee. Based on reviews of the environmental documents for those projects (DOE 2016a, DOE 2020, and NNSA 2021b) and other available information, NNSA concluded that those projects are unlikely to contribute to meaningful cumulative effects for the Proposed Action and they were eliminated from detailed cumulative effect analysis.

NNSA identified five actions for detailed cumulative analysis: (1) continued construction of the UPF at Y-12, with operations beginning in approximately 2029; (2) continued construction of the Oak Ridge Enhanced Training and Technology Center (ORETTC), an emergency response training facility which is approximately 50 percent constructed, with final construction expected in the next three years; (3) construction of the Lithium Processing Facility (LPF), which is expected to begin construction in 2024 and begin operations in 2028/2029; (4) continuation of Integrated Facilities Disposition Program (IFDP)/cleanup actions at ORR; and (5) continued construction of the MTF, which is expected to be operational in approximately 2025.

## 4.2 Potential Cumulative Effects

Table 4-1 presents the cumulative effect analysis of the Proposed Action, construction and operation of the UPF, construction and operation of the ORETTC, construction and operation of the LPF, continuation of the IFDP/cleanup actions, and construction and operation of the MTF.

## Table 4-1. Potential Cumulative Effects by Activity

| Resource Area | Proposed Action: Materials Manufacturing | UPF | ORETTC | LPF | IFDP/Cleanup | MTF |
|---|---|---|---|---|---|---|
| Land Resources | No land disturbance at the TDF. At Y-12, land disturbance for Building 9225-03 would be less than one acre of previously disturbed land. | Land disturbance for UPF construction would be approximately 35 acres of previously disturbed land at Y-12. Once operational, UPF facilities would occupy approximately 5.4 acres. | Up to 24.1 acres could be disturbed during construction, which is less than one percent of land at the ORR. | Land disturbance for LPF construction would be approximately 15.09 acres of previously disturbed land at Y-12. Once operational, the LPF footprint would occupy approximately 12.9 acres. | IFDP/cleanup activities would disposition excess facilities and restore disturbed land at Y-12. Those activities are consistent with NNSA's vision to remove/replace older/inefficient facilities and cleanup the site. | During construction, up to 5 acres of previously disturbed land could be re-disturbed, which is less than one percent of land at Y-12. |
| Visual Resources | Y-12 would remain a highly developed area with an industrial appearance, and there would be no change to the VRM classification. Internal changes to TDF would not affect visual resources. | Y-12 would remain a highly developed area with an industrial appearance, and there would be no change to the Visual Resource Management classification. | No appreciable visual resource effects are expected, as the ORETTC site is largely wooded and would only be visible from traffic on the Oak Ridge Turnpike. | Y-12 would remain a highly developed area with an industrial appearance, and there would be no change to the Visual Resource Management classification. | Activities would improve the density of facilities at Y-12. However, Y-12 would remain a highly developed area with an industrial appearance. | MTF operations would not affect visual resources. |
| Air Quality | Minor, short-term effects would be due to generating airborne dust and other pollutants during construction. The area is in attainment for all NAAQS and emissions from TDF and Building 9225-03 would be below *de minimis* thresholds. | Construction activities would result in releases of criteria pollutants but would not exceed any NAAQS or TDEC standards beyond the Y-12 boundary. Effects would remain well within NAAQS for all criteria pollutants during operations. | Minor, short-term effects would be due to generating airborne dust and other pollutants during construction. The area is in attainment for all NAAQS and emissions from the ORETTC would be below *de minimis* thresholds. | Minor, short-term effects would be due to generating airborne dust and other pollutants during construction. The area is in attainment for all NAAQS and emissions from the Proposed Action would be below *de minimis* thresholds. | Minor, short-term effects would be due to generating airborne dust and other pollutants during IFDP/cleanup activities. The area is in attainment for all NAAQS. | Minor, short-term effects would be due to generating airborne dust and other pollutants during construction. The area is in attainment for all NAAQS. |

| Resource Area | Proposed Action: Materials Manufacturing | UPF | ORETTC | LPF | IFDP/Cleanup | MTF |
|---|---|---|---|---|---|---|
| Noise | There are no sensitive noise receptors in the vicinity of the TDF and Building 9225-03 and there would be no notable noise sources associated with construction and operation. | There would be a potential for minor temporary increases in noise due to additional traffic and construction activities, but noise levels would be below background noise levels at offsite locations. | There are no sensitive noise receptors in the vicinity of the ORETTC and no notable noise sources are associated with ORETTC construction and operation. | There are no sensitive noise receptors in the vicinity of the LPF and there would be no notable noise sources associated with LPF construction and operation. | Noise effects from IFDP/cleanup activities would not be expected beyond the Y-12 site boundary. | There are no sensitive noise receptors in the vicinity of the MTF and there would be no notable noise sources associated with construction and operation |
| Water Resources | Construction of the Proposed Action would not affect surface water or groundwater resources. No water quality effects are expected from operations as the only effluents would be cooling tower blowdowns. | Water requirements for UPF construction and operation would represent less than 10 percent of water use at Y-12 and would be within the bounds of historical water use at the site. | Construction of the ORETTC would not affect surface water or groundwater resources. No water quality effects are expected from operations as stormwater and fire-training runoff water would be managed under NPDES permits, as required. | Construction of the LPF would not affect surface water or groundwater resources. No water quality effects are expected from operations as stormwater and effluents would be managed under NPDES permits, as required. Water requirements for LPF construction and operation would be within the bounds of historical water use at the site. | Activities utilize water for dust suppression and worker potable water requirements. Activities would be conducted in accordance with a SWPPP, and managed under the existing NPDES permit. Cleanup activities would improve water quality at the site. | The proposed water treatment system is expected to reduce mercury concentrations to the 51 ng/L or less in the treated effluent. |
| Geology and Soils | Construction activities would not affect existing geologic and soil conditions. | Construction activities would result in a potential increase in soil erosion. Appropriate mitigation would minimize soil erosion and effects. The UPF has been designed and is being constructed to meet applicable code requirements related to geological hazards. | Construction activities would cause some minor effects to the existing geologic and soil conditions; however, no viable geologic or soil resources would be lost as a result of construction activities. Excavated soils would be used to improve storm water drainage on site. | Construction activities would result in a potential increase in soil erosion. Appropriate mitigation would minimize soil erosion and effects. The LPF would be designed and constructed to meet applicable code requirements related to geological hazards | Activities would disposition excess facilities and restore/cleanup disturbed soils at Y-12. | Remediation activities are expected to reduce mercury Contamination in soils and sediments. |

| Resource Area | Proposed Action: Materials Manufacturing | UPF | ORETTC | LPF | IFDP/Cleanup | MTF |
|---|---|---|---|---|---|---|
| Biological Resources | Construction activities would not affect ecological resources. At TDF, only internal facility modification would occur. At Y-12, less than one acre of previously disturbed land would be re-disturbed. Y-12 would remain heavily industrialized and no change to ecological resources would be expected. No critical habitat for threatened or endangered species is known to exist at Y-12. | Construction activities would not affect ecological resources because the facility is being sited on land that was used as a parking lot. Y-12 would remain heavily industrialized and no change to ecological resources would be expected. No critical habitat for threatened or endangered species is known to exist at Y-12. | Construction of ORETTC would have short- and long-term minor adverse effects on biological resources. Potential effects on biological resources include loss of habitat and wildlife disturbance. Given the small land disturbance, the ORETTC would not reduce the distribution or viability of species or habitats of concern. | Construction activities would not affect ecological resources because the facility is being sited on land that has been used for more than 70 years for the Biology Complex. Y-12 would remain heavily industrialized and no change to ecological resources would be expected. No critical habitat for threatened or endangered species is known to exist at Y-12. | Activities are largely conducted within highly developed areas. Due to the lack of notable ecological resources in these areas, no effects are expected. | The proposed water treatment system is expected to reduce mercury concentrations in surface waters, which would be beneficial to aquatic life. |
| Cultural Resources | Construction activities at the TDF would not affect cultural resources. At Y-12, construction would be outside of the proposed historic district and there would be no cultural resource effects. | Construction activities for the UPF are occurring outside of the proposed historic district and there would be no cultural resource effects. | Construction-related activities and ground disturbance would be small and no cemeteries or known prehistoric sites would be affected. No historic properties eligible or potentially eligible for listing in the NRHP would be affected. | Construction activities for the LPF would occur outside of the Y-12 Historic District and there would be no cultural resource effects. The exterior of the new LPF would be designed to be compatible with existing historic properties. | Activities would be conducted in accordance with regulatory requirements and NNSA would consult with the SHPO as required. | Activities would be conducted in accordance with regulatory requirements and DOE would consult with the SHPO as required. |

| Resource Area | Proposed Action: Materials Manufacturing | UPF | ORETTC | LPF | IFDP/Cleanup | MTF |
|---|---|---|---|---|---|---|
| Socioeconomics | Both the peak construction workforce (30 persons) and operational workforce (5 persons at TDF and 10 persons at Building 9225-03) would be negligible compared to the projected population in the ROI, socioeconomic effects, although beneficial, are expected to be negligible. | Approximately 1,050 direct jobs were estimated during the peak year of construction. After 2025, when construction is completed, the operational workforce at UPF would largely come from existing Y-12 staff, and socioeconomic effects would be minimal. | Because the peak construction workforce (75 persons) and operational/training workforce (270 persons) would be negligible compared to the projected population in the ROI, socioeconomic effects, although beneficial, are expected to be negligible. | Because the peak construction workforce (300 persons) and operational workforce (70 persons) would be negligible compared to the projected population in the ROI, socioeconomic effects, although beneficial, are expected to be negligible. | Activities would produce socioeconomic effects; however, it would be speculative to quantify the number of jobs created. Activities at the ETTP created a large number of temporary jobs relative to the number of operational jobs that were lost when operations ceased. | The construction and operational workforce would be negligible compared to the projected population in the ROI. Socioeconomic effects, although beneficial, are expected to be negligible. |
| Environmental Justice | During construction and operation, no disproportionate and adverse environmental or economic effects on minority or low-income populations are expected. | No notable health risks to the public; radiological dose would remain below the annual dose limit of 10 millirem. There are no special circumstances that would result in any greater effect on minority or low-income populations than the population as a whole. | No environmental justice populations were identified within the census tracts where ORETTC would be located. During construction and operation, no disproportionate and adverse environmental or economic effects on minority or low-income populations are expected. | No environmental justice populations were identified within the census tracts where LPF would be located. During construction and operation, no disproportionate and adverse environmental or economic effects on minority or low-income populations are expected. | No environmental justice populations are expected within the census tracts where activities would occur. No disproportionate and adverse environmental or economic effects on minority or low-income populations are expected. | Improved water quality could have beneficial effects to human health. No disproportionate and adverse environmental or economic effects on minority or low-income populations are expected. |

| Resource Area | Proposed Action: Materials Manufacturing | UPF | ORETTC | LPF | IFDP/Cleanup | MTF |
|---|---|---|---|---|---|---|
| Human Health (Normal Operations) | No radiological or hazardous materials would be used. Workers would be subject to minimal occupational risks. No offsite effects are expected during normal operations. | All radiation doses from normal operations would be below regulatory standards with no statistically significant effect on the health and safety of workers or public. | No offsite effects are expected. During ORETTC construction and operation, 1-2 days of lost work from illness/injury and less than one fatality would be expected. There would be no radiological or hazardous chemical human health effects associated with ORETTC operations. | Workers would be subject to occupational risks. Over the full construction period, approximately 7.7 days of lost work from illness/injury and 0.06 fatalities would be expected. Operational effects would be similar to existing operations. No offsite effects are expected during normal operations. There would be no radiological effects associated with LPF operations. | Activities could cause health and safety effects to workers. Lessons learned from Experience with other cleanup operations has shown that while occupational effects to workers are expected, best management practices can reduce effects. | Improved water quality could have beneficial effects to human health |
| Facility Accidents | No radiological or hazardous materials would be used. No offsite effects are expected during accidents. | New nuclear facilities such as the UPF would have smaller accident consequences compared to older facilities at Y-12 due to meeting modern nuclear safety requirements. | Approximately 0.002 fatalities could be expected to occur annually at the ORETTC specifically from accidents related to firefighting drills/training. Statistically, one death would be expected to occur for every 500 years of operation at the ORETTC. | LPF accidents would not result in high consequences, meaning no member of the public would be exposed to chemical concentrations that could result in irreversible or other serious health effects. | Workers would be subject to occupational hazards/accidents, but offsite accidents would not be expected from IFDP/cleanup activities. | Workers would be subject to occupational hazards/accidents, but offsite accidents would not be expected from remediation activities. |

| Resource Area | Proposed Action: Materials Manufacturing | UPF | ORETTC | LPF | IFDP/Cleanup | MTF |
|---|---|---|---|---|---|---|
| Intentional Destructive Acts | The likelihood of sabotage and terrorism is extremely low because of the absence of radiological or hazardous materials. | NNSA analyzed the potential effects of intentional destructive acts in a classified appendix. In general, it is easier and more cost-effective to protect new facilities such as the UPF, as new security features can be incorporated into their design. New facilities can, as a result of design features, better prevent attacks and reduce the effects of attacks. | The likelihood of sabotage and terrorism is extremely low. However, it is possible but highly unlikely that random acts of vandalism could occur. A variety of measures to control access and maintain security would be used. | The likelihood of sabotage and terrorism is extremely low because of the absence of large quantities of hazardous materials. New facilities can, as a result of design features, better prevent attacks and reduce the effects of attacks. A variety of measures to control access and maintain security would be used. | The likelihood of sabotage and terrorism is extremely low for IFDP/cleanup activities. | The likelihood of sabotage and terrorism is extremely low for MTF operations. |
| Waste Management | No radiological or hazardous waste would be generated. Solid non-hazardous waste would be recycled or transported to an appropriate Y-12 landfill for disposal. | The UPF would generate approximately 6,000 tons of nonhazardous waste annually, which would be disposed of at the ORR landfills. | Solid non-hazardous waste would be recycled or transported to an appropriate ORR landfill for disposal. | The LPF would generate approximately 25.7 tons of nonhazardous waste annually, which would be disposed of at the ORR landfills. | Wastes generated from activities would be managed by the existing ORR waste management and disposal infrastructure. | Wastes generated from activities would be managed by the existing ORR waste management and disposal infrastructure. |
| Transportation | Temporary increases in traffic associated with construction activities would not be notable compared to existing activities in the ROI. Operational traffic would not be notably different than existing operations. | UPF construction has not had a noticeable effect on area transportation. Once operational, transportation effects should be similar to historic levels. | Temporary increases in traffic associated with construction activities would not be notable compared to existing activities in the ROI. | Temporary increases in traffic associated with construction activities would not be notable compared to existing activities in the ROI. Operational traffic would be the same as existing lithium operations. | Temporary increases in traffic associated with activities would not be notable compared to existing activities in the ROI. | Temporary increases in traffic associated with activities would not be notable compared to existing activities in the ROI |

| Resource Area | Proposed Action: Materials Manufacturing | UPF | ORETTC | LPF | IFDP/Cleanup | MTF |
|---|---|---|---|---|---|---|
| Infrastructure | Construction activities would have minimal effects on most infrastructure capacity. The capacity of most existing infrastructure at TDF and Y-12 would be adequate to support the materials mission. Electrical infrastructure at Y-12 needs to be upgraded to fully support the materials mission. | UPF construction and operations would not exceed capacity at Y-12 for electricity, water, or other utility support. | The capacity of the existing infrastructure in the region would be adequate to support the ORETTC. | Construction of the LPF would have minimal effects on most infrastructure capacity, but will require a new 161 kV to 13.8 kV substation to be installed to increase the electrical capacity of the site. . | Infrastructure demands associated with activities are expected to be adequately supported by the Y-12 infrastructure. | Most infrastructure demands associated with activities are expected to be adequately supported by the Y-12 infrastructure. Electrical infrastructure at Y-12 will need to be upgraded to ensure adequate infrastructure exists to support all missions. |

Source: CNS 2023a, NNSA 2011, NNSA 2020b, NNSA 2021c, DOE 2016b.

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