DOE/EA-2252

ENVIRONMENTAL ASSESSMENT FOR OFF-SITE DEPLETED URANIUM MANUFACTURING

National Nuclear Security Administration

July 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 manufacturing plant for depleted uranium (DU) and DU alloy capabilities, which are an important strategic material for ongoing and planned modernization of the nation's nuclear weapons stockpile. DU manufacturing is currently performed in multiple facilities at Y-12, but those facilities are aging and would require significant upgrades and investments to meet future DU requirements. Replacement facilities currently in preliminary planning would also not be reasonably accomplished in time to meet future DU requirements. Until new facilities are available, supplemental production with relocatable government furnished equipment (GFE) is being evaluated.[1] Consequently, NNSA is preparing this environmental assessment (EA) to analyze the potential environmental effects associated with performing DU manufacturing in existing commercial facilities in Oak Ridge, Tennessee and Jonesborough, Tennessee to supplement the DU production at Y-12.

NNSA is proposing to conduct supplemental DU manufacturing in three commercial facilities: (1) 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; (2) the Manufacturing Sciences Corporation (MSC) facility, located at 804 S. Illinois Avenue in Oak Ridge, approximately 0.7 miles northeast of Y-12; and (3) the Aerojet Ordnance Tennessee (AOT) facility, located at 1367 Old State Route 34 in Jonesborough, Tennessee, approximately 100 miles east of Y-12. Each of these facilities currently conducts DU operations for the commercial industry and/or in support of federal agencies such as NNSA and the Department of Defense (DoD). To support supplemental DU manufacturing when needed, minor internal upgrades would be required at each of the three commercial facilities and GFE would be installed at the TDF and the MSC facility. External changes at each of the three commercial facilities would be required to support construction activities, utility upgrades, and/or installation of storage facilities. Less than one acre of land could be disturbed at each commercial site. Operations, which could begin as soon as 2024 under a service agreement, would be conducted by commercial personnel, with technical oversight from Y-12 personnel to ensure manufacturing meets quality and technical requirements.

The analysis in Chapter 3 of this EA shows that the effects associated with construction and operation related to the GFE equipment and manufacturing would be minor at all three commercial facilities. Land disturbance would be minimal (i.e., less than one acre) and generally limited to previously disturbed land. Visually, the external modifications would not notably change the appearances of any of the facilities. Short-term air quality effects associated with construction 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 any of the facilities. Effluent discharges would not appreciably change and groundwater and surface water would not be affected. Construction or manufacturing activities at the sites would not affect ecological or cultural resources.

[1] The AOT facility does not require any GFE.

Because the peak construction workforce (20-40 persons) at any of the commercial facilities would be negligible compared to the populations in the regions of influence (ROIs), socioeconomic effects during construction, although beneficial, are expected to be negligible. The additional operational workforce (a maximum of 10 persons) would also be inconsequential compared to the populations in the ROIs. No disproportionate and adverse environmental or economic effects on minority or low-income populations are expected. Workers would be subject to minimal occupational risks and would be expected to receive radiological doses similar to existing operations at the three commercial facilities. At the TDF and MSC facilities, there would be no additional radiological or hazardous chemical emissions or effluents and no additional accident risks compared to current operations. At the AOT facility, potential accident impacts would result in negligible radiological and chemical consequences (DOE 2020a). Operations would generate minor quantities of low-level radioactive waste (LLW), hazardous waste, and nonhazardous waste that would be disposed of in existing treatment, storage, and disposal facilities. Transportation of DU materials and LLW would result in essentially no latent cancer fatality risks to transport crews or the public. With regard to utility requirements, water and electricity requirements would increase, but would be adequately supported by the existing infrastructure.

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ACRONYMS AND ABBREVIATIONS

AMSL	above mean sea level
AOT	Aerojet Ordnance Tennessee
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	Code of Federal Regulations
CIMC	EPA Cleanups in My Community
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
DoD	Department of Defense
DU	depleted uranium
DRH	Division of Radiological Health
DSAs	Documented Safety Analyses
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	United States 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*
GFE	government furnished equipment
GHG	greenhouse gas
HEPA	High Efficiency Particulate Air
HF	hydrogen fluoride
HVAC	heating, ventilation, and air conditioning
IPaC	USFWS Information for Planning and Consultation
IFDP	Integrated Facilities Disposition Program
kW	kilowatt
LCF	latent cancer fatality
L_{eq}	Equivalent Sound Level
LLW	low-level radioactive waste

LPF	Lithium Processing Facility
MEI	maximally exposed individual
MLLW	mixed LLW
MSC	Manufacturing Sciences Corporation
MTF	Mercury Treatment Facility
MW	megawatts
MSC	Manufacturing Sciences Corporation
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NEPA	*National Environmental Policy Act of 1969*
NHPA	*National Historic Preservation Act*
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
O_3	ozone
ORETTC	Oak Ridge Enhanced Technology and Training Center
ORR	Oak Ridge Reservation
ORUD	Oak Ridge Utility District
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
ROI	region-of-influence
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide
SPCC	spill prevention, control, and countermeasures
SWPPP	Stormwater Pollution Prevention Plan
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
TLD	thermoluminescent dosimeters
TVA	Tennessee Valley Authority
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, 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 manufacturing plant for depleted uranium (DU)[2] and DU alloy capabilities, which are an important strategic material for ongoing and planned modernization of the nation's nuclear weapons stockpile. DU manufacturing is currently performed in multiple facilities at Y-12, but those facilities are aging and would require significant upgrades and investments to meet future DU requirements. Replacement facilities currently in preliminary planning would also not be reasonably accomplished in time to meet future DU requirements. Until new facilities are available, supplemental production with relocatable government furnished equipment (GFE) is being evaluated. Consequently, NNSA is preparing this environmental assessment (EA) to analyze the potential environmental effects associated with performing DU manufacturing in existing commercial facilities in Oak Ridge, Tennessee and Jonesborough, Tennessee to supplement the DU manufacturing at Y-12.

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.

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 DU manufacturing at commercial facilities in Oak Ridge, Tennessee and Jonesborough, 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.

1.2 Purpose and Need for Agency Action

The demand for DU and DU alloy capabilities continues to increase based on the future needs of the stockpile (NNSA 2023a). Historically, NNSA has manufactured DU metal at Y-12 (Figure 1-1). However, some of Y-12's DU operations were shut down or consolidated in the early 2000s, and operations are currently performed in the 9215 Complex (Buildings 9215, 9996, 9998, and 9212 A-2 Wing), and the 9201-05N/W Complex. Many of these facilities are more than 50-70 years old and would require significant upgrades or replacement. NNSA is considering performing supplemental DU manufacturing in commercial facilities to meet NNSA stockpile requirements in

[2] DU is uranium that, through the enrichment process, has been stripped of a portion of the uranium-235 that it once contained so that its proportion is lower than the 0.711 weight-percent found in nature.

the interim until new DU manufacturing facilities are constructed at Y-12 in the 2030s. This strategy would increase capacity, improve reliability of the existing production line, and insert new capabilities into production.

If NNSA cannot establish off-site DU and DU alloy capabilities in time, work could slow or halt on billions of dollars in planned nuclear stockpile modernization programs within the next decade and NNSA would not be able to meet its mission requirements (GAO 2020). In order to meet DU manufacturing requirements for at least the next decade, NNSA is proposing to conduct a portion of this manufacturing at three commercial facilities in Oak Ridge, Tennessee and Jonesborough, Tennessee in the most timely, reliable, cost-effective, and flexible manner possible. The three commercial facilities are shown in Figure 1-2 in relation to the Y-12 Plant.

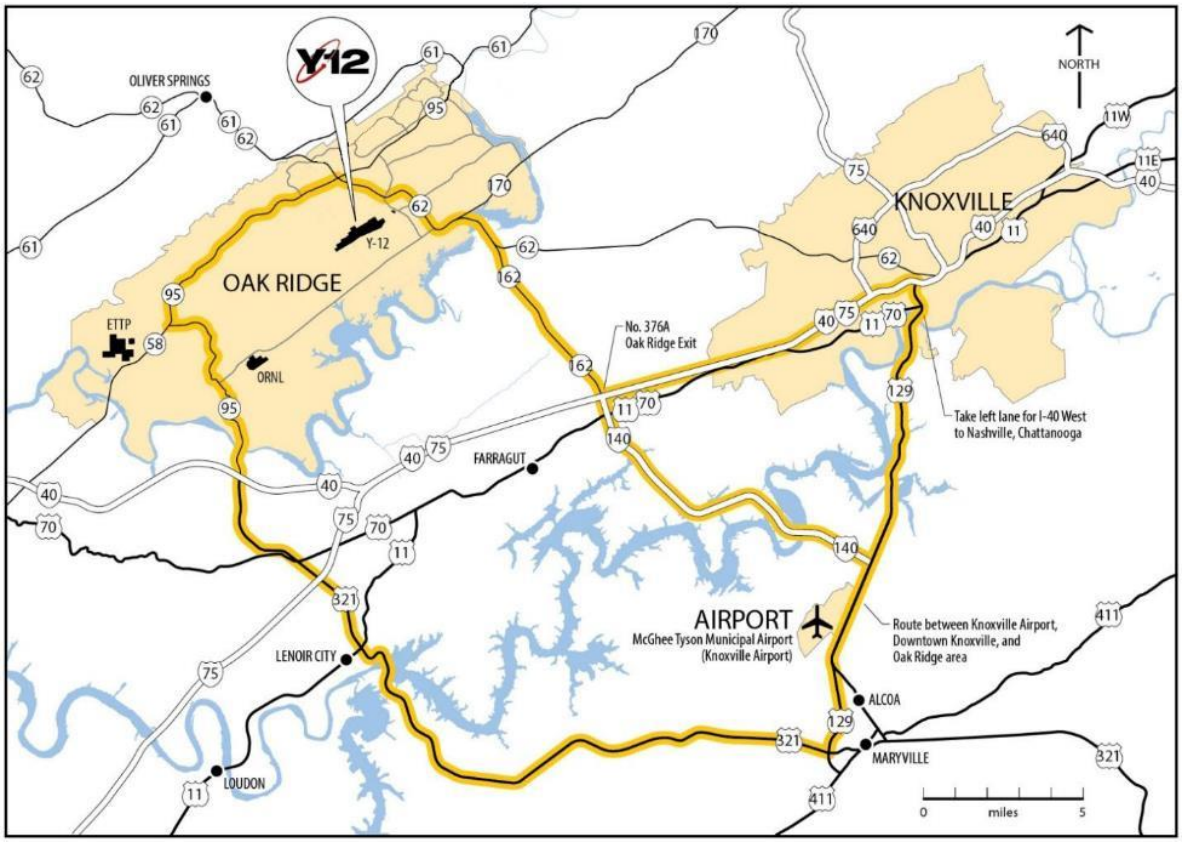


Figure 1-1. Location of Y-12

1.3 Proposed Action Evaluated in this Environmental Assessment

NNSA is proposing to conduct supplemental DU manufacturing in three commercial facilities: (1) 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; (2) the Manufacturing Sciences Corporation (MSC) facility, located at 804 S. Illinois Avenue in Oak Ridge, approximately 0.7 miles northeast of Y-12; and (3) the Aerojet Ordnance Tennessee (AOT) facility, located at 1367 Old State Route 34 in Jonesborough, Tennessee, approximately 100 miles east of Y-12 (see Figures 1-2 and 1-3).

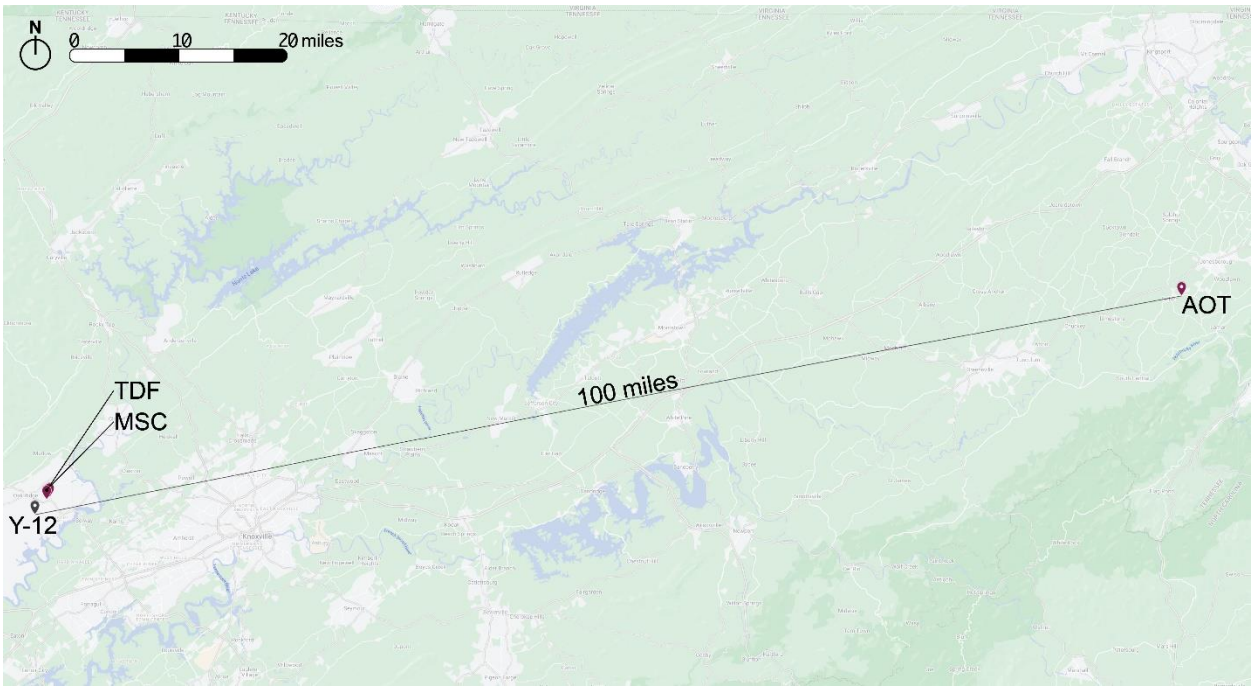


Figure 1-2. Locations of the Commercial Facilities Considered in this EA Relative to Y-12

Each of the three commercial facilities currently conduct DU operations for the commercial industry and/or in support of federal agencies such as NNSA and/or the Department of Defense (DoD). To support supplemental DU manufacturing when needed, minor internal upgrades would be required at each of the three commercial facilities and GFE would be installed at the TDF and the MSC facility. External changes at each of the three commercial facilities would be required to support construction activities, utility upgrades, and/or installation of storage facilities. Less than one acre of land could be disturbed at each commercial site. Operations, which could begin as soon as 2024 under a service agreement, would be conducted by commercial personnel, with oversight from Y-12 personnel. A detailed description of the Proposed Action is presented in Section 2.

1.4 Scope of this Environmental Assessment and Organization

This EA analyzes the potential environmental effects of NNSA's proposal to perform DU manufacturing at the TDF, the MSC facility, and the AOT facility. 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.

Figure 1-3. Locations of the TDF and the MSC Facility

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 July 2024, 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 notified the City of Oak Ridge and the Tennessee Department of Environment and Conservation (TDEC) that the Draft EA was available for review. NNSA also announced the availability of the Draft EA in local newspapers and provided an email address and postal address where comments could be submitted. NNSA is providing an approximately 30-day comment period on the Draft EA.

2 PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

This section describes the three commercial facilities being considered by NNSA to conduct supplemental DU manufacturing. All three facilities currently conduct DU operations, have infrastructure and expertise in-place to expand operations, and are located in Oak Ridge (or within a two hour driving distance) to conduct supplemental DU manufacturing for NNSA in a timely and efficient manner. Section 2.2 describes the existing commercial facilities and the construction activities that would be needed at each facility to expand operations. Section 2.3 describes the DU manufacturing operations that would occur at the three commercial facilities. Section 2.4 discusses the No-Action Alternative. Lastly, Section 2.5 explains why other alternatives (i.e., new facilities at Y-12, other existing facilities at Y-12, or other commercial facilities) were not considered reasonable alternatives for detailed analysis in this EA.

2.2 Construction Activities

2.2.1 Test and Demonstration Facility (TDF)

The TDF (Figure 2-1) is 51,000 square feet in size, and primarily supports research and development (R&D) activities for various material processing technologies. 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. TDF consumes approximately 462,000 kilowatt-hours of electricity monthly and uses approximately 1,440,000 gallons of water annually, primarily for cooling water. There are currently approximately 25 operational workers at the TDF (CNS 2024).

To support the DU manufacturing mission, TBE would use existing and additional installed GFE,[4] and utility systems would be upgraded/replaced. To support equipment installation, minor changes to the exterior walls of the TDF would be required. Externally, a storage building would be constructed within the TDF property, with disturbance of less than one acre of land. The construction work would include: (1) tree and shrub removal/disposal; (2), stripping up to 6 inches of topsoil at the ramp and pad areas and redistributing around the perimeter of the pad; (3) constructing a crushed limestone ramp and a concrete pad; (4) seeding and strawing of the entire disturbed area with grass; (5) procurement and placement of refrigerated and unconditioned intermodal containers; and (6) installing power to the intermodal containers and perimeter lighting. A grading permit would be obtained from the City of Oak Ridge Codes Enforcement Department (CNS 2024).

All construction activities would be managed and performed by TBE or TBE subcontractors and funded by NNSA. A peak construction workforce of 20 would be required, with construction activities expected to be completed in 12 months. Although construction activities would occur in 2027, DU operations using existing research and development prototype equipment could begin

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

[4] GFE facility equipment could include furnaces, melters, manufacturing technologies, powder production technologies, welders, monitors, detectors, probes, and fork lifts.

in 2025, before construction occurs (CNS 2024). DU manufacturing operations are discussed in Section 2.3.

Figure 2-1. Test and Demonstration Facility in Oak Ridge, Tennessee

2.2.2 Manufacturing Sciences Corporation (MSC) Facility

The MSC facility (Figure 2-2) is 160,000 square feet in size within two co-located buildings. The MSC facility provides commercial services to government and private sector companies for DU and DU alloy feedstock production, casting, milling/conversion, machining, welding and other metal fabrication and inspection technologies. MSC has an active stormwater permit from TDEC and an active industrial wastewater permit from the City of Oak Ridge. MSC facility operations do not require a NPDES permit. MSC maintains a permit from TDEC to operate air contaminant sources and has 12 high efficiency particulate air (HEPA) filter banks on site, each equipped with 95 percent efficient pre-filters and certified 99.97 percent efficient HEPA filters. The ventilation exhaust air released from each stack is continuously monitored and sampled. The samples are collected daily and analyzed with a low background counting system. The MSC facility consumes approximately 350,000 kilowatt-hours of electricity monthly and uses approximately 1,200,000 gallons of water annually, primarily for cooling water. The current workforce at the MSC facility is 48 employees (CNS 2024).

Under the Proposed Action, MSC would expand its services, using both existing equipment and GFE[5] to provide process qualification evaluations and/or supplemental DU production for Y-12 manufacturing. Less than 10 percent of the MSC facility would be used for GFE. Exterior changes would include the installation of a roll-up door, roof repairs, foundation improvements, concrete ramps, concrete slabs for utility support equipment and an additional cooling tower. Site work would include grading, trenching, utility installation, backfill, and stormwater management. Less than one acre of previously disturbed land, which currently supports utility equipment and is partially paved, could be re-disturbed. Utility upgrades would include electrical systems, heating, ventilation, and air conditioning (HVAC) system, inert gas connections, and an upgrade of the existing fire suppression system. A backup diesel generator would be installed to provide

[5] GFE facility equipment could include furnaces, drawbenches, bullblocks, die casting machines, and welders.

emergency electrical supply in the event of a loss of normal electrical supply. Construction would occur intermittently over a 5-year period beginning in 2026, with a peak construction workforce of about 30 people. Small-scale operations could begin in 2025 using existing facility equipment. About 10 operational workers may be added to the current MSC facility workforce (CNS 2024). DU manufacturing operations are discussed in Section 2.3.

Figure 2-2. MSC Facility in Oak Ridge, Tennessee

2.2.3 Aerojet Ordnance Tennessee (AOT) Facility

Aerojet Ordnance Tennessee (AOT), a wholly owned subsidiary of Aerojet Rocketdyne, is located in Jonesborough, Tennessee with over 200,000 square feet of processing area on 162 acres of land (Figure 2-3). The on-site facilities include a dedicated building for processing DU including machining, a dedicated building for powder metallurgy of refractory materials, a warhead machining and fabrication area, a metal parts machining and finishing area for munitions and aeronautical components, and a dedicated hand grenade body manufacturing line. To support the production efforts, AOT has a chemical laboratory, metallurgical laboratory, metrology laboratory, and a health physics laboratory. Interspersed within the metal manufacturing and machining facilities are assembly areas, non-destructive testing, and painting lines. AOT keeps its DU manufacturing separate from all other product lines and does not intersperse manufacturing between radioactive materials and non-radioactive materials. The AOT facility has been conducting pilot/bench scale research for approximately 40 years. The proposed new work addressed in this EA would entail higher volumes of material and would be production-oriented rather than research-oriented (CNS 2024).

Figure 2-3. AOT Facility in Jonesborough, Tennessee

The AOT facility is currently licensed by the State of Tennessee for unlimited quantities of DU and natural uranium processing. AOT has an active NPDES permit from TDEC and is authorized to discharge treated process wastewater through Outfall 001, non-contact cooling water and cooling tower blowdown through Outfall 002, and treated sanitary wastewater and shower water through Outfall 003. AOT also has an active stormwater permit. Limestone Creek receives all discharges from the AOT outfalls. AOT maintains a permit from TDEC to operate air contaminant sources and has HEPA filter banks on site, each equipped with 95 percent efficient pre-filters and certified 99.97 percent efficient HEPA filters. The ventilation exhaust air released is continuously monitored and sampled. The samples are collected daily and analyzed with a low background counting system. The AOT facility consumes approximately 500,000 kilowatt-hours of electricity monthly and uses approximately 2,400,000 gallons of water annually, primarily for cooling water. The current workforce at the AOT facility is 90 employees (CNS 2024).

Under the Proposed Action, AOT would expand its service to provide DU feedstock preparation for Y-12 manufacturing. In order to perform NNSA DU production work, AOT would be responsible for any additional state radiological licensing requirements and therefore any additional environmental reviews. All equipment in the AOT facility is Aerojet-owned and operated and no new GFE would be required to support Y-12 DU operations. There would be interior and external modifications to the facility and site. External modifications would include: a new exhaust stack, new hydrogen fluoride (HF) scrubber air intakes, a new access door, and a new chemical storage building constructed behind the process facility. Figure 2-4 shows the location where the proposed activities would occur within the AOT facility. The external modifications, which would occur near the operating area shown in Figure 2-4, would disturb less than one acre of previously disturbed land. Construction would occur in 2027-2028 and would require up to 40 workers on site during the 24-month construction period. Operations, which are planned to start in 2027, prior to the completion of construction, would require 10 additional employees (CNS 2024). DU manufacturing operations are discussed in Section 2.3.

Note: the yellow shaded area with the red star indicates where DU operations in support of Y-12 would occur.

Figure 2-4. DU Operational Area at the AOT Facility

2.3 DU Operations at the Commercial Facilities

DU manufacturing entails a variety of industrial processes, such as feedstock recycling and processing, alloying, casting, rolling, pressing, forming, machining, welding and other advanced manufacturing. The three commercial facilities are licensees of the Tennessee Department of Environment and Conservation (TDEC), Division of Radiological Health (DRH). Tennessee is a Nuclear Regulatory Commission (NRC) Agreement State, with the authority designated to DRH. The licenses for the three facilities are based on Rules of the Tennessee Department of Health and TDEC, Bureau of Environmental Health Services. In order to perform the NNSA DU work, TBE, MSC, and AOT would be responsible for obtaining any additional state radiological licensing and NPDES permit requirements. As discussed in Chapter 3, the three commercial facilities conduct operations in accordance with applicable regulatory requirements and permit requirements governing activities such as effluent discharges, air emissions, and radiological doses to workers and the public (CNS 2024).

In general, the operations in each of the commercial facilities under this Proposed Action would be similar in nature to existing operations. There would be no notable changes in effluent discharges and air emissions compared to current operations and/or allowable permit limits. Worker radiological exposures are not expected to change. Although additional wastes (low-level radioactive [LLW], hazardous, and non-hazardous) would be generated, the waste quantities would not be notably different than current waste generation and would be managed/disposed of at existing waste management facilities. The potential impacts of accidents would not change at the TDF and MSC facility. At the AOT facility, there would be new hazards associated with purification/wet chemistry operations and fluorination. Transportation of DU feedstock and products would increase between the commercial facilities and DOE facilities. There would not be notable changes in employment at any of the commercial facilities, although Y-12 workers would provide oversight to commercial workers at the TDF and the MSC facility to ensure manufacturing meets quality and technical requirements. Electricity and water requirements would increase at some facilities to support additional equipment and increased activities (CNS 2024). Table 2-1 displays the DU manufacturing operational requirements at the TDF, the MSC facility, and the AOT facility.

Table 2-1. Operational Requirements for DU Manufacturing

	Consumption/Use at TDF	Consumption/Use at MSC Facility	Consumption/Use at AOT Facility
Additional Operational Workers	0	10	10
Additional Electricity Use (kilowatt-hours/year)	2,400,000	3,900,000	2,100,000
Additional Water Use (gallons/year)	0	1,500,000	28,000
Additional Wastewater (gallons/year)[a]	0	62,500	62,500
Change in facility air emissions	None	None	None
Additional worker dose (millirem/year [mrem/yr])	0	1,360 (136 mrem/yr to 10 workers)	860 (86 mem/yr to 10 workers)
Additional shipment of DU feedstock and/or product	50/year (Y-12 - TDF)	50/year (Y-12 - TDF) 50/year (MSC - TDF)	14 (Portsmouth. Ohio - AOT) 15 (AOT - Y-12)
Additional accident risks compared to current operations	No	No	Yes. Purification/wet chemistry operations and fluorination add new hazards.
Waste Generation			
Additional low-level radioactive waste (LLW) (yd^3/year)	1	50	15
Additional hazardous waste (gallons/year)	110 gallons (one 55-gal drum every 6 months)	110 gallons (one 55-gal drum every 6 months)	2,860 gallons (one 55-gal drum/week)
Additional hazardous waste (shipments/year)	2	2	12
Additional nonhazardous waste (tons/year)[b]	0.5	4.25	4.25

a. Based on wastewater generation of 25 gallons/person/day.

b. Based on generation of 3 pounds of nonhazardous waste/person/day. Nonhazardous process wastes are estimated at 0.5 tons/year at the TDF, MSC, and AOT facilities.

Source: CNS 2024.

2.4 No-Action Alternative

Under the No-Action Alternative, NNSA would continue to perform DU manufacturing in existing facilities at Y-12. However, because those facilities do not currently have the required DU manufacturing capacity, if additional capacity is not established, NNSA would not be able to meet its mission requirements (NNSA 2023a, CNS 2024).

2.5 Alternatives Considered but Eliminated from Detailed Analysis

Upgrade/Replace Existing Facilities at Y-12 for the DU Manufacturing Mission. DU operations are currently performed in the 9215 Complex (Buildings 9215, 9996, 9998, and 9212 A-2 Wing), and the 9201-05N/W Complex. Many of these facilities are more than 50-70 years old and would require significant upgrades or replacement. Although NNSA is planning to construct a new Depleted Uranium Manufacturing Complex in the future, such a new facility would not be operational until the 2040s or later and would not meet NNSA's current stockpile requirements in the interim. Because the schedule associated with upgrading or replacing the

existing DU manufacturing equipment and infrastructure at Y-12 would not meet current requirements, this alternative was deemed to be unreasonable and eliminated from detailed analysis (NNSA 2023a, CNS 2024).

Utilize Other Existing Facilities at Y-12 for DU Manufacturing. Other existing facilities at Y-12 have on-going missions that cannot be displaced, do not possess excess space needed for the DU manufacturing mission, and/or do not have service life that would support the mission over the next decade. Consequently, this alternative was deemed to be unreasonable and eliminated from detailed analysis (NNSA 2023a, CNS 2024).

Use Other Commercial Facilities for the DU Manufacturing Mission. All three of the commercial facilities under consideration by NNSA in this EA currently conduct DU operations, have the infrastructure and expertise in-place, and are located at Oak Ridge (or within a two hour driving distance) to conduct DU manufacturing for NNSA in a timely and efficient manner. NNSA did not identify any other existing commercial facilities in the Oak Ridge area that possess the same level of attributes as the TDF, the MSC facility, and AOT facility for supporting the DU manufacturing mission (NNSA 2023a, CNS 2024).

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 at, and in the vicinity of Y-12 and the three commercial facilities. It 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 DU 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 Y-12 site, the commercial facilities sites, 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 Y-12 site, the commercial facilities sites, 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 Y-12 site, the commercial facilities sites, and adjacent areas.
- **Water resources:** surface-water and groundwater features, water quality, and water use. The ROI for water resources is the Y-12 site, the commercial facilities sites, 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 and Washington 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 Y-12 site, the commercial facilities sites, 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 Y-12 site, the commercial facilities sites, 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: (1) a four-county area in Tennessee comprised of Anderson, Knox, Loudon, and Roane counties where a majority of the Y-12 workforce resides[6]; and (2) a three-county area in Tennessee comprised of Washington, Sulivan and Greene counties.
- **Waste management:** solid waste generation and management practices. The ROI for waste management is the Y-12 site, the commercial facilities sites, and off-site 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 off-site members of the public.
- **Transportation:** the existing transportation network (i.e., roads) in the areas of Y-12 and the AOT facility to facilitate analysis of traffic effects locally; and the transportation network (i.e., roads) to facilitate analysis of transporting of feedstock, products, and wastes between DOE sites, the commercial facilities, and off-site waste management facilities.
- **Infrastructure:** utilities, energy, and site services, including capacities and demands at Y-12 and the commercial sites.

3.2 Land Use

This section provides a regulatory overview and analysis of the existing land use conditions and the potential impacts of the Proposed Action. The Proposed Action encompasses three sites situated in two distinct Tennessee locations: TDF and MSC in Oak Ridge, Anderson County, and AOT in Jonesborough, Washington County. Y-12, which is located on the Oak Ridge Reservation (ORR), is included in the analysis because it is the location of the No-Action Alternative.

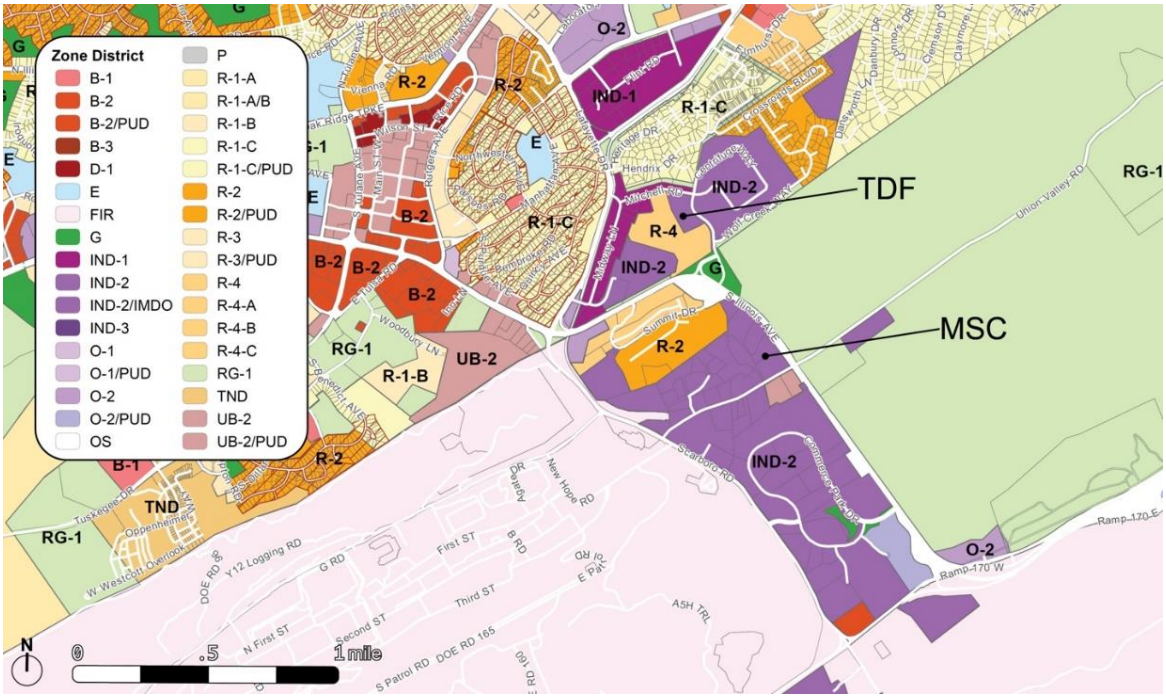
3.2.1 Affected Environment

Y-12, TDF, and the MSC Facility. Located in Anderson County, the City of Oak Ridge lies within the Great Valley of Eastern Tennessee between the Cumberland and Great Smoky Mountains and is bordered on two sides by the Clinch River. The Cumberland Mountains are 10 miles to the northwest; and the Great Smoky Mountains are 32 miles to the southeast. The City of Oak Ridge is intrinsically tied to the ORR and Y-12. The ORR was established in 1943 as one of the three original Manhattan Project sites. 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 remain undeveloped in a natural state. Approximately 20,000 of those 25,000 acres are designated a DOE National Environmental Research Park, an international biosphere reserve, and part of the Southern Appalachian Biosphere Cooperative. Y-12 is located

[6] Because Y-12 employs over 10,000 people, NNSA decided that a larger socioeconomic ROI was appropriate compared to the smaller ROI chosen for the AOT facility, which only employs 90 people.

within the northern portion of ORR. Y-12 spans 811 acres in the Bear Creek Valley, 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 managed by various DOE offices. While modernization/transformation activities have reduced the footprint of operating facilities, Y-12 remains a highly developed area. Nearly 600 of the 800 acres at Y-12 are considered a high security boundary area that is enclosed by perimeter security fences.

The TDF and the MSC facility are located just outside of the ORR and Y-12 within the City of Oak Ridge's planning jurisdiction. Figure 3-1 shows the city's zoning map highlighting the location of the two sites in relation to each other and to Y-12 (shown in pink on the figure). Both sites are located in the City of Oak Ridge's Heavy Industrial Zoning District[7] (IND-2, shown in Dark Purple on Figure 3-1). 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. The IND-2 district is typically appropriate to areas that are more distant from residential areas and have extensive rail or shipping facilities (Oak Ridge 2022).



Source: Oak Ridge 2023.

Figure 3-1. Zoning Designation for the TDF and MSC Facility

There is a diverse mix of land uses surrounding TDF and MSC. The closest land uses are:

[7] The City of Oak Ridge defines the Industrial-II (IND-2) zoning district as: general industrial district 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.

- Residence: approximately 700 feet to the north at Hendrix Drive;
- Church: New Life Church of the Nazarene, approximately 1,800 feet to the west at Lafayette Drive;
- School: Woodland Elementary School, approximately 2,800 feet to the west at Manhattan Avenue;
- Nursing home: Diversicare of Oak Ridge, approximately 4,200 feet to the northeast at Elmhurst Drive;
- Daycare: Oak Ridge Early Head Start, approximately 1 mile to the northwest at Oak Ridge Turnpike.

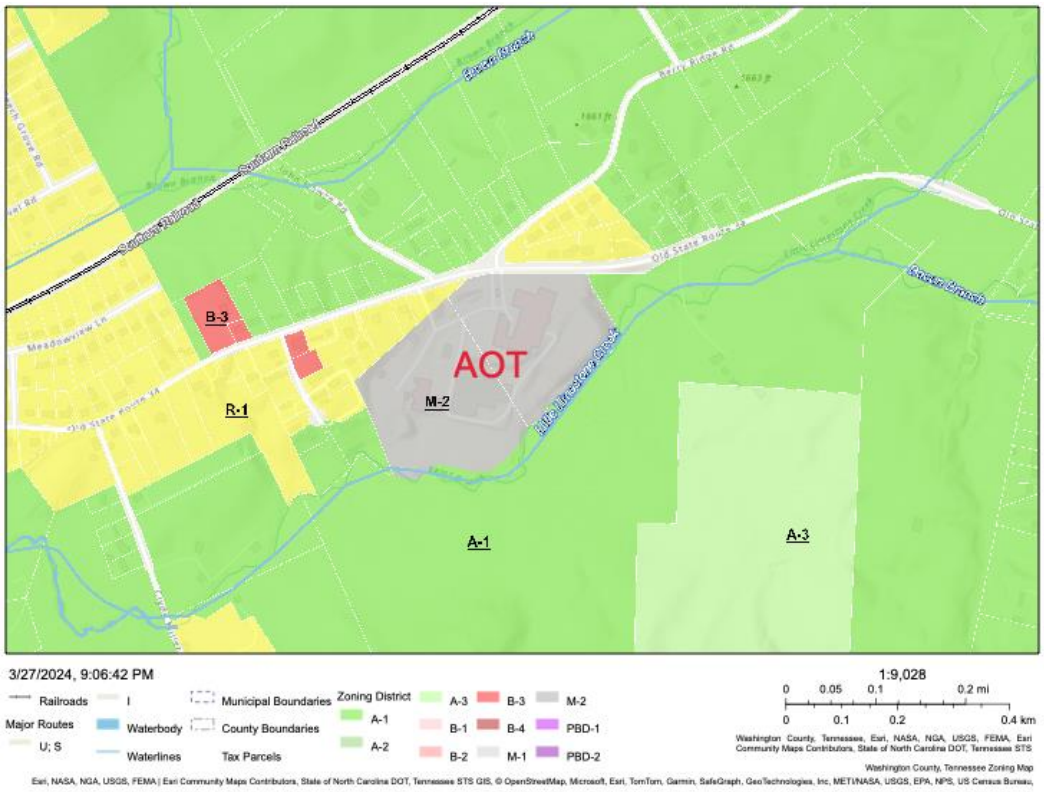
AOT Facility. Jonesborough is situated in the northeastern corner of Tennessee in Washington County, roughly 100 miles east-northeast of Oak Ridge. Spanning approximately five square miles, it is a small municipality. The heart of its commercial activity lies along Old State Route 34, also known as Old Tennessee 34. The town occupies a location where the watersheds of the Watauga River and the Nolichucky River converge, nestled within the same Appalachian Ridge-and-Valley Province as Oak Ridge. Jonesborough shares a common topography and geography with Oak Ridge, featuring a similar visual landscape.

The AOT facility is located outside of the Town of Jonesborough's planning influence, approximately 4 miles from downtown Jonesborough. Figure 3-2 shows Washington County's zoning map highlighting the location of the AOT facility (labeled and shown in grey on the figure). The AOT facility is located in the Washington County's High-Impact Use District (M-2).[8]

The two primary land uses surrounding the AOT facility are agricultural to the south and low-density residential to the north. The closest land uses to the sites are:

- Residence: multiple residences abutting the site;
- Park: Telford Ruritan Ball Field, one mile southwest at Telford New Victory Road;
- Church: Telford Missionary Baptist Church, approximately 3,600 feet west at Old State Route 34;
- School: David Crockett High School, one mile northeast at Old State Route 34;
- Nursing home: Four Oaks Healthcare Center, approximately 3 miles northeast at Persimmon Ridge Road;
- Daycare: Learn & Grow Childcare Center, approximately 5 miles northeast at Boones Creek Road.

[8] Washington County defines the High-Impact Use District (M-2) as: areas which, unless closely regulated, might cause a detrimental effect upon and be injurious to surrounding areas. This district allows for heavy type industries and uses, noise, odor, dust and other objectionable conditions (Washington County 2024b).



Source: Washington County 2024a.

Figure 3-2. Zoning Designation for the AOT Facility

3.2.2 Proposed Action Effects

Key metrics in the analysis of land use include: (1) number and footprint of new facilities and infrastructure; (2) amount of land disturbance and the conversion of currently undeveloped land; and (3) a qualitative analysis of consistency with current land use plans, classifications, and policies. The Proposed Action includes DU manufacturing at the three commercial facilities, as described in Section 3.2.1.

Construction. All three facilities would require the installation of equipment, upgrades to utility systems, interior improvements, and moderate exterior changes (e.g. concrete slabs for utilities, cooling towers, doors, exhaust stacks, foundation repairs, ramps, and roof repairs). Small annex and storage facilities would be built, but no wholly new facility construction would be required under the Proposed Action. The exterior construction required to support the DU mission would disturb less than one acre of land at each site. Construction of the Proposed Action would result in negligible short-term adverse effects. These effects would stem from additional land clearing and construction on previously disturbed land, including areas for temporary construction laydown and parking. At each facility, less than one acre of land per site would be disturbed, which represents a negligible amount of the total land area at each project site.

Operation. During operations, existing land use at each site would remain unchanged and use of the land for DU manufacturing would be consistent with the present-day and historic uses of the facilities. The Proposed Action would not change the current or future land use designation.

Because activities represent a continuation of existing land uses, they would be compatible with existing and approved future land uses at each site. The enduring land disturbance and any increase in square footage of facilities would be negligible. There would be no conflicts with established land uses on-site and off-site, no new land acquisition, and no conflicts with land-use control plans.

3.2.3 No-Action Alternative

Under the No-Action Alternative, NNSA's DU manufacturing mission would not be conducted at any of the three off-site facilities. DU operations would continue uninterrupted at Y-12. Land use resources would remain unchanged compared to existing conditions.

3.3 Visual Resources

Visual resources are natural and man-made features that give a particular "landscape" (visible features of an area of land) or "viewshed" (view on an area from a vantage point) its character and aesthetic quality. Special consideration is given to actions within visually sensitive locations and viewpoints from visually sensitive locations. An example of a visually sensitive location would be a protected area, such as a national park, national monument, or historic district.

3.3.1 Affected Environment

Y-12, TDF, MSC Facility, and AOT Facility. For the purpose of rating the scenic quality of the three sites 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 each site is consistent with VRM Class IV which is used to describe highly developed areas with major modifications to the landscape. This visual classification aligns with the industrial zoning of these districts.

Y-12 is a highly developed site with an industrial appearance. The TDF and MSC facility are located less than one-mile to the north of Y-12 in a developed industrial park. AOT is situated in a less developed rural setting, enveloped by farmlands and low-density residential developments. All three commercial facilities are unremarkable from a visual perspective. As shown on Figures 2-1 through 2-3, they are typical of purpose-built industrial facilities with design and materials chosen for utilitarian function over form.

The lands surrounding TDF and MSC 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. TDF and MSC do not abut any residential developments, however there are homes that boarder 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. MSC is similarly screened by vegetation though there are sightlines from vehicular traffic along South Illinois Avenue. The lands immediately across South Illinois Avenue from MSC are state government lands, housing the University of Tennessee Arboretum. These lands are considered a visually sensitive location for the purpose of this analysis. The lands in the immediate vicinity of the AOT

facility are rural and agrarian in nature. Farmlands surround the site to the south and low-density residential to the north. There are sightlines from these residences and farmland to the AOT facility, but no visually sensitive locations were identified in the surrounding area.

3.3.2 Proposed Action Effects

Construction. Construction activities would result in short-term, less-than-significant adverse visual effects because of the presence of construction equipment, support structures, and infrastructure in various stages of construction. Those activities would not be out of character for an industrial installation, and site visitors and employees observing the construction would find it consistent with past construction activities. Post-construction, equipment, and temporary construction office trailers (if any) would be removed, and construction laydown areas would be restored. Construction activities at the MSC facility would have no impacts on the University of Tennessee Arboretum as sightlines between the trail system and the facility are screened by vegetation, distance, and topography.

Operations. During steady-state operations, the visual landscape as described in Section 3.3.1 would not change appreciably because of the previously developed nature of the site. The proposed improvements are predominantly interior renovations and would not be noticeable to the casual viewer once complete. The Proposed Action would occur within the context of similar development and would mirror the improvements that have historically occurred. They would feature layouts, designs, and materials in keeping with the highly developed nature of the existing built environment. Each site would remain a highly developed area with an industrial appearance, and there would be no change to the VRM Class IV ratings.

3.3.3 No-Action Alternative Effects

Under the No-Action Alternative, NNSA would not proceed with the Proposed Action and there would be no changes at the off-site commercial facilities. NNSA would continue to perform DU manufacturing in facilities at Y-12, but would not be able to meet mission requirements. Visual resources would remain unchanged compared to existing conditions.

3.4 Air Quality

3.4.1 Affected Environment

Y-12, TDF, MSC Facility, and AOT Facility. 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 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*. 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). "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 and Washington County, which are used as the ROI for the air quality analysis. According to EPA, both Anderson County and Washington County are in attainment for all criteria pollutants (EPA 2023a). Anderson County and Washington County emissions were obtained from the latest U.S. Environmental Protection Agency (EPA) National Emissions Inventory (NEI), as shown in Tables 3-1 and 3-2. The 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.

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.

Table 3-2. Baseline Criteria Pollutant Emissions for Washington County, TN (2020)

Anderson County	Criteria pollutant (tons/year)[a]					
	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOCs
Mobile & Area Sources	12,760	1,844	2,177	764	21	8,609
Point Sources	164	70	35	34	1.7	175
Totals:	12,924	1,914	2,212	798	23	8,784

b. 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 Washington County were listed as 0.0 tons per year.

Source: EPA 2023b.

Airborne discharges from Y-12 and off-site commercial facilities are subject to regulation by the EPA and the TDEC. Permits issued by the State of Tennessee are the primary vehicle used to convey the clean air requirements that are applicable to Y-12 and the off-site commercial facilities. New projects are governed by construction permits and modifications to the existing operating permits, and eventually the requirements are incorporated into those operating permits. 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. MSC maintains a permit to operate air contaminant sources from TDEC, permit number 078606. AOT also maintains a permit to operate air contaminant sources from TDEC, permit number 079430.

Y-12 and the commercial sites have comprehensive air regulation compliance assurance and monitoring programs to ensure that airborne emissions satisfy all regulatory requirements and do not adversely affect ambient air quality. Common air pollution control devices employed include exhaust gas scrubbers, fabric filters, and/or HEPA filtration systems designed to remove contaminants from exhaust gases before release to the atmosphere. The releases of non-radiological contaminants into the atmosphere at Y-12 and the commercial sites occur as a result of plant production, maintenance, waste management operations, and steam generation (at Y-12 only). Most process operations are served by ventilation systems that remove air contaminants from the workplace. 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. Radiological emissions are addressed in Section 3.11.

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, Washington County, and the State of Tennessee, are presented in Table 3-3.

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

Area	Greenhouse Gases (million metric tons/year)
	CO_2e
Anderson County	1.5
Washington County	1.6
Tennessee	83.3

Sources: EIA 2021a, EPA 2023b.

3.4.2 Proposed Action Effects

There would be minor adverse effects to air quality. Short-term effects, which would be due to generating airborne dust and other pollutants during construction, would be minimal because less than one acre of land could be disturbed at each commercial site. The only long-term adverse effects would be due to personnel commutes during operations. However, because a maximum of 10 additional employees would be required at any of the commercial facilities, the additional emissions from employee commuting would be minor. 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. Construction air permits from TDEC would not be required at any of the commercial facilities. Because less than one acre of land could be disturbed at each commercial site, no notable air emissions associated with construction are expected; however, construction emissions were estimated for construction equipment and worker trips (Table 3-4).

Table 3-4. Maximum Annual Air Emissions at any of the Commercial Sites 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
Source: derived from NNSA 2021b.

During construction, the owners of the commercial facilities would take reasonable precautions to prevent fugitive dust from becoming airborne, although this is expected to be minimal given that the area to be disturbed is less than one acre. 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.

Operation. Operational emissions were estimated at the commercial sites for commuting workers. No new stationary sources of air emissions would be associated with the Proposed Action, with

the possible exception of a backup emergency diesel generator.[9] Although both Anderson County and Washington County are 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. Radiological emissions are addressed in Section 3.11.

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
Washington County, Tennessee	1.6
Proposed Action	0.0002 (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: Calculated using the EPA "Greenhouse Gas Equivalencies Calculator," available online at https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results. Conservatively assumes that the maximum emissions associated with commuting workers for construction and operations occur in same year.

Sources: EIA 2021a, 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-

[9] All three commercial sites already have existing backup emergency diesel generators. As such, there would be no additional emissions associated with the Proposed Action. 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 Effects

Under the No-Action Alternative, NNSA would not proceed with the Proposed Action and there would be no changes at the off-site commercial facilities. NNSA would continue to perform DU manufacturing in facilities at Y-12, but would not be able to meet mission requirements. Air quality would be unaffected compared to levels discussed in Section 3.4.1.

3.5 Noise

3.5.1 Affected Environment

Y-12, TDF, MSC Facility, and AOT Facility. 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
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	TV audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator

Outdoor	Sound Level (dBA)	Indoor
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 the 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, TDF, and MSC 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. 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). Washington County does not have any noise ordinances in effect.

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 (Oak Ridge 2022), 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 and MSC facility, the nearest sensitive noise receptor is the New Life Church of the Nazarene, which is located approximately 1,800 feet to the west at Lafayette Drive. The nearest residence to the TDF and MSC facility is approximately 700 feet to the north at Hendrix Drive. At the AOT facility, the nearest sensitive noise receptor is the Telford Missionary Baptist Church, which is approximately 1 mile southwest at Telford New Victory Road. The nearest residences to the AOT facility abut the site. At Y-12, the nearest sensitive noise receptor from DU manufacturing facilities is the Oak Ridge Schools' Preschool at Scarboro Park, which is

approximately 4,030 feet away, to the northwest. The nearest residence is approximately 3,230 feet to the northwest. There have been no known noise complaints associated with Y-12, TDF, MSC, or AOT operations in the recent past.

3.5.2 Proposed Action Effects

Construction. Construction activities would consist of site preparation and both internal and external construction at the commercial facilities. 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. At all three commercial facilities, there would be minor external construction, and noise levels could exceed 64 dBA at any receptor within a distance of 1,000 feet.

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 and MSC facility are located in the City of Oak Ridge's Heavy Industrial Zoning District, which is not considered to be a noise sensitive area. Although construction-related noise effects would be minor at all of the commercial sites, 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 at any of the commercial sites.

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 impacts from current operations, as discussed in Section 3.5.1.

3.6 Water Resources

3.6.1 Affected Environment

3.6.1.1 Groundwater

Because of the abundance of surface water and its proximity to the points of use, very little groundwater is used in vicinity of the TDF and MSC. In Oak Ridge, 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 the TDF and MSC are south of the Clinch River (NNSA 2011). In vicinity of the AOT in Jonesborough, potable water is obtained from the Nolichucky River.

Y-12. The Y-12 aquitard is comprised of six geologic formations which collectively have low permeability and low transmissivity. 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. More than 200 sites have been identified at Y-12 that represent known or potential sources of contamination as a result of past waste management practices (NNSA 2011).

TDF. Groundwater at the TDF is expected to generally flow northwest and west, following the topography towards a tributary of the East Fork Poplar Creek (EFPC) (Figure 3-3). The TDF site is underlain by the Rome Formation, which consists of shale and siltstone with beds of fine-grained sandstone. This formation does not readily convey or yield groundwater, and is considered an aquitard. There are no cleanup sites located within one-mile of the TDF, as mapped by the EPA Cleanups in My Community (CIMC) Map (EPA 2024). There is no known groundwater contamination at the TDF site. The water table is expected at greater than 80 inches below grade (USDA 2023).

MSC Facility. Groundwater at the MSC facility is expected to generally flow south and southeast, following the topography towards a tributary of Scarboro Creek (Figure 3-3). The MSC site is underlain by the Nolichucky Shale and Maryville Limestone, which consists of calcareous shales and shaly limestones. These formations are considered aquitards. There are no cleanup sites located within one-mile of the MSC, as mapped by the EPA CIMC Map (EPA 2023). There is no known groundwater contamination at the MSC site. The water table is expected at greater than 80 inches below grade (USDA 2023).

AOT Facility. Groundwater at the AOT facility is expected to generally flow south towards Little Limestone Creek (Figure 3-3). The AOT site is underlain by the Knox Group including Jonesboro Limestone, which is characterized by dark bluish-gray, limestone, and numerous interbeds of dark-gray dolomite. Soil and groundwater contamination from past operations at the AOT facility has been remediated and is currently under a monitoring program. The water table is greater than 80 inches below grade near the facility buildings, but may be shallow, between 18 to 39 inches, near the Little Limestone Creek (USDA 2024).

3.6.1.2 Surface Water

In Oak Ridge, surface water draining from the TDF and MSC facility eventually reaches the Tennessee River via the Clinch River. The TDF and MSC facility lie within the Valley and Ridge Physiographic Province, which is composed of a series of drainage basins containing many small

streams feeding the Clinch River (NNSA 2011). The AOT, located approximately 100 miles northeast of Oak Ridge, is also within the Valley and Ridge Physiographic Province. Surface water from the AOT facility drains south to the Little Limestone Creek, which flows generally south-southwest and is a tributary of the Nolichucky River, which flows into the French Broad River, and eventually reaching the Tennessee River.

Y-12. 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, which forms the southern and western boundaries of the ORR (NNSA 2011). Y-12 discharges are covered under Tennessee NPDES permit (TN0002950) which requires annual monitoring of 20 representative outfalls for total suspended solids, pH, and flow. Additionally, selected outfalls are sampled for pollutants (NNSA 2021c).

TDF. There are no streams located near the TDF (USFWS 2024a). Current operations in the TDF do not result in the discharge of process water, and thus, do not require an NPDES permit. Non-contact cooling tower water is discharged to the sanitary sewer system as needed, which has been approved by the City of Oak Ridge.

MSC Facility. A tributary stream to Scarboro Creek is located on the western side of the MSC site (Figure 3-4) (USFWS 2024a). Current operations in the MSC do not result in the discharge of industrial waste water to surface water bodies, and thus, do not require a NPDES permit. However, this stream receives stormwater runoff from the site. MSC has an active Stormwater Permit (Tennessee Multi Sector Permit [permit number TNR050388]) from TDEC. In addition, MSC has an active Industrial Waste Water Permit (Permit number 9-91) from City of Oak Ridge for discharging treated waste water into the sanitary sewer system. MSC performs storm water sampling and sampling of treated process waste water before it is released to the sanitary sewer system. Relevant data including sample results are submitted to TDEC for storm water and the City of Oak Ridge for industrial waste water.

AOT Facility. Little Limestone Creek is located on the south side of the AOT site, and flows south to southwest to the Nolichucky River. Current operations in the AOT facility result in the discharge of treated waste water to Little Limestone Creek covered under Tennessee NPDES permit (TN0057983) for three permitted outfalls, 1,2, and 3. Treated process waste water is discharged via Outfall 1; non-contact cooling water and cooling tower blowdown is discharged via Outfall 2; and treated sanitary waste water and shower water is discharged via Outfall 3. In addition, Little Limestone Creek receives stormwater runoff from the site from three stormwater outfalls (A, B, and C), which is permitted under active Tennessee Stormwater permit (TNR051099). AOT samples stormwater runoff in accordance with the permit requirements. In addition, AOT samples treated waste water (process and sanitary) and non-contact cooling water before it is released to Little Limestone Creek in accordance with permit requirements. Relevant data including sample results are submitted to TDEC.

3.6.1.3 Wetlands

Wetlands are protected under Executive Order (EO) 11990 (42 FR 26961, May 24, 1977). In the City of Oak Ridge, wetlands occur at lower elevations, primarily in the riparian zones of headwater

streams and their receiving streams, as well as in the Clinch River embayments. In Jonesborough, wetlands are generally associated with streams and riparian areas and low-lying areas.

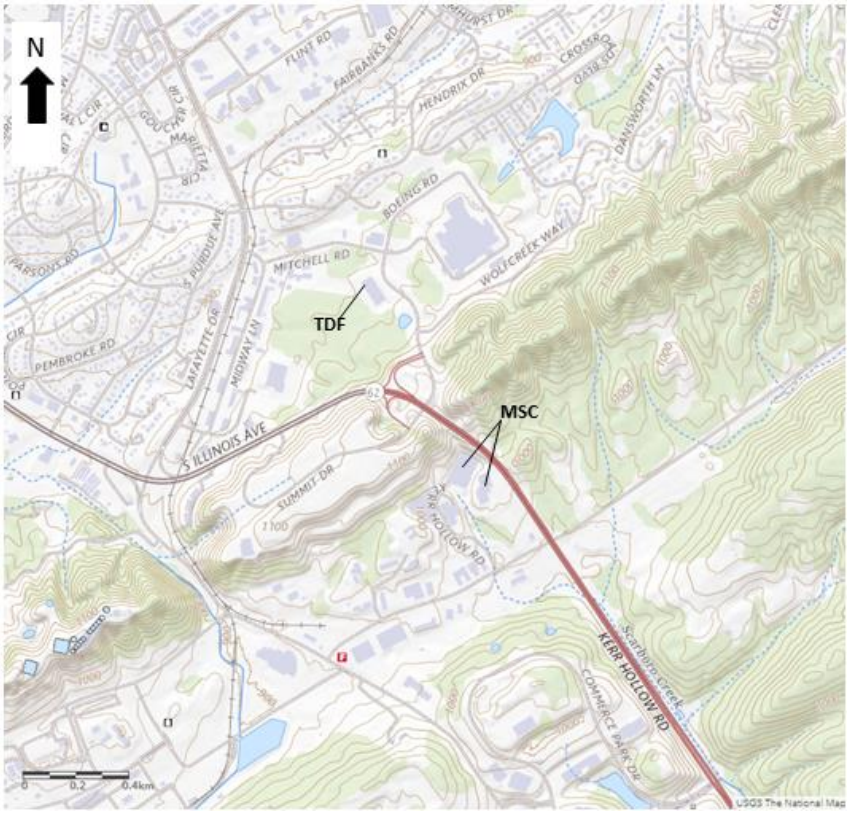


Figure 3-3. Surface Water Features near the TDF and MSC sites

Y-12. Wetlands exist on Y-12, with most classified as forested palustrine, scrub/shrub, and emergent wetlands. Wetlands occur across Y-12 at lower elevations, primarily in the riparian zones of headwater streams and their receiving streams (NNSA 2011).

TDF. According to the U.S. Fish & Wildlife Service (USFWS) National Wetland Inventory (NWI) Mapper, there are no wetlands near the TDF (USFWS 2024a).

MSC Facility. According to the USFWS NWI, there are no wetlands near the MSC facility (USFWS 2024a).

AOT Facility. According to the USFWS NWI, forested wetland may be associated with Little Limestone Creek and riparian area near the southern boundary of the AOT facility (USFWS 2024a).

3.6.1.4 Floodplains

A floodplain is defined as the valley floor adjacent to a streambed or arroyo channel that may be inundated during high water. DOE regulations (10 CFR Part 1022) consider the critical action floodplain to be those areas affected during a 500-year flood (with a 0.2-percent chance of

occurrence in any given year). The base floodplain is defined as the 100-year floodplain, which has a 1.0-percent chance of flooding in any given year.

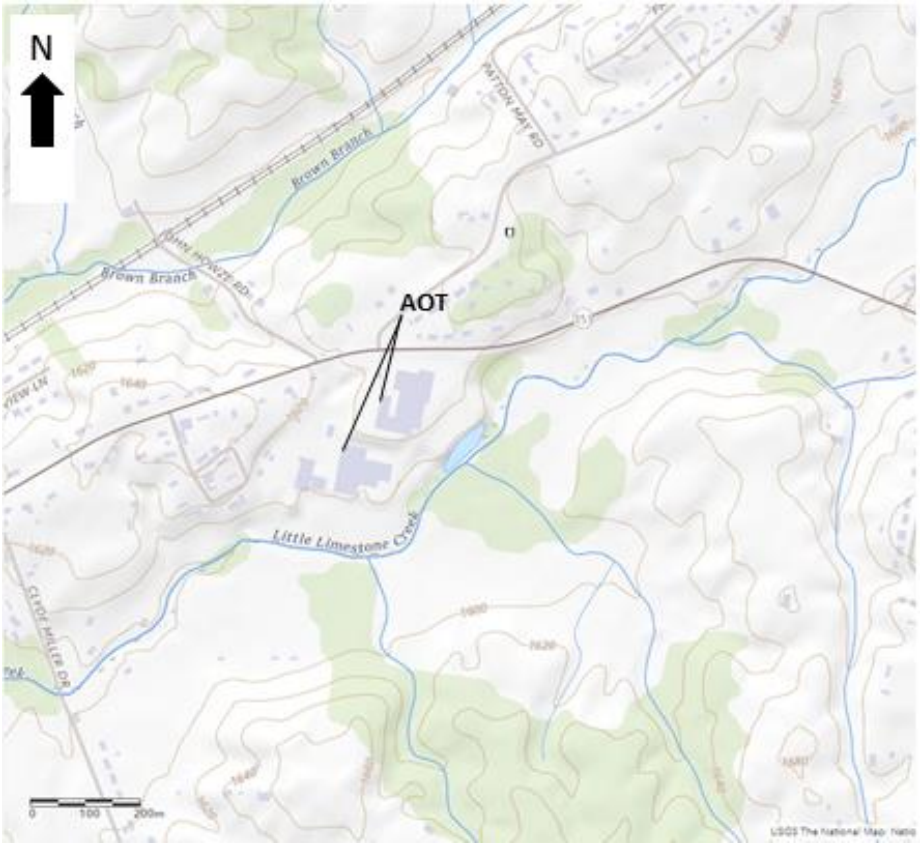


Figure 3-4. Surface Water Features near the AOT site

Y-12. Eastern portions of Y-12 lie within the 100- and 500-year floodplains of EFPC (NNSA 2011).

TDF. The TDF is not located within a floodplain. The TDF is located over 3,500 feet to the northeast of the 100- and 500-year floodplains associated with the EFPC (FEMA 2024).

MSC Facility. The MSC facility is not located within a floodplain. The MSC facility is located over 4,800 feet to the east of the 100- and 500-year floodplains associated with the EFPC (FEMA 2024).

AOT Facility. The AOT facility is not located within a floodplain. There are no 100- and 500-year floodplains in vicinity of the site (FEMA 2024).

3.6.2 Proposed Action Effects

Construction and Operation.

Groundwater. Groundwater would not be used as a water source. Groundwater resources would be protected from potential contaminant releases during construction and operations of facilities

under the Proposed Action. Potential contaminant sources could include construction materials; spills of hydraulic fluid, oil, and diesel fuel; and releases from transportation or waste handling accidents. The TDF, MSC, and AOT facilities would follow prevention and mitigation steps from their respective spill prevention, control, and countermeasures (SPCC) plans in the event of a hazardous material spill. Any spills would be contained and cleaned up in an appropriate manner under the SPCC.

As described in Section 3.6.1, waste water discharge and stormwater runoff from the sites would be subject to permit requirements. Potential impacts to groundwater quality from facility discharges of treated waste water and stormwater runoff would be minimized by complying with NPDES, Industrial Waste Water, and Stormwater permit limits and requirements.

No impacts to groundwater are anticipated from construction activities or normal facility operations at the TDF, MSC, and AOT facilities. Potential impacts to groundwater quality from effluent, or surface spills, are not expected during the manufacturing process. As such, facility operations would not be expected to contaminate the groundwater.

Surface Water. No impacts to surface water are anticipated from construction activities at the TDF, MSC, and AOT facilities. In general, site work would include grading, trenching, utility installation, backfill, and stormwater management to support modification to the existing facilities. In addition, a storage building would be newly constructed at the TDF and AOT facility. At each site, the area of soil disturbance is expected to be less than one acre on previously disturbed land. As such, a construction stormwater NPDES permit for discharges of stormwater associated with construction activities is not required. However, during construction, stormwater best management practices would be implemented to minimize the potential for stormwater pollution. Mitigation measures would 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.

As shown on Figures 3-3 and 3-4, a tributary to Scarboro Creek is located along the southwest boundary of the MSC facility, and Little Limestone Creek is located along the southern boundary of the AOT site. There are no streams near the TDF site. 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 off-site and to these streams. Installing and maintaining erosion controls around the perimeter of the construction footprint would contain disturbed site soils and reduce potential for off-site transport of sediment. The potential for off-site sediment transport would exist until disturbed areas are stabilized and revegetation is established.

During operations at the TDF, there would be no effluent discharges associated with DU manufacturing. Non-contact cooling water would continue to be discharged to the sanitary sewer, as described in Section 3.6.1. At the MSC facility, manufacturing discharges would not appreciably change, and would be adequately covered under the current Industrial Waste Water Permit for discharging treated wastewater into the City of Oak Ridge sanitary sewer system, as described in Section 3.6.1. MSC facility discharges are expected to remain within current permitted amounts, and permit modification would not be required. At the AOT facility, waste

water generated from operations would be treated and discharged as effluent from three outfalls to Little Limestone Creek. The existing NPDES permit would require modification to reflect the new DU activity. Approximately 24,000 gallons of treated effluent would be generated annually from DU manufacturing at the AOT facility.

During operations, impacts to stormwater quality and receiving streams from these sites is not expected. The MSC and AOT facilities would continue to meet their respective Stormwater Permit requirements. The AOT would modify its Stormwater Permit to reflect the new DU activity. The TDF site does not require a Stormwater Permit because there are no receiving streams near the site and because storage of hazardous materials is minimal.

During operations, the TDF, MSC, and AOT facilities would follow prevention and mitigation steps from their respective SPCC plans in the event of a hazardous material spill. Any spills would be contained and cleaned up in an appropriate manner under the SPCC plans. At the AOT facility, the DU manufacturing area (Building 300) was designed with permanent tertiary containment. Under normal operations, there is no scenario including a complete vessel failure while unattended for a long period of time that could lead to chemical spills escaping the containment boundaries of the building.

Wetlands. There are no wetlands within or adjacent to either the TDF or MSC facility. There would be no impacts to wetlands from construction and operations. As discussed in Section 3.6.1, forested wetland is associated with Little Limestone Creek along the southern boundary of the site. During construction both the wetland and Little Limestone Creek would be identified as resources to be protected, and soil disturbance would not take place within wetland area. Stormwater runoff from the site to wetland area and Little Limestone Creek is not expected to adversely impact these resources because the AOT facility would comply with Stormwater Permit requirements.

Floodplains. There are no floodplains within or adjacent to either TDF or MSC facility. The TDF and MSC facility are located over 3,500 feet to the northeast and over 4800 feet east, respectively, of the 100- and 500-year floodplains of the EFPC. There are no 100- and 500-year floodplains in vicinity of the AOT facility. There would be no impacts from flooding nor floodplain disturbance during construction and operations.

3.6.3 No-Action Alternative Effects

Under the No-Action Alternative, the Proposed Action would not proceed and there would be no changes to water resources from current operations, as discussed in Section 3.6.1.

3.7 Geology and Soils

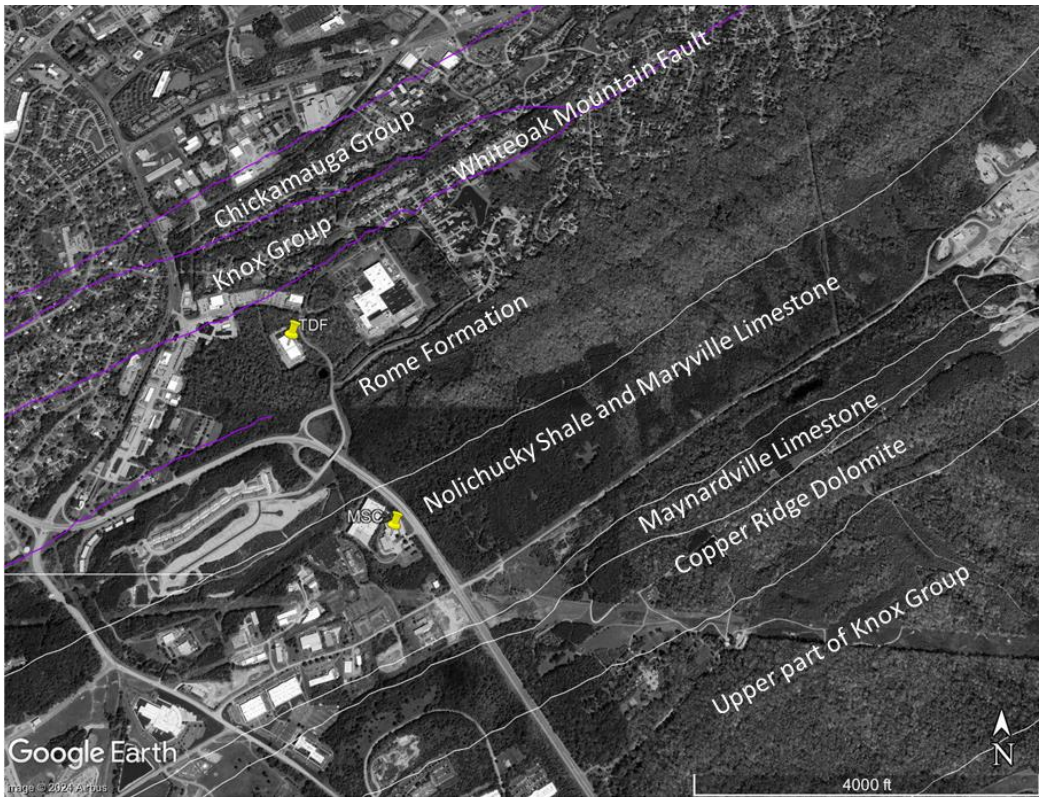
3.7.1 Affected Environment

3.7.1.1 Geology

***Y-12, TDF and MSC Facility*.** Y-12 and the TDF and MSC sites are located within 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).

The TDF is located within the Rome Formation, on the north side of Pine Ridge at an elevation of approximately 950 feet above mean sea-level (AMSL). The Rome Formation consists of massive-to-thinly bedded sandstones interbedded with minor amounts of thinly bedded, silty mudstones, shales, and dolomites. The MSC facility is located within Union Valley on the south side of Pine Ridge at an elevation of approximately 960 feet AMSL, and is underlain by the Nolichucky Shale and Maryville Limestone, which consist of calcareous shales and shaly limestones (USGS 2024a). Generalized bedrock geology for the TDF and MSC facility is shown in Figure 3-5.



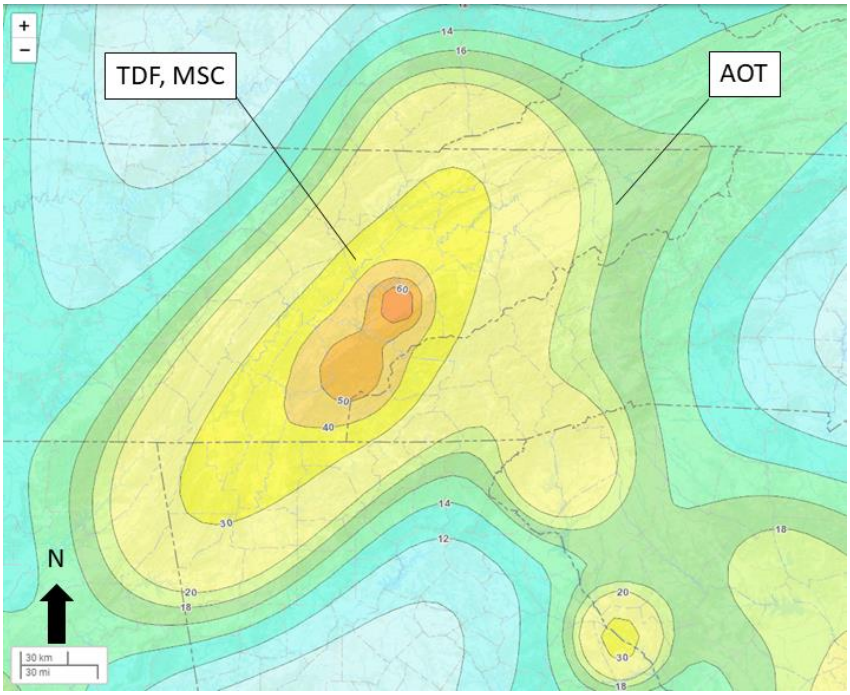
Source: USGS 2024a.

Figure 3-5. Generalized Bedrock Map Near the TDF and MSC Facility

The regional geology is complex as a result of extensive thrust faults and folds. The White Oak Mountain Thrust Fault located near the TDF and MSC facility, and other major faults are located in the vicinity (*see* Figure 3-5). Although major thrust faults are numerous, 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, 212 earthquakes have been recorded within 62 miles of the sites with the highest magnitude of 4.7 (USGS 2024b).

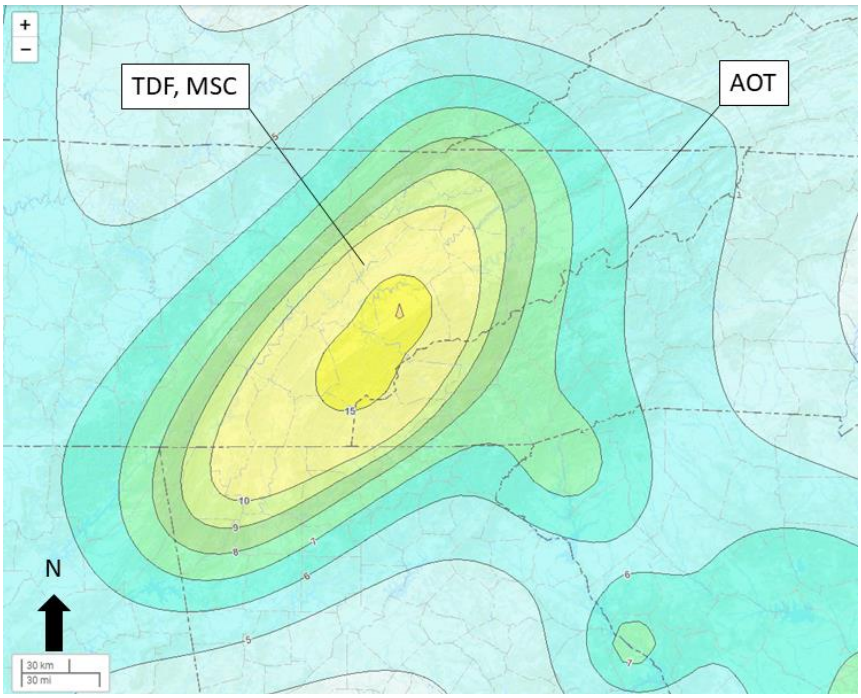
The U.S. Geological Survey (USGS) Earthquake Hazards Program's 2018 Long-term Model (USGS 2018) for the Conterminous United States shows earthquake ground motions for various probability levels across the United States. The USGS rates ground motions using peak ground acceleration, which is the maximum 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 TDF and MSC are 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 3-6 and 3-7). 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 in the Valley and Ridge Province. Surface evidence of karst development includes sinking streams (swallets) and overflow swallets, karst and overflow springs, accessible caves, and numerous sinkholes of varying size. Although present in the region, karst features have not been identified at the TDF or MSC facility.



Source: USGS 2018.

Figure 3-6. 2018 National Seismic Hazard Model for the conterminous United States Peak horizontal acceleration (percent of gravity) with a 2% probability of exceedance in 50 years



Source: USGS 2018.

Figure 3-7. 2018 National Seismic Hazard Model for the conterminous United States Peak horizontal acceleration (percent of gravity) with a 10% probability of exceedance in 50 years

***AOT Facility*.** The AOT site is located approximately 100 miles northeast of the of the TDF and MSC sites, and is also located within the Valley and Ridge Physiographic Province. Site elevation is approximately 1620 feet AMSL and slopes to the south toward Little Limestone Creek. The AOT is located within the Knox Group, Jonesboro Limestone which is characterized by dark bluish-gray, limestone, and numerous interbeds of dark-gray dolomite (Figure 3-8). The Long-Term Seismic Model indicates that the AOT facility is located in an area with a low seismic hazard class rating: 0.18g peak horizontal ground acceleration with a 2 percent probability of exceedance in 50 years; and 0.06g peak horizontal ground acceleration with a 10 percent probability of exceedance in 50 years (*see* Figures 3-6 and 3-7). An earthquake generating 0.18g would produce strong perceived shaking. Moderate damage would occur in well-built ordinary structures. An earthquake generating 0.06g would be perceived by all, with minimal damage to well-built ordinary structures (USGS 2018, NNSA 2011, NNSA 2020a). Since 1900, 68 earthquakes have been recorded within 62 miles of the sites with the highest magnitude of 5.2 (USGS 2024b).

Although present in the region, karst features have not been identified at the AOT facility.

Source: USGS 2024a.

Figure 3-8. Generalized Bedrock Map for AOT

3.7.1.2 Soils

Y-12. Undisturbed soils within Bear Creek Valley consist of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskinghum associations. Soils at Y-12 are generally acceptable for standard construction techniques.

TDF. The TDF is located on the Salacoa silt loam with 5 to 12 percent slopes, characterized as well drained, and not prone to flooding or ponding. Weathered bedrock may be encountered between 20 to 40 inches below grade, and the water table is greater than 80 inches below grade. This soil is not prime farmland (USDA 2023).

MSC Facility. The MSC facility is located on three soil types including the Armuchee silt loam, 5 to 12 percent slopes, Armuchee channery silty clay loam, 12 to 20 percent slopes, eroded, and the Armuchee silt loam, 12 to 20 percent slopes. These soil types are well drained, and not prone to flooding or ponding. The water table is greater than 80 inches below grade. Weathered bedrock is located at depths of 20 to 40 inches below grade. These soil types are not classified as prime farmland (USDA 2023).

AOT Facility. The AOT facility is located on three soil types including Urban land-Udorthents complex, Bowmantown silt loam, 6 to 12 percent slopes, and Dewey-Udorthents-Urban land

complex, 5 to 20 percent slopes. These soil types are composed of urban land, Udorthents (loamy fill), and silt and clay loam (Bowmantown). These soil types are well drained, and not prone to flooding or ponding. Bedrock is greater than 80 inches below grade. The water table may be encountered between 18 to 39 inches in the Bowmantown silt loam near the Limestone Creek, but otherwise is greater than 80 inches below grade. These soil types are not classified as prime farmland (USDA 2024).

Soil and groundwater contamination from past operations at the AOT facility has been remediated, and is currently under a monitoring program.

3.7.2 Proposed Action Effects

3.7.2.1 Construction

TDF. During construction, external changes to the TDF building include replacing and/or upgrading existing utility systems and minor changes to the exterior walls to support equipment installation. A storage building would be constructed outside the current building and within the TDF property. In total, less than one acre of land would be disturbed.

MSC Facility. During construction, exterior changes to the MSC facility would include the installation of a roll-up door, roof repairs, foundation improvements, installation of concrete ramps, concrete slabs for utility support equipment and an additional cooling tower. Site work would include grading, trenching, utility installation, backfill, and stormwater management. Less than one 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 system, inert gas connections, upgrade of the existing fire suppression system, and installation of a diesel backup generator.

AOT Facility. During construction, external modifications to the AOT facility would include an exhaust stack, HF scrubber air intakes, access door, and an enclosure for HF storage. Additionally, a storage building would be constructed behind the process facility for chemical storage. Less than 1 acre of previously disturbed land could be re-disturbed.

Construction activities at each facility would be performed in accordance with the International Building Code (IBC), which specifies the seismic design requirements for buildings based on the seismic hazard level of the region. The construction at the TDF, MSC, and AOT facilities would cause minor impacts to the existing geologic and soil conditions at the site. The near surface geologic conditions and existing soil column would be disturbed by construction for utility upgrades and building/equipment foundations. Grading would temporarily disturb soils, and site contours would be permanently changed from site grading to support equipment and storage building foundations and for stormwater management (e.g. berms and swales). Because of soil disturbance, the potential for increased soil erosion due to stormwater runoff and wind would increase during construction. However, construction activity would occur on previously disturbed land, and the sites are generally level, which would reduce potential stormwater velocity and sediment transport.

In general, potential impacts from erosion would be minimized through the (1) installation and maintenance of erosion controls (e.g., straw bales, silt fence); (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. Although the site soils are not classified as prime farmland, site topsoil could be stripped and conserved prior to grading activities, and re-applied post-construction to facilitate revegetation. With implementation of the above measures, impacts to geology and soils during construction would be minimized.

For all 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 for the TDF and MSC facility due to the presence of historic thrust faults, and earthquake risk is low for the AOT facility (USGS 2018). There are no quaternary faults (i.e., faults less than 1.6 million years old) near the sites.

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.

3.7.2.2 Operation

Once construction is complete, areas used for laydown would be restored to pre-construction conditions. Meanwhile, areas of soil disturbance would be cleaned up, restored, and revegetated. Although erosion from stormwater runoff and wind action would occur occasionally during operation, it is anticipated to be minimal.

3.7.3 No-Action Alternative Effects

Under the No-Action Alternative, the Proposed Action would not proceed and there would be no changes to geology and soils from current operations, as discussed in Section 3.7.1.

3.8 Biological Resources

3.8.1 Affected Environment

Y-12, TDF, MSC Facility, and AOT Facility. This section describes the biological resources surrounding Y-12, TDF, MSC, and AOT facilities (*see* Figures 1-2 and 1-3). 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 Cumberland and Great Smokey Mountains (DOE 2022). The TDF and MSC facility are located less than one mile northeast of Y-12 in an industrial area in Anderson County. Vegetation adjacent to the TDF and MSC facility are consistent with vegetation types in the ORR and consists of areas of mixed pine-hardwood forests, second-growth loblolly pine forests. The TDF and MSC facility are not within a designated natural area classified primarily on the basis of the presence of listed species.

The AOT facility is located approximately 100 miles east of Y-12 in a rural area of Jonesborough, in Washington County. The AOT facility is on a developed area bordered by a mixture of

developed, residential, agriculture, and vegetation areas. Vegetation adjacent to the AOT facility includes maintained grassy areas and mixed pine-hardwood forests. A freshwater pond is located to the east of the facility on boundary property.

Wildlife. Y-12, the TDF, and the MSC facility are located in a developed and industrial area. The TDF and MSC facility are not within a designated natural area classified primarily on the basis of the presence of listed species. The area adjacent to the TDF and MSC facility 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. The AOT facility is located in a rural area of Jonesborough. The AOT facility is developed and mixed forested and agricultural area. The area adjacent to the AOT facility site consists of residential and agricultural and areas of mixed pine-hardwood forests. Wildlife species consists of common species found in rural 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). 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 in the vicinity of the TDF, MSC, and AOT facilities. Information from TDEC was also reviewed to identify rare species by county.

The TDEC identified 66 rare species with the potential to occur in Anderson County. Species identified include five mammals, four amphibians, two reptiles, five insects, eight fish, three crustaceans, 15 mollusks, four birds and 20 plants. Of these species 11 were deemed in need of management, 22 are endangered, 10 are rare (not state listed), six are species of special concern, and 17 are threatened (TDEC 2024). IPaC identified seven endangered species and seven migratory birds with the potential to occur in the vicinity of the TDF and the MSC facility. Endangered species included four mammals, one bird, one fish, and one insect (USFWS 2024b, USFWS 2024c). Species identified by IPaC are included in Table 3-10. 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 or the MSC facility.

Table 3-10. Threatened, Endangered, or Sensitive Animal Species with Potential to Occur in the Vicinity of the TDF and the MSC Facility

Scientific name	Common Name	Federal Status	State Status
Myotis grisescens	Gray bat	E	E
Myotis sodalist	Indiana bat	E	
Myotis septentrionalis	Northern long-eared bat	E	
Perimyotis subflavus	Tri-colored bat	PE	T
Grus americana	Whooping crane	EXPN	
Erimonax monachus	Spotfin chub	T	T
Danaus plexippus	Monarch butterfly	C	

C=Candidate; E=Endangered; PE=Proposed Endangered; T=Threatened; EXPN=Experimental population, Non-essential
Source: TDEC 2024, USFWS 2024b, USFWS 2024c.

The TDEC identified 35 rare species with the potential to occur in Washington County. Species identified include two mammals, one insect, four fish, four mollusks, two birds and 21 plants. Of these species five were deemed in need of management, three are endangered, nine are rare (not state listed), ten are species of special concern, and eight are threatened (TDEC 2024).

IPaC identified six endangered species and two migratory birds with the potential to occur in the vicinity of the TDF and the MSC facility. Endangered species included four mammals, one bird, one fish, and one insect (USFWS 2024d). Species identified by IPaC are included in Table 3-11. 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 AOT facility.

Table 3-11. Threatened, Endangered, or Sensitive Animal Species with Potential to Occur in the Vicinity of the AOT Facility

Scientific name	Common Name	Federal Status	State Status
Myotis grisescens	Gray bat	E	E
Myotis sodalist	Indiana bat	E	
Myotis septentrionalis	Northern long-eared bat	E	
Perimyotis subflavus	Tri-colored bat	PE	T
Danaus plexippus	Monarch butterfly	C	
Isotria medeoloides	Small whorled pogonia	T	

C=Candidate; E=Endangered; PE=Proposed Endangered; T=Threatened; EXPN=Experimental population, Non-essential
Source: TDEC 2024, USFWS 2024d.

3.8.2 Proposed Action Effects

Potential impacts 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. Impacts to wildlife are evaluated in terms of disturbance, displacement, or loss of wildlife.

Construction. Construction activities at the TDF would consist of internal modifications including the installation of GFE and utility upgrades. Externally, a storage building would be constructed within the TDF property, but would disturb less than one acre of land. 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 impacts.

Construction activities at the MSC facility would expand its services, using both existing equipment and GFE. Less than 10 percent of the MSC facility would be used for GFE. Exterior changes would include the installation of a roll-up door, roof repairs, foundation improvements, concrete ramps, concrete slabs for utility support equipment and an additional cooling tower. Site work would include grading, trenching, utility installation, backfill, and stormwater management. Less than one acre of previously disturbed land could be re-disturbed.

Construction activities at the AOT facility would include interior and external modifications to the facility and site. External modifications would include: a new exhaust stack, new HF scrubber air intakes, a new access door, and a new chemical storage building constructed behind the process

facility. The external modifications would disturb less than one acre of previously disturbed land. At all three facilities, there would be no notable exterior construction; therefore, impacts to threatened and endangered or special status species would not be expected.

Operation. Impacts to biological resources to support the DU manufacturing operations would be similar to currently observed industrial operations at the TDF, MSC, and AOT facilities. Impacts to biological resources at the three facilities would be similar to existing operations and currently observed industrial operations within the surrounding area. Monitoring to assure that there are no negative impacts to threatened and endangered or special status species would continue.

3.8.3 No-Action Alternative Effects

Under the No-Action Alternative, NNSA would perform DU manufacturing in existing facilities at Y-12 and commercial 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 federal actions. 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 State Historic Preservation Office (SHPO) when actions may affect historic properties. The Tennessee Historical Commission (THC) serves as the SHPO.

Y-12. Y-12 currently has a proposed National Register Historic District of historic buildings associated with the Manhattan Project that are eligible for listing in the NRHP (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 (NNSA 2021c).

TDF and MSC Facility. According to THC surveys, two properties listed on the NRHP, the Woodland-Scarboro Historic District and the Bear Creek Checking Station, are located less than one mile from the TDF and MSC facility. Additional surveys of historic resources are ongoing by the THC; however, according to THC's Historical Architectural Survey GIS System, no archaeological sites or historic resources have been identified within the boundaries of the TDF or the MSC facility (THC 2024a).

AOT Facility. According to THC surveys, a single family dwelling located west of the AOT facility is currently being surveyed. The surveys of historic resources is ongoing by the THC; however, no archaeological sites or historic resources have been identified within the boundary of the AOT facility (THC 2024b).

3.9.2 Proposed Action Effects

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

Construction. Construction activities at the commercial facilities would consist of internal modifications including the installation of equipment and utility upgrades. Minor exterior construction would occur, with disturbance of less than one acre of land at any site. Unanticipated discoveries of archaeological materials during construction, although unlikely to occur, would be evaluated and, if needed, mitigated. Therefore, no notable impacts to archaeological resources are anticipated.

Operation. Operational activities are not expected to have an impact on cultural resources, as all operations under the Proposed Action would be similar to existing operations at the commercial facilities and consistent with currently observed industrial operations in the vicinities of the facilities.

3.9.3 No-Action Alternative Effects

Under the No-Action Alternative, NNSA would perform DU manufacturing in existing facilities at Y-12 and commercial facilities would not be upgraded or repurposed. There would be no impacts 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 the TDF, MSC and the AOT facilities ROI and the impacts associated with the Proposed Action and No-Action Alternative.

3.10.1 Affected Environment

The ROI for socioeconomic analysis is defined as the counties immediately surrounding the TDF, the MSC facility, and the AOT facility where DU manufacturing activities would occur and where the existing workforce and proposed workforce are assumed to reside. TDF and the MSC facility

are both located in Anderson County and have the same ROI. The ROI for the TDF and the MSC facility is a four-county area in Tennessee comprised of Anderson, Knox, Loudon, Roane counties (Figure 3-9). The AOT facility is located in Washington County. The ROI for the AOT facility is a three-county area in Tennessee comprised of Washington, Sulivan and Greene counties (see Figure 3-9).

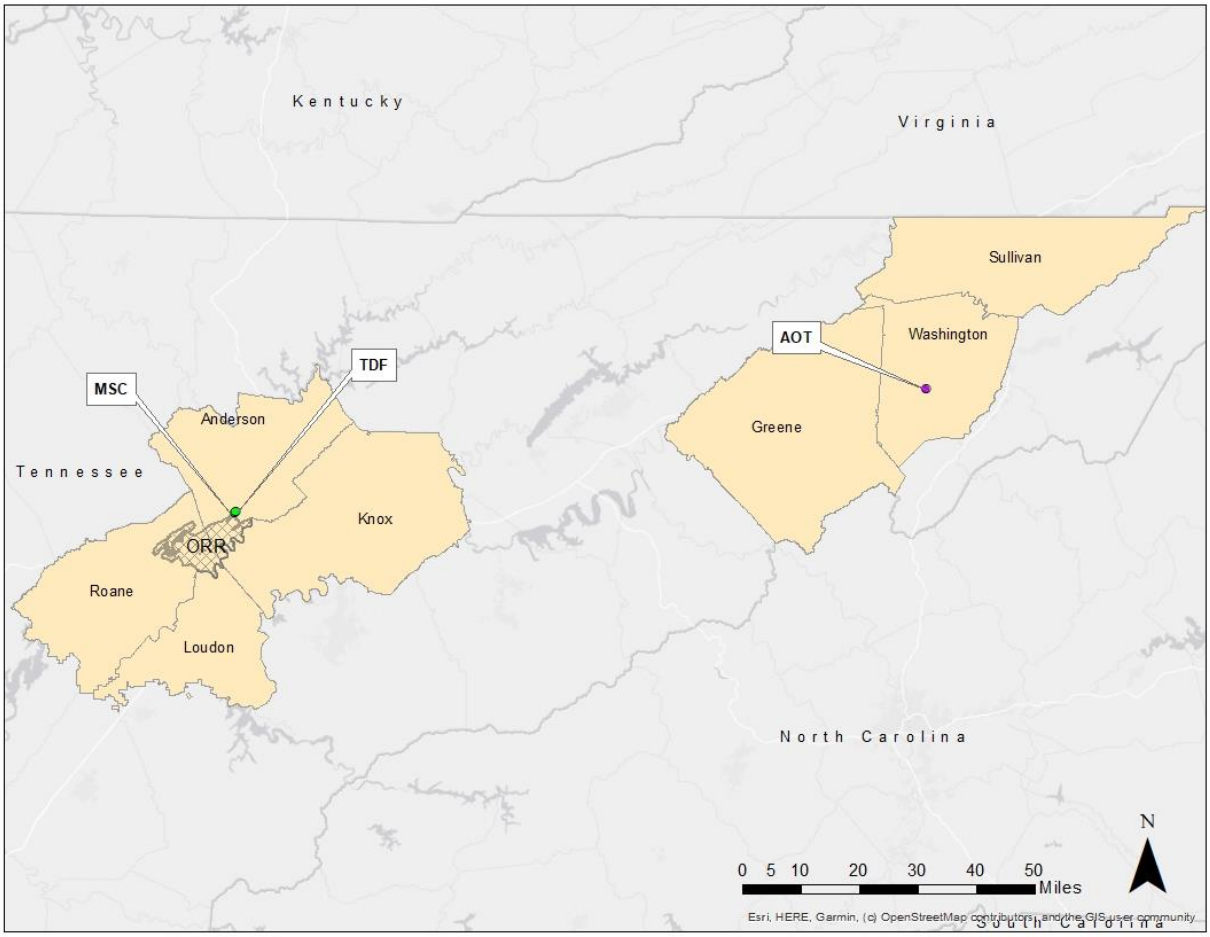


Figure 3-9. Location of TDF, MSC, AOT and Region of Influence

3.10.1.1 Socioeconomic Resources

Socioeconomics considers the attributes of human social and economic interactions associated with the DU manufacturing process proposed construction and operations and the impacts that such action may have on the ROI. Socioeconomic areas of discussion include the regional and local economy, local demographics, local housing, and community services. Socioeconomic impacts may be defined as the environmental consequences of a proposed action in terms of potential demographic and economic changes.

Y-12, TDF, and MSC Facility. From 2010 through 2022, the labor force in the ROI increased 7.3 percent to 334,395 persons. During the same time period, employment in the ROI increased by 13.2 percent to 324,361 persons, and the number of unemployed decreased by 60.0 percent. Over that same period, the unemployment rate declined from 8.0 percent to 3.0 percent. Table 3-12

presents the employment profile in the ROI and Tennessee for 2010 and 2022. The TDF and MSC facility are located in Anderson County. Anderson County had a per capita personal income of $51,436 and ranked 20th in the state in 2022. In 2012, the per capita personal income was $36,216. The 2012-2022 compound annual growth rate of the per capita personal income reflected was 3.6 (BEA 2024a). The median family income in Anderson County was $60,633 in 2022 (USCB 2022a). Anderson County had a total of 1,573 business establishments in 2021, with a combined annual payroll of over 3 billion (USCB 2022).

Table 3-12. Employment Profile for the TDF and MSC Facility ROI

Area	Labor Force		Employed		Unemployed		Percent Unemployed	
	2010	2022	2010	2022	2010	2022	2010	2022
Anderson	34,950	35,280	31,642	34,107	3,308	1,173	9.5%	3.3%
Knox	229,895	250,987	212,529	243,788	17,366	7,199	7.6%	2.9%
Loudon	22,372	24,373	20,259	23,581	2,113	792	9.4%	3.2%
Roane	24,340	23,755	22,065	22,885	2,275	870	9.3%	3.7%
ROI	311,557	334,395	286,495	324,361	25,062	10,034	8.0%	3.0%
Tennessee	3,093,118	3,361,979	2,789,056	3,247,975	304,062	114,004	9.8%	3.4%

Source: BLS 2024a.

In Anderson County, the manufacturing sector accounts for approximately 26.3 percent of the total employment in the county. Professional, scientific, and technical services accounts for approximately 10.6 percent, and government and government enterprises accounts for 9.1 percent of total employment in Anderson County (BEA 2024b).

In 2022, the population in the ROI was estimated to be 668,027 (USCB 2022a). From 2010 to 2022, the total population in the ROI increased 9.5 percent, which was similar to the growth rate in Tennessee (USCB 2022b). Between 2022 and 2031, the population of the ROI is projected to steadily increase. In 2027, when construction is estimated to take place at the TDF, the population in the ROI is projected to be 699,735. In 2031, when construction in estimated to be completed at the MSC facility, the population in the ROI is projected to be 718,574 (Boyd Center 2022). Table 3-13 presents the historic and projected population of the ROI and Tennessee.

Table 3-13. County and State Historic and Projected Population for TDF and MSC ROI

County	2010	2015	2020	2022	2025	2026	2027	2028	2031
Anderson	75,129	75,430	77,123	77,337	79,165	79,416	79,648	79,863	80,429
Knox	432,226	444,348	478,971	481,406	497,923	502,133	506,257	510,323	522,221
Loudon	48,556	50,229	54,886	55,507	58,579	59,243	59,885	60,507	62,264
Roane	54,181	53,162	53,404	53,777	54,003	53,981	53,945	53,893	53,660
ROI	610,092	623,169	664,384	668,027	689,670	694,773	699,735	704,586	718,574
Tennessee	6,346,105	6,499,615	6,910,840	6,923,772	7,179,307	7,231,338	7,282,134	7,331,859	7,475,781

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

As of 2022, the ROI had 297,639 housing units of which 9.1 percent were vacant. Of the estimated 27,079 vacant units, 8,391 were estimated to be vacant rental units, or 2.8 percent of the housing stock (USCB 2022c, USCB 2022d). 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 eight school districts with a total of 157 schools serving a student population of 86,890 during the 2022-2023 school year (NCES 2024). There are 11 hospitals serving the ROI with the majority located in Knox County. There are 30 fire departments in the ROI made up of career and volunteer firefighters (TDCI 2022). 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 2022, there were 1,250 total law enforcement employees (FBI 2022). The police protection service with primary responsibility would be the Oak Ridge Police Department.

AOT Facility. From 2010 through 2022, the labor force in the ROI decreased 3.9 percent to 158,939 persons. During the same time period, employment in the ROI increased by 2.8 percent to 153,395 persons, and the number of unemployed decreased by 65.8 percent. Over that same period, the unemployment rate declined from 9.8 percent to 3.5 percent. Table 3-14 presents the employment profile in the ROI and Tennessee for 2010 and 2022.

The AOT facility is located in Washington County. Washington County had a per capita personal income of $53,392 and ranked 11th in the state in 2022. In 2012, the per capita personal income was $37,230. The 2012-2022 compound annual growth rate of the per capita personal income reflected was 3.7 (BEA 2024a). The median family income in Anderson County was $51,975 in 2022 (USCB 2022a). Anderson County had a total of 2,966 business establishments in 2021, with a combined annual payroll of nearly 2.5 billion (USCB 2023).

Table 3-14. Employment Profile for the AOT Facility ROI

Area	Labor Force		Employed		Unemployed		Percent Unemployed	
	2010	2022	2010	2022	2010	2022	2010	2022
Greene	31,031	28,801	26,983	27,655	4,048	1,146	13.0%	4.0%
Sullivan	73,678	68,794	66,902	66,378	6,776	2,416	9.2%	3.5%
Washington	60,716	61,344	55,334	59,362	5,382	1982	8.9%	3.2%
ROI	165,425	158,939	149,219	153,395	16,206	5,544	9.8%	3.5%
Tennessee	3,093,118	3,361,979	2,789,056	3,247,975	304,062	114,004	9.8%	3.4%

Source: BLS 2024a.

In Washington County, the government and government enterprises accounts for approximately 15.0 percent of the total employment in the county. Health care and social assistance accounts for approximately 14.7 percent, and retail trade accounts for 11.2 percent of total employment in Washington County (BEA 2024b).

In 2022, the population in the ROI was estimated to be 348,633 (USCB 2022a). From 2010 to 2022, the total population in the ROI increased 4.0 percent, which was lower than the growth rate in Tennessee (USCB 2022b). Between 2022 and 2028, the population of the ROI is projected to steadily increase. In 2028, when construction in estimated to be completed at the AOT facility, the

population in the ROI is projected to be 368,775 (Boyd Center 2022). Table 3-15 presents the historic and projected population of the ROI and Tennessee.

Table 3-15. County and State Historic and Projected Population for the AOT Facility ROI

Area	2010	2015	2020	2022	2025	2026	2027	2028
Greene	68,831	68,576	70,152	70,399	70,339	70,428	70,498	70,553
Sullivan	156,823	156,752	158,163	158,722	160,263	160,421	160,539	160,624
Washington	122,979	125,317	133,001	133,282	135,157	136,000	136,811	137,598
ROI	348,633	350,645	361,316	362,403	365,759	366,849	367,848	368,775
Tennessee	6,346,105	6,499,615	6,910,840	6,923,772	7,179,307	7,231,338	7,282,134	7,331,859

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

As of 2022, the ROI had 32,300 housing units of which 14.0 percent were vacant. Of the estimated 4,523 vacant units, 4,298 were estimated to be vacant rental units, or 13.3 percent of the housing stock (USCB 2022c, USCB 2022d). 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 93 schools serving a student population of 45,737 during the 2022-2023 school year (NCES 2024). There are 13 hospitals serving the ROI with the majority located in Washington County. There are 36 fire departments in the ROI made up of career and volunteer firefighters (TDCI 2022). County Sheriff's Offices provide police protection services in cooperation with Tennessee Highway Patrol. In 2022, there were 565 total law enforcement employees (FBI 2022).

3.10.1.2 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 impacts 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 impacts that proposed actions may have on minority and low-income populations, and whether such impacts 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 the commercial facilities with a focus on the four-county and three-county ROIs. 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. The analysis used estimates from the U.S. Census Bureau's 2018-2022 American Community Survey 5-Year estimates to identify minority and low-income populations. Table 3-16 presents the state thresholds used for the analysis.

Table 3-16. Thresholds for Identification of Minority and Low-Income Communities

Area	Minority Population	Low-Income Population
Tennessee	47.4%	33.9%

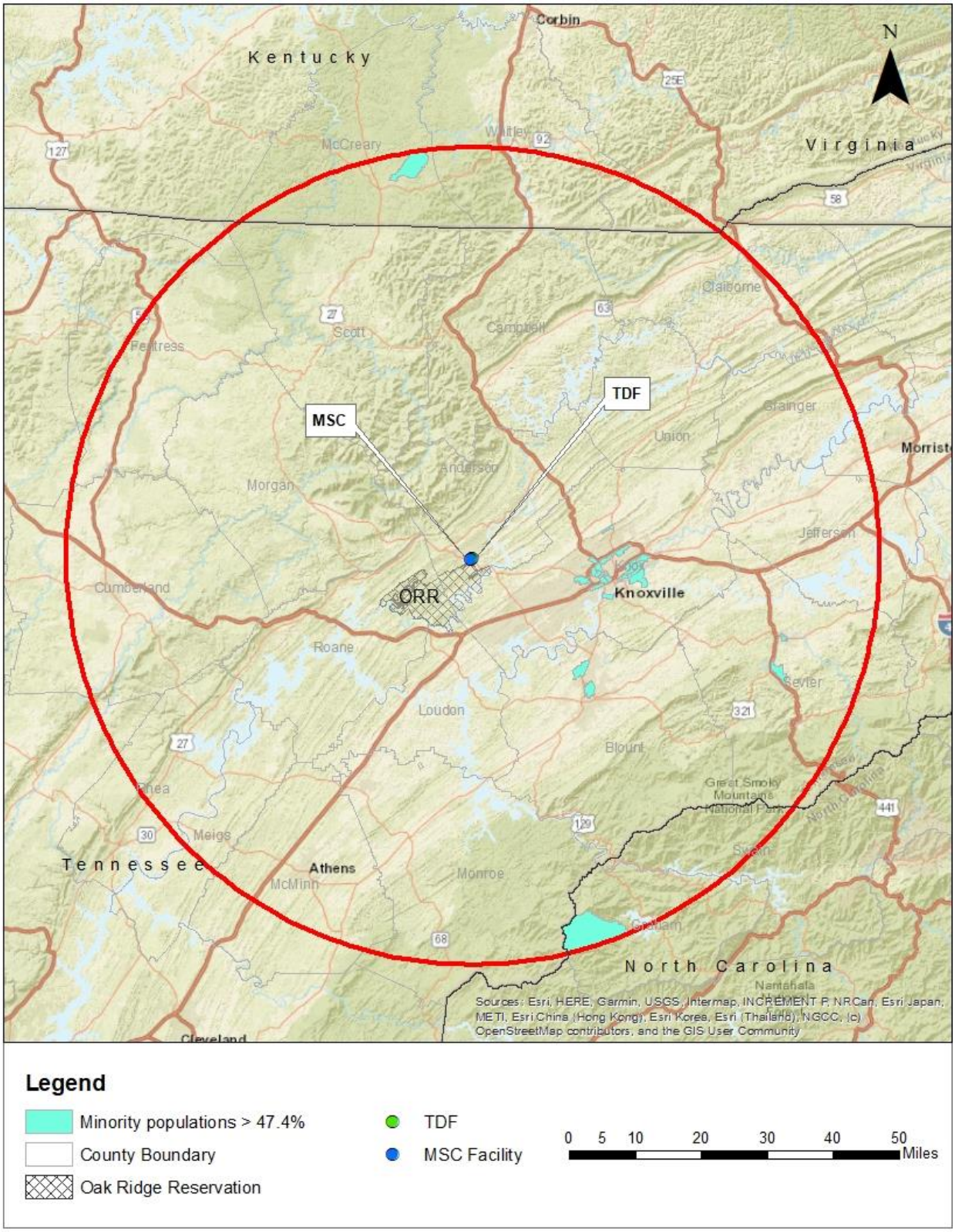
Y-12, TDF, and MSC Facility. There are 429 census block groups in the four-county ROI. Of the 429 census block groups, 50 exceed the thresholds for minority and/or low-income populations. Census block groups that exceed minority and/or low-income thresholds are predominantly located in the Knoxville area, approximately 15 miles from the TDF and MSC facility. The facilities are both located in Anderson County. No census block groups immediately surrounding the proposed project sites exceed the thresholds for minority populations. Table 3-17 summarizes the demographic composition of the four-county ROI. Figures 3-10 and 3-11 show the geographic distribution of minority and low-income populations within the 50-mile radius of the TDF and MSC facility.

AOT Facility. There are 254 census block groups in the three-county ROI. Of the 254 census block groups, 26 exceed the thresholds low-income populations. No census block groups immediately surrounding the proposed project site exceed the thresholds for minority populations. One census block group located to the south of the AOT facility was identified as having low-income populations. Table 3-18 summarizes the demographic composition of the AOT Facility three-county ROI. Figures 3-12 and 3-13 show the geographic distribution of minority and low-income populations within the 50-mile radius of the AOT facility.

Table 3-17. Demographic Composition of the TDF and MSC Facility Four-County ROI

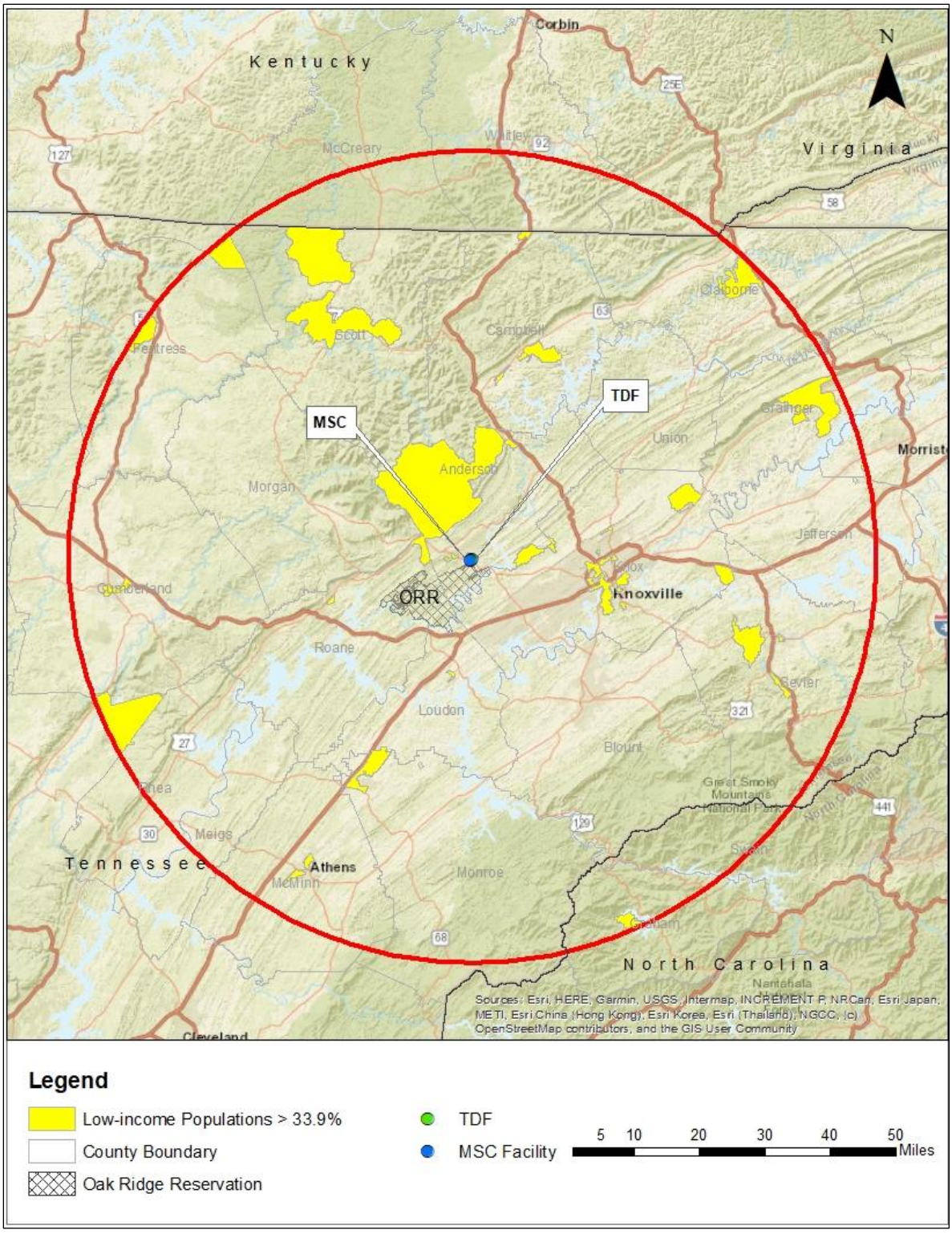
Population Group	Anderson		Knox		Loudon		Roane		Tennessee	
	Population	% of Total	Population	% of Total	Population	% of Total	Population	% of Total	Population	% of Total
Nonminority	67,733	87.6%	390,243	81.1%	47,929	86.3%	49,060	91.2%	5,024,964	72.6%
Hispanic	2,661	3.4%	22,896	4.8%	5,307	9.6%	1,201	2.2%	412,622	6.0%
Black or African American	2,442	3.2%	39,347	8.2%	691	1.2%	1,450	2.7%	1,116,871	16.1%
American Indian or Alaska Native	196	0.3%	427	0.1%	38	0.1%	130	0.2%	8,159	0.1%
Asian	1,017	1.3%	10,892	2.3%	529	1.0%	337	0.6%	127,367	1.8%
Pacific Islander	62	0.1%	258	0.1%	0	0.0%	17	0.0%	3,173	0.0%
Other Race	434	0.6%	1,877	0.4%	209	0.4%	56	0.1%	23,185	0.3%
Two or More Races	2,792	3.6%	15,466	3.2%	804	1.4%	1,526	2.8%	207,431	3.0%
Total Minority	9,604	12.4%	91,163	18.9%	7,578	13.7%	4,717	8.8%	1,898,808	27.4%
Total Population	77,337	100.0%	481,406	100.0%	55,507	100.0%	53,777	100.0%	6,923,772	100.0%
% Below Poverty Level	15.8%		12.9%		11.0%		13.3%		13.9%	

Source: USCB 2022b, USCB 2022e.



Source: USCB 2022b.

Figure 3-10. Minority Populations within a 50-Mile Radius of the TDF and MSC Facility



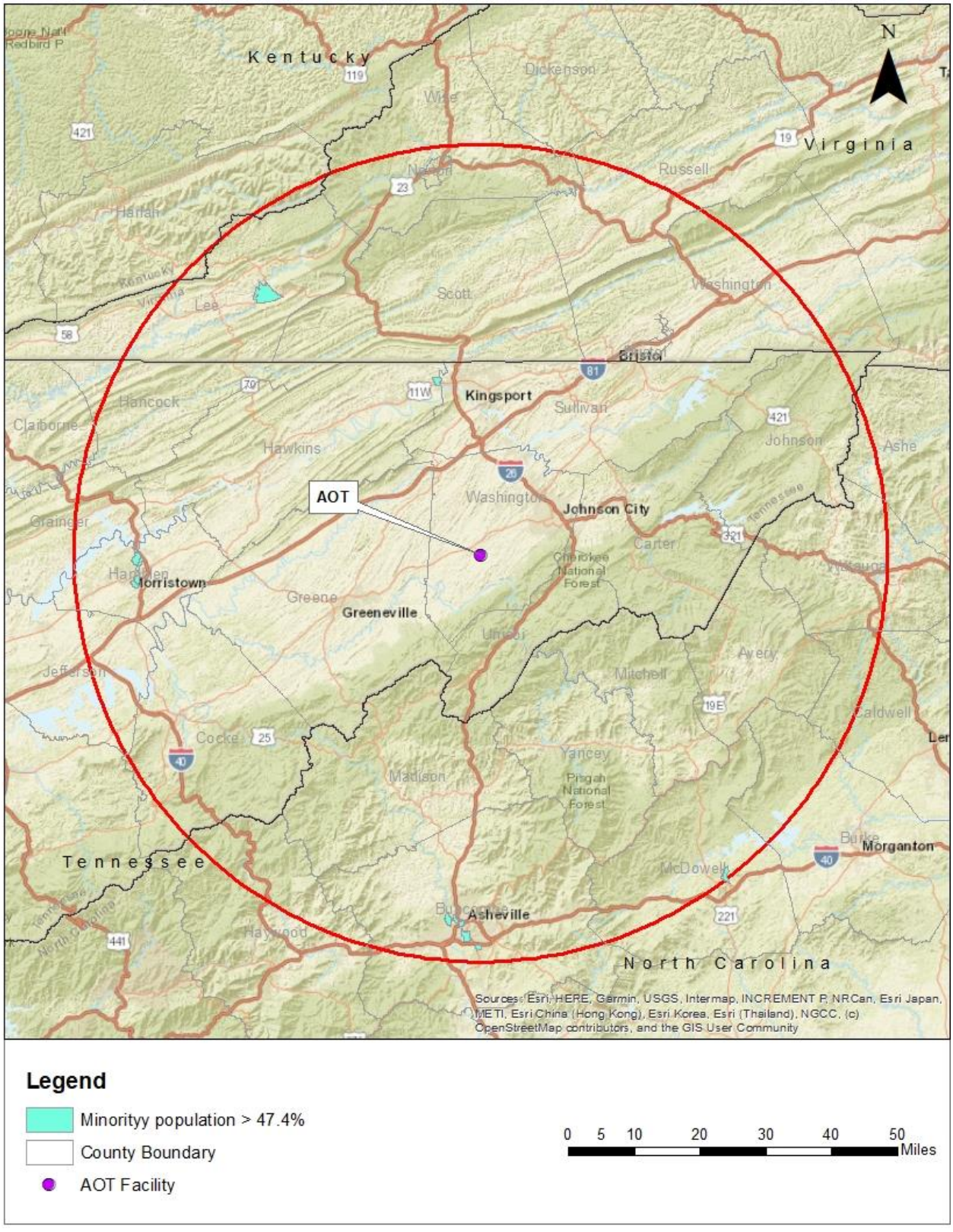
Source: USCB 2022e.

Figure 3-11. Low-income Populations within a 50-Mile Radius of the TDF and MSC Facility

Table 3-18. Demographic Composition of the AOT Facility Three-County ROI

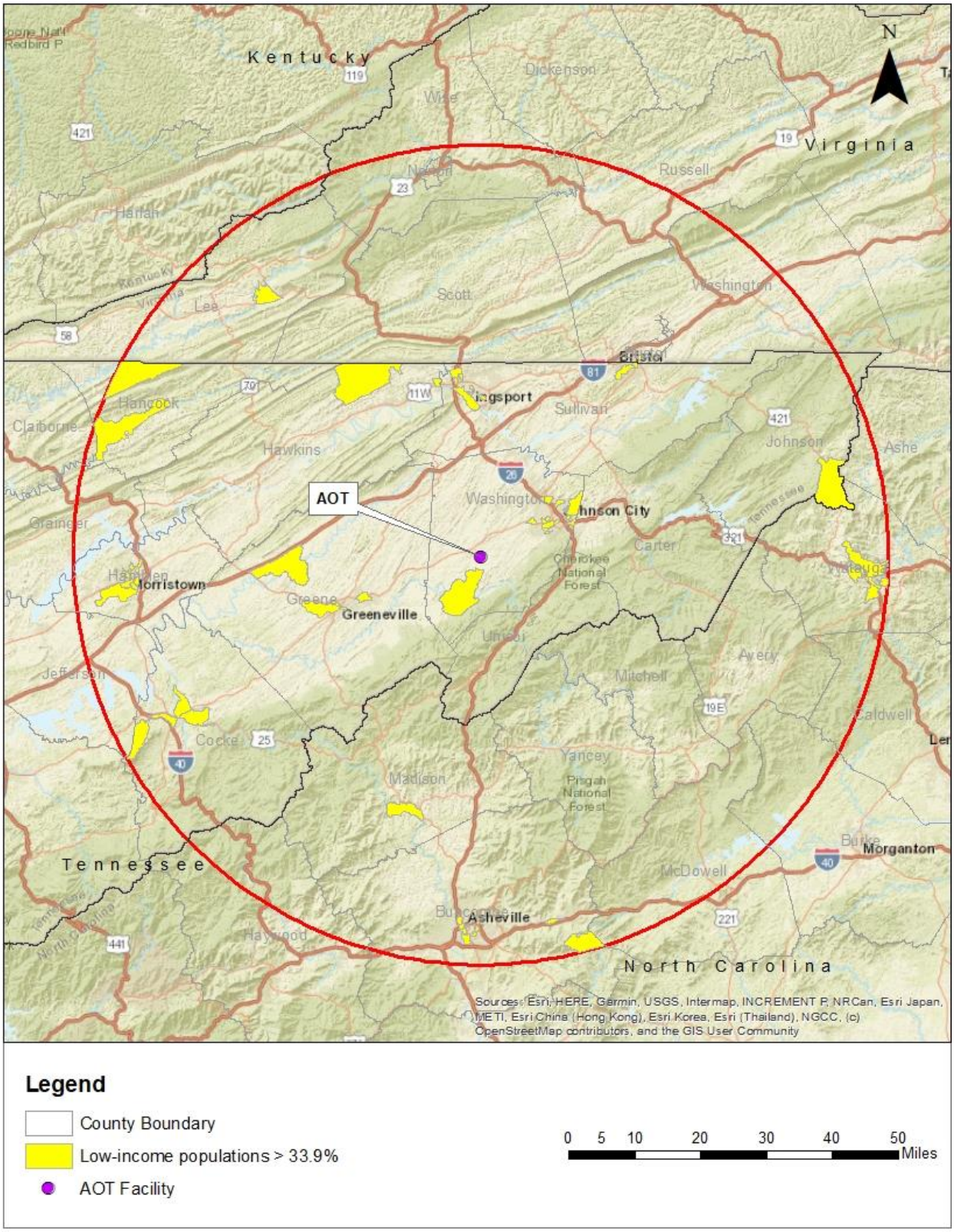
Population Group	Greene		Sullivan		Washington		Tennessee	
	Population	% of Total	Population	% of Total	Population	% of Total	Population	% of Total
Nonminority	64,771	92.0%	146,667	92.4%	116,450	87.4%	5,024,964	72.6%
Hispanic	2,290	3.3%	3,534	2.2%	5,172	3.9%	412,622	6.0%
Black or African American	1,169	1.7%	3,022	1.9%	4,872	3.7%	1,116,871	16.1%
American Indian or Alaska Native	72	0.1%	222	0.1%	118	0.1%	8,159	0.1%
Asian	343	0.5%	1,225	0.8%	2,051	1.5%	127,367	1.8%
Pacific Islander	20	0.0%	0	0.0%	0	0.0%	3,173	0.0%
Other Race	107	0.2%	399	0.3%	123	0.1%	23,185	0.3%
Two or More Races	1,627	2.3%	3,653	2.3%	4,496	3.4%	207,431	3.0%
Total Minority	5,628	8.0%	12,055	7.6%	16,832	12.6%	1,898,808	27.4%
Total Population	70,399	100.0%	158,722	100.0%	133,282	100.0%	6,923,772	100.0%
% Below Poverty Level	15.8%		15.3%		16.4%		13.9%	

Source: USCB 2022b, USCB 2022e.



Source: USCB 2022b.

Figure 3-12. Minority Populations within a 50-Mile Radius of the AOT Facility



Source: USCB 2022e

Figure 3-13. Low-income Populations within a 50-Mile Radius of the AOT Facility

3.10.2 Proposed Action Effects

3.10.2.1 Socioeconomic Resources

Construction. Construction activities at the TDF would occur in 2027 and require a peak construction workforce of approximately 20 workers, with construction activities expected to be completed in 12 months. Construction activities at the MSC facility would require peak construction workforce of approximately 30 workers, with construction activities beginning in 2026 over a 5-year period beginning in 2026. Construction activities at the AOT facility would require 40 workers on site during the 24-month construction period starting in 2027. It is anticipated that some portion of construction materials would be purchased locally. Payroll and materials expenditures would have a positive impact 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 (ranging from 20 to 40 persons) would be negligible compared to the projected population in the ROI, socioeconomic impacts 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. At the TDF, small-scale DU operations using existing equipment could begin in 2025, before construction occurs. Operations would not require any additional workers. At the MSC facility small-scale operations could begin in 2025 with existing equipment. Approximately 10 operations workers may be added to the current MSC facility workforce. At the AOT facility operations, which are planned to start in 2027, prior to the completion of construction, would require 10 additional workers. Future operations at the commercial facilities would have a positive impact on regional economics. In terms of other operational impacts:

Population. Based on the estimated number of new direct jobs and the assumption that workers from the current labor force would fill direct jobs and local workers in the ROI would fill indirect jobs, impacts to population would be negligible.

Housing. Based on the estimated number of jobs and the assumption that workers from the current labor force would fill direct jobs and local workers in the ROI would fill indirect jobs, there would be no need for additional housing. Local personnel would not require temporary housing and, thus, would have neither adverse nor beneficial impacts 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 the current labor force would fill direct jobs and local workers in the ROI would fill indirect jobs, there would be minimal impact on public schools, law enforcement, or firefighting capabilities.

3.10.2.2 Environmental Justice

Construction and Operation. Environmental impacts 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. In the area surrounding the TDF and MSC facility, there are 50 census block groups

and, in the area surrounding the AOT facility there are 78 census block groups that meet the definition of minority and/or low-income populations. During construction and operation related activities, it is anticipated that environmental and health impacts would be minimal, temporary, and confined to the TDF and MSC facility areas (*see* Section 3.11). Based on the impacts analysis for resource areas, no notable adverse effects are expected from construction and DU manufacturing operations at either commercial facility. For impacts that would occur, it is expected that impacts would affect all populations in the area equally. There would be no discernable adverse impacts 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 approximately1.3 miles west of the TDF and MSC facility). However, it is anticipated that any impacts 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 impacts 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 continue to perform DU manufacturing in existing facilities at Y-12 and commercial facilities would not be upgraded or repurposed. There would be no additional socioeconomic or environmental justice impacts.

3.11 Health and Safety, Accidents, and Intentional Destructive Acts

3.11.1 Affected Environment

Y-12, TDF, MSC Facility, and AOT Facility. The Proposed Action would utilize DU and small quantities of hazardous chemicals. Consequently, the discussions related to human health and potential accident impacts are focused on occupational injuries to the construction and operating workforce and radiological and chemical hazards to workers and the public. With regard to the public, the analysis focuses on whether operations could cause off-site exposures to radiological materials and hazardous chemicals that would result in adverse health effects.

Y-12 operations result in radiological emissions to the air. In 2022, an estimated 0.0311 Curies of uranium was released into the atmosphere as a result of Y-12 process and operational activities. The calculated radiation dose to the maximally exposed individual (MEI)[10] from airborne radiological release points at Y-12 during 2022 was 0.5 millirem. This dose is well below the National Emission Standards for Hazardous Air Pollutants standard of 10 millirem (DOE 2022).

Current operations at the TDF do not result in any radiological exposures to workers or the public. At MSC, the average worker dose from current operations is approximately 136 mrem per year. MSC monitors off-site dose levels with thermoluminescent dosimeters (TLD) and uses those results to calculate the potential dose to the public. In 2022, the dose to the MEI was calculated to be 20.7 millrem per year, which is below the 100 millirem per year regulatory limit (10 CFR 20). At AOT, the average worker dose from current operations is approximately 86 millirem per year.

[10] The MEI is a hypothetical member of public who would be expected to receive the highest dose from operations at a given facility.

AOT also calculates the dose to the MEI. AOT has calculated a dose of 17 millirem per year above the background dose of approximately 310 millirem per year (CNS 2024).

3.11.2 Proposed Action Effects

Construction. Potential effects to construction 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 commercial facilities are assumed to be represented by injury/illness and fatality rates for general industrial construction.[11] Table 3-19 lists the potential estimates of injuries/illnesses and fatalities estimated for construction. Over the construction period, a total of 7.5 days of lost work from illness/injury and zero (0.025) fatalities would be expected from construction activities at the three commercial facilities.

Table 3-19. Occupational Injury/Illness and Fatality Estimates for Construction

Injury, Illness, and Fatality Categories	TDF	MSC	AOT	Total
Peak workforce	20	30	40	N/A
Total construction worker-years	20[a]	150[a]	80	250
Lost days due to injury/illness	0.6	4.5	2.4	7.5
Number of fatalities	0.002	0.015	0.008	0.025

a. Conservatively assumes the peak construction workforce of 30 workers lasts the entire 18-month construction period.
Sources: CNS 2024, BLS 2024b.

Operation. Occupational effects would involve a maximum of 10 additional personnel at the MSC and AOT facilities, but no additional personnel at the TDF. 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 3-20 presents the potential estimates of injuries/illnesses and fatalities for the average year of operations at the three commercial facilities. In an average year, a total of one (0.8) day of lost work from illness/injury and zero (0.0004) fatalities would be expected from concurrent operations at the three commercial facilities.

Table 3-20. Occupational Injury/Illness and Fatality Estimates for Operations

Injury, Illness, and Fatality Categories	TDF	MSC	AOT	Total
Additional Operational workers (persons)	0	10	10	20
Lost days due to injury/illness	0	0.4	0.4	0.8
Number of fatalities	0	0.0002	0.0002	0.0004

a. Results reflect average annual effects.
Sources: CNS 2024, BLS 2024b.

Operational workers would be expected to receive radiological doses similar to existing operations at the three commercial facilities. At TDF, there would be no additional operational workers and no additional dose to workers. At the MSC facility, the 10 additional workers would receive an average annual dose of 136 mrem per year. Statistically, this would equate to a latent cancer

[11] Because construction at the TDF, MSC, and AOT facilities would be performed by commercial entities, the BLS values are considered representative.

fatality (LCF) risk of 8.2×10^{-5} for each worker. The total dose to all 10 workers would be 1,360 mrem per year. Statistically, one LCF would be expected to occur every 1,225 years of operation at the MSC. At the AOT facility, the 10 additional workers would receive an average annual dose of 86 mrem per year. Statistically, this would equate to a LCF risk of 5.2×10^{-5}. The total dose to all 10 workers would be 860 mrem per year. Statistically, one LCF would be expected to occur every 1,937 years of operation at the AOT. Because radiological and hazardous effluents and emissions would not change at the three commercial facilities, no change in health impacts to the public are expected during normal operations (CNS 2024).

Accidents. Accident risks at the TDF and MSC facility would not change compared to current operations (CNS 2024). At the AOT facility, DU manufacturing operations would utilize the following hazardous materials: HF, nitric acid (HNO_3), nitric oxide (NOx), sodium hydroxide (NaOH), tributyl phosphate (TBP), dodecane, and uranium oxide. As discussed below, there are three primary accident scenarios in the DU manufacturing process that could have impacts (CNS 2024, AOT 2023).

Liquid Chemical Spill. Identified Materials: HNO_3, TBP, and dodecane. The process equipment is the primary containment for chemicals and is designed with compatible materials and to be mechanically sound. The equipment is located within acid resistant secondary containment dyke in Building 300 with a capacity of approximately 4,500 gallons. The largest single vessel capacity of the process is 30 gallons. Building 300 was designed with permanent tertiary containment. There is no scenario including a complete vessel failure while unattended for a long period of time that could lead to chemical spills escaping the containment boundaries of the building (CNS 2024, AOT 2023).

Toxic Gas Release. Identified Gases: HF, HNO_3, and NOx. The process equipment is the primary containment for anhydrous HF and HNO_3 and is designed with compatible materials and to be mechanically sound. The HF equipment and gas delivery system are located within a secondary containment room that is ventilated through a Potassium Hydroxide (KOH) wet scrubber to neutralize HF. There is a leak detection system in the room that will shut down the process if a leak is detected. The scrubber has the capacity to neutralize approximately 12 times the amount of HF gas in use in a single cylinder in the process. In addition, in case of a scrubber failure, there is a backup anhydrous ammonia suppression system that will activate to neutralize the HF gas. Processes that generate NOx are vented through a separate KOH scrubber. If an accidental release were to occur, Building 300 would be evacuated. Workers would not return until the air is scrubbed and ventilated and the building is determined safe for occupancy. Quantities of HF, HNO_3, and NOx would be minimized such that adverse off-site health effects would not occur in the event of an accidental release (CNS 2024, AOT 2023).

Radionuclide Release. Identified Materials: Uranium oxide. The process equipment is the primary containment for radionuclide particles and is designed with compatible materials and to be mechanically sound. All equipment that processes solid material that can generate dust is ventilated through HEPA filters which are the secondary containment. The discharge stack air quality is monitored to ensure integrity of the HEPA filters. Building 300 is kept under negative pressure to eliminate any possibility of dust not captured by the ventilation system from being released. Air quality is monitored in the production areas. Quantities of uranium oxide would be

minimized such that adverse off-site health effects would not occur in the event of an accidental release (CNS 2024, AOT 2023).

For workers, the physical hazards associated with handling large, heavy cylinders could result in injuries and/or death as a result of on-the-job accidents unrelated to radiation or chemical exposure. The potential for accidental injuries and/or death are similar to other industries that use heavy equipment or manipulate heavy objects.

Previously, DOE has performed extensive and detailed radiological accident analyses in NEPA documents and Documented Safety Analyses (DSAs) for DU operations and the handling and transportation of DU materials. The DSAs that analyzed the handling and storage of cylinders of DU oxide concluded that no accident scenarios or mechanisms were identified that could result in the airborne dispersion of substantial quantities of DU oxide, and that the hazards associated with DU oxide evaluated resulted in acceptable-risk events (DOE 2020a). All of the operational and natural phenomena-initiated events identified in the DSAs that involved DU oxide were found to have low unmitigated (without preventive or mitigative features) radiological and chemical consequences to facility (involved) or collocated (noninvolved) workers, and negligible radiological and chemical consequences to the public (DOE 2020a).

In the *Final Environmental Impact Statement for the Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky Site* (DOE/EIS-0359) (DOE 2004a) and the *Final Environmental Impact Statement for the Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio Site* (DOE/EIS-0360) (DOE 2004b), DOE evaluated a spectrum of potential accidents, ranging from cylinder damage, fires, plane crashes, equipment leaks and ruptures, hydrogen explosions, earthquakes, and tornadoes. Per the analyses in these documents, the accident with the highest risk to a MEI was a failure of a uranium oxide (specifically, U_3O_8) container while in transit.[12] That accident, which was estimated to have a probability of occurrence of $1x10^{-2}$ (i.e., one accident every 100 years), resulted in an LCF risk to the MEI of 3.18×10^{-6} (statistically, this means that the MEI had a 1 in 314,000 chance of developing an LCF as a result of this accident).[13] Accident risks for the Proposed Action analyzed in this EA are expected to be similar in nature and bounded by the accident impacts presented in DOE 2004a and DOE 2004b, as the quantities of DU would be smaller at the three commercial sites compared to the two DOE DUF_6 conversion facilities.

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. Because of the low hazard posed by DU oxide, the material would not be an attractive target for a terrorist attack or other intentional destructive acts (DOE 2020a). The 2004 DUF_6 Conversion Facility EISs (DOE 2004a, DOE 2004b) demonstrated that other hazardous chemicals and cylinders of other forms of uranium (including DUF_6) present a higher potential impacts to workers and the public than DU oxide when released. In addition, because of the conservative assumptions made in those NEPA documents, the consequences from potential intentional destructive events are likely to either be bounded by, or

[12] Feedstock to the AOT facility is expected to come annually from the Portsmouth DUF_6 conversion site and from Y-12 in containers with U_3O_8.
[13] See Table 5.2-9 of DOE 2004a.

be comparable, to the releases and consequences presented in the 2004 EISs (including operational accidents, tornados, seismic events, and aircraft crashes) (DOE 2020a). Consequently, the risk of terrorist acts associated with the Proposed Action are considered minimal given that there would be minimal quantities of hazardous and radiological materials at any of the three commercial facilities, especially in relation to other commercial and government facilities. Substantial security measures (such as gates and fences) would also be in place to reduce the likelihood of a successful intentional destructive act at the three commercial facilities.

3.11.3 No-Action Alternative Effects

Under the No-Action Alternative, there would be no construction activities or DU manufacturing operations at the three commercial facilities. Consequently, there would be no change in health effects or potential accident impacts compared to existing operations at Y-12.

3.12 Waste Management

3.12.1 Affected Environment

Y-12. Y-12 has no active disposal facility on-site for disposal of low-level radioactive waste (LLW), mixed LLW (MLLW), or hazardous waste. Solid LLW is generally disposed of at the Nevada National Security Site (NNSS) or a Y-12 approved commercial vendor. Liquid LLW is treated in several facilities at Y-12, including the West End Treatment Facility. Hazardous waste is disposed of at a Y-12 approved commercial vendor. With regard to nonhazardous waste, DOE operates and maintains solid waste disposal facilities located near Y-12, called the ORR Landfills, three of which are active (see Table 3-21).

Table 3-21. 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 • Total capacity of 2.08 million yd^3 • Remaining years of use as of 2022: 48.5
Industrial Landfill IV	TDEC Permit	Sanitary/industrial waste (including office waste, equipment, construction/ demolition debris)	• 4.2-acre landfill, opened in 1989 • Permitted total capacity of 89,000 yd^3 • Remaining years of use as of 2022: 81.7
Industrial Landfill V	TDEC Permit	Sanitary/industrial waste (including office/cafeteria waste, construction/demolition debris)	• 25.9-acre landfill, opened in 1994 • Total capacity of 2.1 million yd^3 • Remaining years of use as of 2022: 14.3

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.

Each of the commercial facilities generates waste during current operations. Current operational waste quantities are identified in Table 3-22.

Table 3-22. Current Waste Generation at TDF, MSC, and AOT

Waste Type	Facility		
	TDF	MSC	AOT
Low-level radioactive waste (LLW) (yd^3/year)	2	47.6	285
Hazardous waste (kg/year)	1,000	1,500	2,495
Hazardous waste (shipments/year)	6	9	12
Nonhazardous waste (tons/year)	20	50	87.5

Source: CNS 2024.

TDF. At the TDF, annual waste generation from current operations is summarized as follows: two cubic yards of LLW; 1,000 kg of hazardous waste; and 20 tons of nonhazardous waste. Under current waste management practice, waste (LLW and hazardous) is surveyed and transferred to a Y-12 approved vendor for disposal, or transferred to Y-12 for final disposition. Nonhazardous waste is disposed of at commercial landfills. Significant quantities of hazardous chemicals are not currently used or stored at the TDF.

MSC Facility. At the MSC facility, annual waste generation from current operations is summarized as follows: 48 cubic yards of LLW; 1,500 kg of hazardous waste; and 50 tons of nonhazardous waste. Under current waste management practice, waste (LLW and hazardous) is surveyed and transferred to a Y-12 approved vendor for disposal, or transferred to Y-12 for final disposition. Nonhazardous waste is disposed of at commercial landfills. In 2022, two shipments of LLW were transported off-site to Waste Control Specialists [(a licensed treatment, storage, and disposal facility (TSD facility)] in Andrews, Texas. Hazardous chemicals stored and used at the MSC facility include nitric acid contained in 55-gallon stainless steel drums with a maximum storage of four drums (220 gallons). The nitric acid is used during a current manufacturing process. In addition, MSC has sodium hydroxide on site stored in 55-gallon stainless steel drums with a maximum storage of three drums (165 gallons). Sodium hydroxide is used in the waste water treatment process.

AOT Facility. At the AOT facility, annual waste generation from current operations is summarized as follows: 285 cubic yards of LLW; 2,495 kg of hazardous waste; and 87.5 tons of nonhazardous waste. The LLW and hazardous waste is disposed of off-site at a licensed TSD facility (Waste Control Specialists in Andrews, Texas). The nonhazardous waste is disposed of at commercial landfills. LLW, hazardous and nonhazardous waste generated from current DU manufacturing includes weak nitric acid/uranyl nitrate, ammonium hydroxide, titanium sludge, magnesium oxide crucibles and sand, and lithium/calcium fluoride slag. The liquid waste is treated in the AOT facility water treatment plant and released as effluent (*see* Section 3.6). The solid LLW waste is packaged in containers and shipped to the licensed TSD facility. Management of generated waste is covered by AOT Work Instruction on "Acceptable and Preventable Waste".

The AOT facility currently uses and stores the following chemicals for DU manufacturing: nitric acid, deionized water, uranyl nitrate, tributyl phosphate, and dodecane at the site. Chemical storage is outside of the DU manufacturing facility. Safety, Health & Environment (SH&E personnel) are responsible for maintaining the necessary transportation permits, licensing, profiling, and disposal agreements with the respective waste processor and/or burial site and the

State agency. SH&E or a contracted broker schedule shipments of waste to the respective processor or burial site and complete the necessary surveys, manifests, and bill of lading required by law. The transport of waste and materials is covered by Work Instruction 120-02-316, "Waste Preparation, Packaging, Survey, and Shipment to Waste Processor/Burial Site".

3.12.2 Proposed Action Effects

Construction.

***TDF*.** No notable quantities of hazardous and nonhazardous waste would be generated during construction.

MSC Facility. No notable quantities of hazardous and nonhazardous waste would be generated during construction.

AOT Facility. No notable quantities of hazardous and nonhazardous waste would be generated during construction. During construction at the AOT facility, there is the possibility that contaminated soil or groundwater (due to historic site release) may be encountered during excavation for utility work. Should contaminated soil be encountered AOT's plant operation and Work Information procedures would guide the safe and responsible management of any potentially contaminated material. Gross soil contamination is not expected to be encountered during construction.

Operation. In general, the operations in each of the commercial facilities would be similar in nature to existing operations. Although additional waste (LLW, hazardous, and non-hazardous) would be generated, the waste handling and management practices would remain the same, and there is sufficient available capacity for the disposal of additional waste. No adverse impacts to waste management are expected from the Proposed Action. Waste generation associated with the Proposed Action is described below and identified in Table 3-23.

Table 3-23. Additional Waste Generation under the Proposed Action

Waste Type	Facility		
	TDF	MSC	AOT
Low-level radioactive waste (LLW) (yd^3/year)	1	50	15
Hazardous waste (gallons/year)	110 gallons (one 55-gal drum every 6 months)	110 gallons (one 55-gal drum every 6 months)	2,860 gallons (one 55-gal drum/week)
Hazardous waste (shipments/year)	2	2	12
Nonhazardous waste (tons/year)	0.5	4.25	4.25

Source. CNS 2024.

***TDF*.** Under the Proposed Action, additional annual waste generation is summarized as follows: one cubic yard of LLW; 110 gallons of hazardous waste; and 0.5 tons of nonhazardous waste. Two additional hazardous waste shipments to off-site TSD facilities are projected annually. Four additional waste shipments from TDF to Y-12 are projected annually. Waste would be handled per current practice, as described in Section 3.12.1. Nonhazardous waste associated with DU manufacturing would be disposed of at the ORR landfills or at commercial landfills. Compared to the 145,289 cubic yards of nonhazardous waste that was disposed of in the ORR landfills in

2021, TDF DU manufacturing would increase wastes by 0.003 percent. Significant quantities of hazardous chemicals would not be used during DU manufacturing (CNS 2024).

MSC Facility. Under the Proposed Action, additional annual waste generation is summarized as follows: 50 cubic yards of LLW; 110 gallons of hazardous waste; and 4.25 tons of nonhazardous waste. Two additional LLW shipments to Waste Control Specialists in Andrews, Texas are projected annually. Two additional hazardous waste shipments to off-site TSD facilities are projected annually. Waste would be handled per current practice, as described in Section 3.12.1. Nonhazardous waste associated with DU manufacturing would be disposed of at the ORR landfills or at commercial landfills. Compared to the 145,289 cubic yards of nonhazardous waste that was disposed of in the ORR landfills in 2021, MSC DU manufacturing would increase wastes by 0.02 percent.

AOT Facility. Under the Proposed Action, additional annual waste generation is summarized as follows: 15 cubic yards of LLW; 2,860 gallons of hazardous waste; and 4.25 tons of nonhazardous waste. During DU manufacturing, LLW would be produced; the raffinate from the extraction column would contain nitric acid, trace uranium and uranium daughters, and titanium nitrate and other material separated from the uranium. The waste would be solidified and stored in 55-gallon drums. Annually, 48 to 52, 55-gallon drums are projected from the DU operations, which is approximately 15 cubic yards of LLW. LLW would be disposed of at the off-site licensed TSD facility, as described in Section 3.12.1. Twelve additional hazardous waste shipments to off-site TSD facility (Waste Control Specialists in Andrews, Texas) are projected annually. Waste would be handled per current practice, as described in Section 3.12.1.

Hazardous chemicals that would be used for DU manufacturing include hydrogen (H_2), HF, nitrogen (N_2), nitric acid, sodium hydroxide, tributyl phosphate, dodecane, and uranium oxide. These chemicals would be properly stored within a dedicated chemical storage building outside of the DU manufacturing building.

3.12.3 No-Action Alternative Effects

Under the No-Action Alternative, DU manufacturing would not be conducted at the TDF, MSC, and AOT facilities, 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, TDF, and MSC Facility. Y-12 is located within 50 miles of three interstate highways: I-40, I-75, and I-81. As shown on Figure 3-14, collector roads serving the area around Y-12, TDF, and MSC facility 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 3-24. In the vicinity of the site, the collector roads have traffic speed limits of between 25 and 40 miles per hour.

Table 3-24. Average Daily Traffic Counts on Roads in Vicinity of Y-12, TDF, and MSC

Pointer on Figure 3-14	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 3-14. Roads in the Vicinity of Y-12, TDF, and MSC

AOT Facility. The AOT facility is located on Tennessee Route 353 in rural Washington County, approximately 4 miles southwest of the Jonesborough downtown area. Traffic on Tennessee Route 353 and other area roads is generally free flowing with minimal congestion.

3.13.2 Proposed Action Effects

Construction and Operation. As shown in Table 3-24, roads in the vicinity of Y-12, TDF, and MSC facility 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 a maximum 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. During operations, the addition of a maximum of 10 workers would not affect traffic on area roads. At the AOT facility, construction activities could add approximately 40 vehicles to daily traffic counts in the area, would represent much less than a one percent increase in the Washington County employment, which also suggests that area traffic would not be adversely affected. During operations, the addition of a maximum of 10 workers would not affect traffic on area roads.

The potential impacts of transporting DU materials and the associated LLW has been extensively studied by DOE (*see* DOE 2004a, DOE 2004b, and DOE 2020a). Although transport of DU materials could occur via either truck or train, truck transport is the most likely mode. Shipments of DU materials are expected as follows:

- Up to 50 shipments of DU feedstock/product per year are expected between Y-12 and TDF;
- About 50 shipments of DU materials per year are expected between Y-12 and the MSC facility;
- About 50 shipments of DU materials are expected between the MSC facility and TDF per year;
- About 14 shipments of DU feedstock could occur annually between the Portsmouth DUF_6 conversion site and the AOT facility;
- Up to 15 shipments could occur annually between Y-12 and the AOT facility (CNS 2024).[14]

In total, about 180 shipments of DU materials are expected annually. In DOE 2020a, DOE analyzed the transport of 46,200 shipments of DU materials over much longer distances than the distances associated with the Proposed Action in this EA. The potential impacts were calculated as follows: (1) Transport crews: 0.08 LCFs; and (2) Public: 0.2 LCFs (*see* Table 4-18 of DOE 2020a). Compared to the impacts associated with transporting 46,200 shipments of DU materials, the potential impacts of transporting about 180 shipments of DU materials associated with the Proposed Action in this EA would be: (1) Transport crews: 0.0002 LCFs; and (2) Public: 0.0006 LCFs. Per the analysis in DOE 2020a, the transportation of one LLW shipment resulted in calculated impacts of a maximum of 2×10^{-7} LCFs to both transport crews and the public (*see* Table 4-20 of DOE 2020a). Because a maximum of four additional shipments of LLW from the commercial facilities could occur annually, transportation impacts from the commercial site would not be expected to exceed 8×10^{-7} LCFs to either the transport crews and the public. Accident impacts associated with transport of DU materials are presented in Section 3.11.2.

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.

[14] DoD munitions could also be provided to AOT as needed. There is currently about 2.5 million pounds of DU material at Aerojet for the DU program, which is backup fill material.

3.14 Site Infrastructure

Site infrastructure are the essential resources and services necessary to support the construction and operation of the DU manufacturing mission. This section provides an overview of the availability and capacity of existing infrastructure, as well as the anticipated future infrastructure needs. For the purposes of this analysis, infrastructure includes electricity, natural gas and fuel, and potable water and wastewater. The Proposed Action consists of interior retrofits, moderate exterior alterations, and ongoing operations at three distinct facilities located in two geographic areas. All sites are existing facilities tied into existing infrastructure. The analysis for Oak Ridge encompasses TDF and MSC facility, while Jonesborough pertains to the AOT facility. Additionally, Y-12 on the ORR is included in this analysis as it represents the location of the No-Action Alternative.

3.14.1 Affected Environment

Y-12, TDF, MSC Facility, and AOT Facility.

***Electricity*.** The Tennessee Valley Authority (TVA) generates power in the region. The TVA operates a diverse mix of power generating facilities providing electricity for 153 local power companies in Tennessee and parts of six surrounding states (TVA 2024). Together, TVA facilities produce a combined 34 gigawatts of electricity generating capacity, making it the largest government-owned electricity provider in the United States (EIA 2021b). Oak Ridge and Jonesborough receive their TVA power supply through third-party intermediaries; the City of Oak Ridge Electric Department supplying TDF and MSC, and BrightRidge distributing power to the AOT facility. Y-12 receives power directly from the TVA.

***Natural Gas and Fuel*.** Oak Ridge. The Oak Ridge Utility District (ORUD) supplies natural gas to TDF and MSC facility. ORUD is an independent non-profit utility supplying natural gas to 15,000 customers in Anderson and Roane Counties, Tennessee (ORUD 2023). Jonesborough. Atmos Energy is the natural gas supplier in Jonesborough and Washington, County. Y-12. 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.

***Water*.** Raw water for Oak Ridge 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 water treatment plant can deliver water to two water storage reservoirs at a potential rate of 24 million gallons per day. Water from the reservoirs is distributed to the City of Oak Ridge and the Oak Ridge Reservation. 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 (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).

Y-12 is served by the City of Oak Ridge's water system. Separate underground piping systems provide distribution of raw and treated water within Y-12. Raw water is routed to Y-12 by two lines: a 16-inch main from the booster station, installed in 1943, and an 18-inch main from the 24-inch filtration plant feed line. In 2016, potable water consumption at Y-12 averaged 1.5 million gallons per day or 560 million gallons per year.

The Town of Jonesborough Water Distribution system, encompassing a network of over 350 miles of water lines, serves a population exceeding 14,000 residents within Washington County. Drawing from the Nolichucky River, the system employs a dual treatment method featuring charcoal filtration and a MIOX mixed oxidant disinfection process. Jonesborough also assumes control of the pump stations dispersed throughout the water system, alongside the management of numerous water storage reservoirs totaling a capacity exceeding 5.4 million gallons. The AOT facility is connected to a six-inch water main at Old State Route 34 supplied by Jonesborough Water (Jonesborough 2024).

Wastewater. Oak Ridge operates two wastewater treatment plants that treat a combined flow of 5.6 million gallons of wastewater per day for a total of 2.1 billion gallons per year. The operators perform daily operations of the main wastewater plant and the Rarity Ridge wastewater plant (Oak Ridge 2024). TDF and MSC facility are connected to the City of Oak Ridge's public wastewater infrastructure.

Jonesborough's Wastewater infrastructure extends from its northern boundary southward along Old State Route 34, encompassing areas up to David Crockett High School. Properties south of the high school, including the AOT facility, lie beyond Jonesborough's sewer service system and rely on distinct septic systems. AOT, under NPDES permit no. TN0057983, is authorized to discharge various treated waters, such as process wastewater, noncontact cooling water, cooling tower blowdown, treated sanitary wastewater, and shower water. Furthermore, AOT operates within the parameters of NPDES Permit TNR051099 for Stormwater Discharges. Wastewaters and stormwaters are discharged into the receiving waters of Little Limestone Creek (AOT 2023).

The Y-12 sanitary sewer system was first installed in 1943 and expanded as the plant grew. Sewage from most buildings flows to a 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 750,000 gallons per day (NNSA 2011). Y-12 has a sanitary sewer users permit, issued by the City of Oak Ridge, which regulates water discharges.

3.14.2 Proposed Action Effects

Construction and Operation.

***Electricity*.** The TVA electrical system has sufficient capacity to support the Proposed Action. As shown on Table 3-25, peak demand at TDF would be 5.3 MW with an average monthly electrical consumption of 662 MWh. Peak demand at the MSC facility would be 2.1 MW with an average monthly electrical consumption of 658 MWh. Peak demand at the AOT facility would be 3.2 MW with an average monthly electrical consumption of 675 MWh. The electricity demands of the Proposed Action would be minimal compared to the TVA electricity generating capacity.

Table 3-25. Baseline and Projected Electrical Demand and Consumption

Facility	Baseline		Proposed Action			
	Peak Electrical Demand	Average Electrical Consumption (monthly)	Increase to Peak Demand	Increase to Electrical Consumption (monthly)	Projected Peak Demand	Projected Electrical Consumption (monthly)
TDF	5.3 MW	462 MWh	no increase	200 MWh	5.3 MW	662 MWh
MSC	1.1 MW	333 MWh	1 MW	325 MWh	2.1 MW	658 MWh
AOT	2.4 MW	500 MWh	0.8 MW	175 MWh	3.2 MW	675 MWh

Natural Gas and Fuel. Natural gas would generally be needed for supplying the vacuum furnaces. Each of the natural gas providers have sufficient supply capacity to support the natural gas demands of the Proposed Action. All facilities would be equipped with outdoor emergency diesel-engine generator systems to provide backup power in the event of a utility power outage. Fuel usage would be limited to monthly testing and usage during outage events.

Water. Construction activities would require a maximum of 40 workers and water demands from DU manufacturing would be negligible. Operational water demands, which are shown in Table 3-26, would be adequately supported by the existing supplies and infrastructure. Potable water use by workers would be less than historical usages at each site.

Table 3-26. Baseline and Projected Water Demand and Consumption

Facility	Baseline Average Water Demand	Increase to Water Demand	Projected Water Demand
TDF	1.4 MGY	no change	1.4 MGY
MSC	1.2 MGY	+1.5 MGY	2.7 MGY
AOT	2.4 MGY	+28,000 gallons per year	2.4 MGY

MGY = million gallons per year

Wastewater. Wastewater increases would be minimal and existing wastewater facilities would be adequate to support DU manufacturing at the three commercial facilities.

3.14.3 No-Action Alternative Effects

Under the No-Action Alternative, NNSA would perform DU manufacturing in existing facilities at Y-12 and commercial facilities would not be upgraded or repurposed. Infrastructure requirements would remain unchanged when compared to existing conditions.

4 CUMULATIVE EFFECTS

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

Construction activities at the three commercial facilities would occur as early as 2026 and could last until 2031 (at the MSC facility). Operations could begin as early as 2025 using existing equipment. Operations would only be expected to last until a long-term Depleted Uranium Manufacturing Complex is constructed at Y-12 (expected by approximately 2040). Consequently, cumulative effects associated with operations at the three commercial facilities are analyzed over a period of 2025-2040. 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 off-site 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) off-site 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 2020b, 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 impact analysis: (1) continued construction of the Uranium Processing Facility (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 75 percent constructed, with final construction expected in the next two 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 Mercury Treatment Facility (MTF), which is expected to be operational until approximately 2026. All of these projects are occurring on Y-12 and/or in the vicinity of the TDF and the MSC Facility. No projects were identified in the Jonesborough area that would notably contribute to cumulative impacts.

4.2 Potential Cumulative Effects

Table 4-1 presents the cumulative impact 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: DU Manufacturing	UPF	ORETTC	LPF	IFDP/Cleanup	MTF
Land Resources	A total of less than 3 acres of previously disturbed land at the three commercial facilities could be re-disturbed.	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 13.9 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	There would be no notable changes to the visual character of the three commercial facilities.	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. All areas are in attainment for all NAAQS and emissions at the three commercial facilities 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: DU Manufacturing	UPF	ORETTC	LPF	IFDP/Cleanup	MTF
Noise	There are no sensitive noise receptors in close proximity to the three commercial facilities 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 off-site 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 effluents would not notably change.	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: DU Manufacturing	UPF	ORETTC	LPF	IFDP/Cleanup	MTF
Biological Resources	Construction activities would not affect ecological resources at any of the three commercial facilities. No critical habitat for threatened or endangered species is known to exist at any of the three commercial facilities.	Construction activities are occurring on previously disturbed land and would not affect ecological resources. 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 three commercial facilities would not affect cultural resources.	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: DU Manufacturing	UPF	ORETTC	LPF	IFDP/Cleanup	MTF
Socioeconomics	The peak construction workforce (20-40 persons) and additional operational workforce (a maximum of 10 persons) would be negligible compared to the projected populations 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 mrem. 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: DU Manufacturing	UPF	ORETTC	LPF	IFDP/Cleanup	MTF
Human Health (Normal Operations)	Workers would be subject to minimal occupational risks. Radiological impacts to workers would be similar to existing impacts. No off-site radiological or hazardous chemical impacts 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 off-site 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 off-site 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	All of the operational and natural phenomena-initiated events that involve DU oxide are expected to have low unmitigated radiological and chemical consequences to involved workers, collocated (noninvolved) workers, and negligible radiological and chemical consequences to the public (DOE 2020a).	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 off-site accidents would not be expected from IFDP/cleanup activities.	Workers would be subject to occupational hazards/accidents, but off-site accidents would not be expected from remediation activities.

Resource Area	Proposed Action: DU Manufacturing	UPF	ORETTC	LPF	IFDP/Cleanup	MTF
Intentional Destructive Acts	Because of the low hazard posed by DU oxide, the material would not be an attractive target for a terrorist attack or other intentional destructive acts (DOE 2020a). Consequently, the risk of terrorist acts associated with the Proposed Action are considered minimal.	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	Operations would generate minor quantities of LLW, hazardous waste, and nonhazardous waste that would be disposed of in existing treatment, storage, and disposal facilities.	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 and planned ORR and commercial 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: DU Manufacturing	UPF	ORETTC	LPF	IFDP/Cleanup	MTF
Infrastructure	Construction activities would have minimal effects on infrastructure capacity. The capacity of existing infrastructure at the three commercial facilities would be adequate to support the DU manufacturing 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 2024, NNSA 2011, NNSA 2020b, NNSA 2021c, DOE 2016b.

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