# Orano Enrichment USA, LLC



# IKE Enrichment Facility
# Environmental Report

Revision 0

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# Master Table of Contents


| | | |
|---|---|---|
| 1.0 | INTRODUCTION TO THE ENVIRONMENTAL REPORT | 1-1 |
| | 1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION | 1-2 |
| | 1.2 THE PROPOSED ACTION | 1-5 |
| | 1.3 APPLICABLE REGULATORY REQUIREMENTS, PERMITS, AND REQUIRED CONSULTATIONS | 1-9 |
| | APPENDIX 1A: REGULATORY CORRESPONDENCE | 1-16 |
| 2.0 | ALTERNATIVES | 2-1 |
| | 2.1 DETAILED DESCRIPTION OF THE ALTERNATIVES | 2-1 |
| | 2.2 ALTERNATIVES CONSIDERED BUT ELIMINATED | 2-16 |
| | 2.3 CUMULATIVE EFFECTS | 2-18 |
| | 2.4 COMPARISON OF THE PREDICTED ENVIRONMENTAL IMPACT | 2-18 |
| 3 | DESCRIPTION OF THE AFFECTED ENVIRONMENT | 3-1 |
| | 3.1 LAND USE | 3-1 |
| | 3.2 TRANSPORTATION | 3-12 |
| | 3.3 GEOLOGY AND SOILS | 3-13 |
| | 3.4 Water Resources | 3-44 |
| | 3.5 ECOLOGICAL RESOURCES | 3-64 |
| | 3.6 METEOROLOGY, CLIMATOLOGY, AND AIR QUALITY | 3-90 |
| | 3.7 NOISE | 3-151 |
| | 3.8 HISTORIC AND CULTURAL RESOURCES | 3-160 |
| | 3.9 VISUAL AND SCENIC RESOURCES | 3-167 |
| | 3.10 SOCIOECONOMIC ENVIRONMENT | 3-183 |
| | 3.11 PUBLIC AND OCCUPATIONAL HEALTH | 3-207 |
| | 3.12 WASTE MANAGEMENT | 3-219 |
| 4 | ENVIRONMENTAL IMPACTS | 4-1 |
| | 4.1 LAND USE IMPACTS | 4-1 |
| | 4.2 TRANSPORTATION IMPACTS | 4-4 |
| | 4.3 GEOLOGY AND SOILS IMPACTS | 4-25 |
| | 4.4 WATER RESOURCES IMPACTS | 4-29 |
| | 4.5 ECOLOGY IMPACTS | 4-37 |

| | | | |
|---|---|---|---|
| | 4.6 | AIR QUALITY IMPACTS | 4-46 |
| | 4.7 | NOISE IMPACTS | 4-62 |
| | 4.8 | Historical and Cultural Resources impacts | 4-70 |
| | 4.9 | VISUAL/SCENIC RESOURCES IMPACTS | 4-72 |
| | 4.10 | SOCIOECONOMIC IMPACTS | 4-78 |
| | 4.11 | ENVIRONMENTAL JUSTICE | 4-81 |
| | 4.12 | PUBLIC AND OCCUPATIONAL HEALTH IMPACTS | 4-81 |
| | 4.13 | WASTE MANAGEMENT IMPACTS | 4-111 |
| 5.0 | MITIGATION MEASURES | | 5-1 |
| | 5.1 | LAND USE | 5-1 |
| | 5.2 | TRANSPORTATION | 5-1 |
| | 5.3 | GEOLOGY AND SOILS | 5-2 |
| | 5.4 | WATER RESOURCES | 5-3 |
| | 5.5 | ECOLOGICAL RESOURCES | 5-5 |
| | 5.6 | AIR QUALITY | 5-5 |
| | 5.7 | NOISE | 5-6 |
| | 5.8 | HISTORIC AND CULTURAL RESOURCES | 5-7 |
| | 5.9 | VISUAL/SCENIC RESOURCES | 5-7 |
| | 5.10 | SOCIOECONOMICS | 5-7 |
| | 5.11 | ENVIRONMENTAL JUSTICE | 5-7 |
| | 5.12 | PUBLIC HEALTH | 5-7 |
| | 5.13 | WASTE MANAGEMENT | 5-8 |
| 6 | ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS | | 6-1 |
| | 6.1 | RADIOLOGICAL MONITORING | 6-1 |
| | 6.2 | PHYSIOCHEMICAL MONITORING | 6-7 |
| | 6.3 | ECOLOGICAL MONITORING | 6-9 |
| 7.0 | Cost Benefit Analyses | | 7-1 |
| | 7.1 | Costs and Benefits of the Proposed Action | 7-1 |
| | 7.2 | Environmental Cost | 7-2 |

8 Summary of Environmental Consequences 8-1
8.1 Introduction 8-1
8.2 Unavoidable Adverse Environmental Impacts 8-1
8.3 Irreversible and Irretrievable Commitments of Resources 8-1
8.4 Short-Term and Long-Term Impacts 8-2
8.5 Short-Term uses of the Environment and Maintenance and ENHANCEMENT of Long-Term Productivity 8-2

9 REFERENCES 9-1
9.1 Chapter 1 Introduction to the Environmental Report 9-1
9.2 Chapter 2 Alternatives 9-2
9.3 Chapter 3 Description of the Affected Environment 9-3
9.4 Chapter 4 Environmental Impacts 9-11
9.5 Chapter 5 Mitigation Measures 9-15
9.6 Chapter 6 Environmental Measurements and Monitoring Program 9-15
9.7 Chapter 7 Cost Benefit Analysis 9-15
9.8 Chapter 8 Summary of Environmental Consequences 9-15

10.0 LIST OF PREPARERS 10-1

## List of Acronyms

| Acronym | Definition |
|---|---|
| AADT | Average Annual Daily Traffic |
| ac. | Acre |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ACP | American Centrifuge Plant |
| ACS | American Community Survey |
| AERMOD | American Meteorological Society (AMS)/EPA Regulatory Model |
| AES | AREVA Enrichment Services |
| AGL | Above Ground Level |
| ALARA | As Low As Reasonably Achievable |
| ALOHA | Areal Locations of Hazardous Atmospheres |
| AMR | Advanced Modular Reactor |
| AMSL | Above Mean Sea Level |
| ANL | Argonne National Laboratory |
| ANSI | American National Standard Institute |
| APE | Area of Potential Effects |
| AQI | Air Quality Index |
| ARAP | Aquatic Resource Alteration Permit |
| ASCE | American Society of Civil Engineers |
| ASER | Annual Site Environmental Report |
| ASOS | Automated Surface Observing System |
| ASTM | American Society for Testing and Materials |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| AWOS | Automated Weather Observing System |
| BA | Biological Assessment |
| BEIR | Biological Effects of Ionizing Radiation |
| BLM | Bureau of Land Management |
| BMP | Best Management Practice |
| BSPB | Blending, Sampling and Preparation Building |
| CAA | Controlled Access Area |
| CAA | Clean Air Act |
| CAB | Centrifuge Assembly Building |
| CAMP | Central Atlantic Magmatic Province |
| CAS | Chemical Abstracts Service |
| CBG | Census Block Group |
| CCTV | Closed-Circuit Television |
| CDE | Carbon Dioxide Equivalents |
| CEDE | committed effective dose equivalent |
| CEUS | Central and Eastern United States |

| Acronym | Definition |
|---|---|
| CFR | Code of Federal Regulations |
| CFTF | Carbon Fiber Technology Facility |
| CH | fat clay |
| CMA | Cooperative Management Area |
| CO | Carbon monoxide |
| CPD | clean parcel determination |
| Cr | Rome Formation |
| CRA | Cultural Resource Analysts, Inc. |
| CRN | Clinch River Nuclear |
| CRSB | Cylinder Receiving & Shipping Building |
| CSP | Cylinder Storage Pads |
| CSX | CSX Transportation |
| CVRF | Control Volume Reduction Facility |
| CWA | Clean Water Act |
| D&D | Deactivation & Decommissioning |
| dB | decibel |
| DEQ | Department of Environmental Quality |
| DF | Decontamination Factor |
| DGs | Diesel Generators |
| DOD | U.S. Department of Defense |
| DOE | U.S. Department of Energy |
| DOI | U.S. Department of the Interior |
| $DUF_6$ | Depleted Uranium |
| EA | Environmental Assessment |
| EDCFs | Exposure-to-Dose conversion factors |
| EECP | Entry Exit Control Point |
| EERF | Enhanced Emergency Response Facility |
| EFPC | East Fork Poplar Creek |
| EHS&L | Environmental, Health, Safety, and Licensing |
| EIA | U.S. Energy Information Administration |
| EIS | Environmental Impact Statement |
| EOC | Emergency Operations Center |
| EPA | U.S. Environmental Protection Agency |
| EPFS | Eastern Piedmont Fault System |
| ER | Environmental Report |
| EREF | Eagle Rock Enrichment Facility |
| ERTF | Emergency Response Training Facility |
| ESA | Endangered Species Act |
| ESB | Electrical Services Building |
| ESP | Early Site Permit |

| Acronym | Definition |
|---|---|
| ET | East Tributaries |
| ETC | Enrichment Technology Company Ltd. |
| ETEDA | East Tennessee Economic Development Agency |
| ETTP | East Tennessee Technology Park |
| ETSZ | Eastern Tennessee Seismic Zone |
| EUP | Enriched Uranium Product |
| FAA | U.S. Federal Aviation Administration |
| FEMA | U.S. Federal Emergency Management Agency |
| FIR | Federal and Institutional Research |
| FIRM | Flood Insurance Rate Map |
| FLM | Federal Land Managers |
| FOCI | Foreign Ownership, Control, or Influence |
| FONSI | Finding Of No Significant Impact |
| FPEIS | Final Programmatic Environmental Impact Statement for Depleted Uranium |
| FTE | Full-Time Equivalent |
| FTIR | Gas Fourier Transform Infrared Spectrometry |
| G | gravity |
| Ga | giga annum |
| GDFS | Gasoline and Diesel Fueling Station |
| GDP | Gaseous Diffusion Plant |
| GE | General Electric |
| GEH | GE Hitachi Nuclear Energy |
| GEVS | Gaseous Effluent Ventilation System |
| GIS | Geographic Information System |
| gpm | gallons per minute |
| GLE | Global Laser Enrichment LLC |
| HA | Habitat Area |
| HC | Hazard Category |
| HCFC | halogenated fluorocarbons |
| HCS | Horizon Center Site |
| HEPA | High-Efficiency Particulate Air |
| HF | Hydrogen Fluoride |
| HFCs | hydrofluorocarbons |
| HHE | Health Hazard Evaluation |
| HRCQ | Highway Route Controlled Quantity |
| HUD | U.S. Department of Housing and Urban Development |
| HVAC | Heating, Ventilation and Air Conditioning |
| IBR | Incorporated by Reference |
| ICAO | Automated Weather Observing System |

| Acronym | Definition |
|---|---|
| ICP-AES | Inductively Coupled Plasma Atomic Emission Spectroscopy |
| ICP-MS | Inductive Coupled Plasma Mass Spectrometry |
| ICRP | International Commission of Radiological Protection |
| IDA | Intrusion Detection & Assessment |
| IEA | International Energy Agency |
| IEC | International Electrotechnical Commission |
| IDLH | Immediately Dangerous to Life or Health |
| INL | Idaho National Laboratory |
| IPaC | Information for Planning and Consultation |
| IROFS | Items Relied On For Safety |
| ISA | Integrated Safety Analysis |
| ISAS | Integrated Safety Analysis Summary |
| ISO | International Organization for Standardization |
| JHA | Job Hazard Analysis |
| JSA | Job Safety Analysis |
| KDU | potassium diuranate |
| km | kilometer |
| KOH | potassium hydroxide |
| Ldn | Day-Night Average Sound Level |
| Leg | Equivalent Sound Level |
| LES | Louisiana Energy Services |
| LEU | low-enriched uranium |
| LLD | Lower limits of detection |
| LPM | liters per minute |
| LLW | Low-Level Waste |
| LTA | Lost Time Accident |
| LWR | Light Water Reactor |
| Ma | mega annum |
| MAPEP | Mixed Analyte Performance Evaluation Program |
| MCL | maximum contaminant levels |
| MCNP | Monte Carlo N particle |
| MDC | Minimum detectable concentration |
| ME&I | Mechanical, Electrical and Instrumentation |
| MEI | Maximally Exposed Individual |
| MGD | Million gallons per day |
| mi. | mile |
| MIMS | Manifest Information Management System |
| MLLW | Mixed Low-Level Waste |
| mph | miles per hour |
| MOVES | Motor Vehicle Emissions Simulator |

| Acronym | Definition |
|---|---|
| MRI | Mean Recurring Interval |
| MRLC | Multi-Resolution Land Characteristics Consortium |
| MSB | Mechanical Services Building |
| MSWU | Million separative works unit |
| MBTA | Migratory Bird Treaty Act |
| NA | Natural Area |
| NaF | Activated sodium fluoride |
| NEF | National Enrichment Facility |
| NFIP | National Flood Insurance Program |
| NCDC | National Climatic Data Center |
| NAAQS | National Ambient Air Quality Standards |
| NCES | National Center for Education Statistics |
| NCRP | National Council on Radiation Protection and Measurements |
| NEI | Nuclear Energy Institute |
| NELAC | National Environmental Laboratory Accreditation Conference |
| NELAP | National Environmental Laboratory Accreditation Program |
| NEPA | National Environmental Policy Act |
| NESHAP | National Emission Standards Hazardous Air Pollutants |
| NIOSH | National Institute for Occupational Safety and Health |
| NFI | No Further Investigation |
| NFIP | National Flood Insurance Program |
| NIST | National Institute of Standards and Technology |
| NLCD | National Land Cover Database |
| NMSS | The Office of Nuclear Material Safety and Safeguards |
| NNSA | National Nuclear Security Administration |
| NO | Nitrogen dioxide |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| NRC | U.S. Nuclear Regulatory Commission |
| NRCS | Natural Resource Conservation Service |
| NRHP | National Register of Historic Places |
| NRPWs | non-relatively permanent waters |
| NWI | National Wetlands Inventory |
| NWS | National Weather Service |
| OE | Orano Enrichment USA LLC |
| OEHHA | Office of Environmental Health Hazard Assessment |
| ORED | Oak Ridge Electric Department |
| OREIS | Oak Ridge Environmental Information System |
| ORETTC | Oak Ridge Enhanced Technology Training Center |
| ORNL | Oak Ridge National Laboratory |

| Acronym | Definition |
|---|---|
| ORR | Oak Ridge Reservation |
| OSB | Operation Support Building |
| OSHA | Occupational Safety and Health Administration |
| PEL | Permissible Exposure Limit |
| PEM | palustrine emergent |
| PEZ | Paleozoic Extended Crust |
| PFO | palustrine forested |
| PHA | Potential Habitat Area |
| PM | Particle Matter |
| PMF | probable maximum flood |
| PFPE | Perfluoropolyether |
| PGA | Peak ground acceleration |
| POTW | Publicly Owned Treatment Works |
| PSD | Prevention of Significant Deterioration |
| RA | Reference Area |
| RADTRAN | Radioactive Material Transport |
| RCRA | Resource Conservation Recovery Act |
| REL | Reference Exposure Level |
| REMP | Radiological Environmental Monitoring Program |
| RIDDOR | Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations |
| RIMS II | Regional Input-Output Modeling System |
| RLME | Repeated Large Magnitude Earthquakes |
| ROD | Record of Decision |
| ROI | Region of Influence |
| RPWs | relatively permanent waters |
| RQD | Rock Quality Designation |
| SAR | Safety Analysis Report |
| SBM | Separations Building Module |
| SDC | Seismic Design Category |
| SHPO | State Historic Preservation Office |
| SIP | State Implementation Plan |
| SNM | special nuclear material |
| SMR | Small Modular Reactor |
| SO | Sulfur dioxide |
| SPCC | Spill Prevention Control and Countermeasures |
| SQG | small quantity generator |
| SR | State Route |
| SRDT | Solar Radiation Delta Temperature |
| SRS | Savannah River Site |

| Acronym | Definition |
|---|---|
| SRT | Seismic Refraction Tomography |
| SSAB | Security and Secure Administrative Building |
| SSC | Seismic Source Characterization |
| SSE | safe-shutdown earthquake |
| SSP-2 | Self-Sufficiency Parcel 2 |
| STEL | Short Term Exposure Limit |
| SWPPP | Stormwater Pollution Prevention Plan |
| SWSA | Solid Waste Storage Area |
| SWU | separative work units |
| TDEC | Tennessee Department of Environment and Conservation |
| TDF | Tennessee Division of Forestry |
| TDOA | Tennessee Division of Archaeology |
| TDOT | Tennessee Department of Transportation |
| TEDE | total effective dose equivalent |
| TF3 | TRISO-X Fuel Fabrication Facility |
| TGS | Tennessee Geological Survey |
| THC | Tennessee Historical Commission |
| TLD | thermoluminescent dosimeters |
| TN SHPO | Tennessee State Historic Preservation Office |
| TSB | Technical Support Building |
| TSDF | treatment, storage, and disposal facility |
| TVA | Tennessee Valley Authority |
| TWA | Time Weighted Average |
| TWRA | Tennessee Wildlife Resources Agency |
| TYS | McGhee Tyson Airport |
| UCL | Urenco Capenhurst Limited |
| $UF_4$ | uranium tetrafluoride |
| $UF_6$ | uranium hexafluoride |
| $UO_2F_2$ | Uranyl Fluoride |
| USACE | U.S. Army Corps of Engineers |
| USCB | U.S. Census Bureau |
| USDA | U.S. Department of Agriculture |
| USEC | United States Enrichment Corporation |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geologic Survey |
| VOC | Volatile Organic Compounds |
| VRM | Visual Resource Management |
| Vs | velocity |
| WCS | Waste Control Specialist |

| Acronym | Definition |
|---|---|
| WebTRAGIS | Web-Based Transportation Routing Analysis Geographic Information System |
| WMO | World Meteorological Organization |
| WNA | World Nuclear Association |
| WOTS | Water of the State |
| WOTUS | waters of the U.S. |
| WWC | wet-weather conveyance |
| WWSY | White Wing Scrap Yard |

# Chapter 1: Introduction

## TABLE OF CONTENTS


1.0 INTRODUCTION TO THE ENVIRONMENTAL REPORT ..... 1-1

1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION ..... 1-2

1.1.1 Market Analysis of Enriched Uranium Supply and Requirements ..... 1-2

1.2 THE PROPOSED ACTION ..... 1-5

1.3 APPLICABLE REGULATORY REQUIREMENTS, PERMITS, AND REQUIRED CONSULTATIONS ..... 1-9

APPENDIX 1A: REGULATORY CORRESPONDENCE ..... 1-16

## LIST OF TABLES

Table 1-1 Schedule ..... 1-9
Table 1-2 Permits and Approvals Required for Construction and Operation ..... 1-10
Table 1-3 Log for Documenting Interactions with Federal and State Agencies ..... 1-14

## LIST OF FIGURES

Figure 1-1 Number of Nuclear Reactors (U.S. and World) and U.S. Capacities (2020-2040) . 1-3
Figure 1-2 Purchases of Enrichment Services by Origin Country and Year (2019–2023)..... 1-5
Figure 1-3 Oak Ridge, Tennessee Regional Map..... 1-6
Figure 1-4 Location of SSP-2 in relation to Oak Ridge. ..... 1-7
Figure 1-5 SSP-2 Tracts ..... 1-8

# 1.0 INTRODUCTION TO THE ENVIRONMENTAL REPORT

This Environmental Report (ER) constitutes one portion of an application submitted by Orano Enrichment USA LLC (OE) to the Nuclear Regulatory Commission (NRC) for a license to construct and operate a gas centrifuge uranium enrichment facility (the Facility). The scope of this ER specifically excludes any power supply, transmission lines, and switchyards siting and construction.

The Facility will be located near the city of Oak Ridge, Tennessee at latitude 35°57'04"N and longitude 84°21'26"W. The Environmental Report (ER) for the Facility serves two primary purposes. First, it provides information that is specifically required by the NRC to assist it in meeting its obligations under the National Environmental Policy Act (NEPA) of 1969 (Pub. Law 91-190, 83 Stat. 852) and the agency's NEPA-implementing regulations. Second, it demonstrates that the environmental protection measures proposed by OE are adequate to protect both the environment and the health and safety of the public.

This ER evaluates the environmental impacts of the Facility. Accordingly, this document discusses the Proposed Action, the need for and purposes of the Proposed Action, and applicable regulatory requirements, permits, and required consultations (Chapter 1); considers reasonable alternatives to the Proposed Action (Chapter 2); describes the Facility and the environment potentially affected by the Proposed Action (Chapter 3); presents and compares the potential impacts resulting from the Proposed Action and its alternatives (Chapter 4); identifies mitigation measures that could eliminate or lessen the potential environmental impacts of the Proposed Action (Chapter 5); describes environmental measurements and monitoring programs (Chapter 6); provides a cost benefit analysis (Chapter 7); and summarizes potential environmental consequences (Chapter 8). A list of references is provided (Chapter 9), as well as a list of contributors to the ER (Chapter 10).

Orano SA is a corporation founded under the laws of France and governed by an Executive Board, with a share capital of 136,649,559 euros. Orano SA offers products and services covering the whole nuclear fuel cycle including uranium mining, chemistry and enrichment, as well as waste management, recycling, decommissioning, radiological protection, maintenance, logistics services, and medical nuclear isotopes.

Since its latest capital increase on October 24, 2024, ownership of Orano SA's share capital is as follows:

- French State: 90.33%
- Mitsubishi Heavy Industries: 4.83%
- Japan Nuclear Fuel Limited: 4.83%

Orano Chimie Enrichissement SASU is a 100% subsidiary of Orano SA and is headquartered in Châtillon, France. Orano Chimie Enrichissement SASU is responsible for uranium chemistry and enrichment activities worldwide.

Orano 15 SASU is a 100% subsidiary of Orano Chimie Enrichissement SASU and is headquartered in Châtillon, France.

Orano Enrichment USA Holding LLC is a 100% subsidiary of Orano 15 SASU and is headquartered in the US.

OE is a 100% subsidiary of Orano Enrichment USA Holding LLC and is headquartered in Bethesda, MD, USA. OE will be operating the Facility once licensed and constructed.

The President and Chief Executive Officer of OE is Jean-Luc Palayer, a naturalized citizen of the United States of America and a citizen of France.

## 1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

To support commercial availability of LEU and to promote diversity of supply in domestic uranium enrichment Orano Enrichment USA (OE) proposes to build a gaseous centrifuge uranium enrichment facility that would have a maximum annual enrichment capacity of 7.4 million Separative Work Units (SWU). The proposed enrichment facility will Increase capacity to enhance the domestic supply chain for Low Enriched Uranium (LEU) used to manufacture fuel for U.S. commercial nuclear energy companies.

### 1.1.1 Market Analysis of Enriched Uranium Supply and Requirements

An analysis of the market for uranium enrichment services during the period 2025 through 2040 is presented in this section.

Several factors since 2022 including the Russia-Ukraine War have forced Western enrichers to consider expanding capacities. In the U.S. context, the need is to replace imported Russian supply of enriched uranium due to the Prohibiting Russian Uranium Imports Act, the extension of operating life for existing commercial nuclear power plants and the growing interest in nuclear energy to meet the demand by AI and data centers. All these factors are expected to drive increased demand for Western enriched uranium.

#### 1.1.1.1 Forecast of Installed Nuclear Power Generating Capacity

##### 1.1.1.1.1 Nuclear Power Expected to Play a Greater Role in Meeting Growing U.S. Electricity Demand

Uranium enrichment is critical to the production of fuel for U.S. commercial nuclear power plants, which currently provide approximately 18.6% of the nation's electricity requirements (EIA December 2024). Forecasts of installed nuclear generating capacity suggest a continuing demand for uranium enrichment services, both in the U.S. and abroad. Nuclear Power Expected to Play a Greater Role in Meeting Growing U.S. Electricity Demand

In the International Energy Agency's (IEA) 2023 World Energy Outlook, nuclear generation is forecasted to grow by 25 percent by 2030 and 45 percent by 2040 under the "Stated Policies" scenario. In the "Net Zero Emissions by 2050" scenario, nuclear generation would grow by 47 percent by 2030 and more than double by 2040.

Nuclear power is indeed increasingly being positioned as a key energy source to support the rapid growth of power-intensive technologies like data centers, AI, and quantum computing, as shown on Figure 1-1. In the U.S., Microsoft is supporting the restart of Constellation's Three Mile Island-1 (TMI-1) reactor under a 20-year power agreement. Amazon is partnering with Energy Northwest and Dominion to develop Small Modular Reactors (SMR) and has also invested in X-energy. Google has committed to purchasing 500 MW from SMRs developed by Kairos Power. Other major tech players are also exploring nuclear partnerships, fueling a resurgence of interest in deploying both large light-water reactors, SMRs, and Advanced Modular Reactors (AMR) across the U.S. over the next 10 to 20 years.

On the policy side, in 2023 the Biden administration joined 22 other countries at the COP28 summit in pledging to triple global nuclear energy capacity by 2050. Even though the Trump administration, alongside Republican majorities in both houses of Congress, has signaled

significant shifts in U.S. energy policy, promotion of nuclear energy will likely prevail. In March 2025, the Department of Energy (DOE) re-issued a $900 million solicitation to support the deployment of small modular reactors to align with President Trump's agenda to “unleash American energy and AI dominance”. In May 2025, President Donald Trump signed four Executive Orders aimed at boosting domestic nuclear deployment, including increasing the domestic enrichment capacities.

Despite these announcements, World Nuclear Association (WNA) projections suggest that the evolution of U.S. nuclear capacity, in terms of both the number of reactors and total capacity, is expected to remain largely unchanged, with a slight increase during the 2030s (WNA 2023).

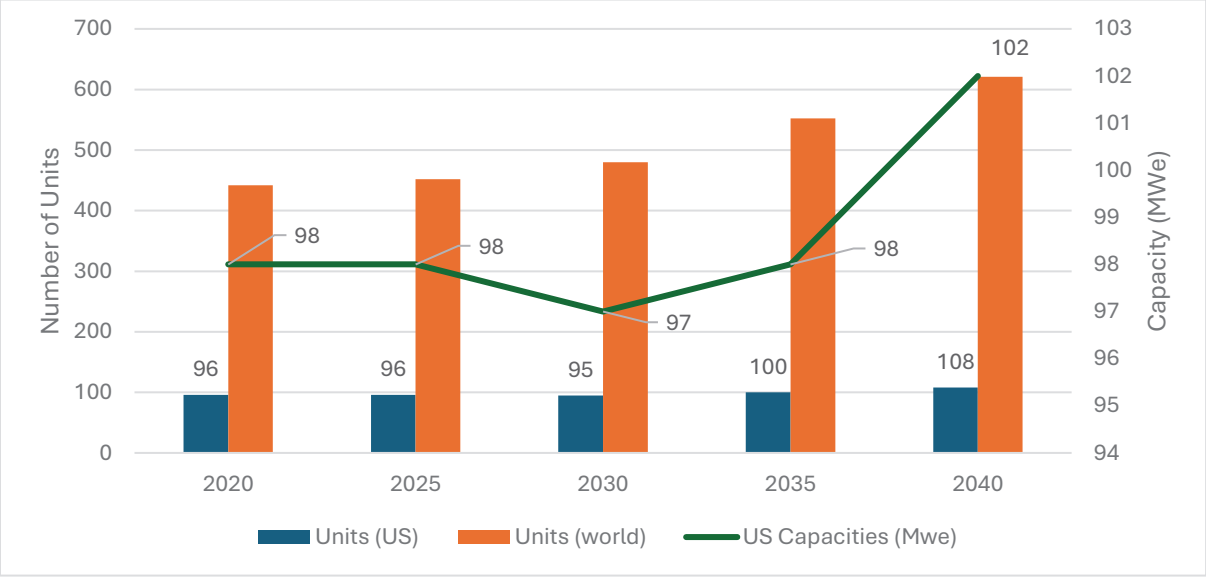



**Figure 1-1 Number of Nuclear Reactors (U.S. and World) and U.S. Capacities (2020-2040)**

1.1.1.1.2 Extended & Restarted Nuclear Power Plants

In 2023, 16 U.S. nuclear reactors applied for license renewals, to extend their operational life from 60 to 80 years. Moreover, the shutdown of TMI-1, Palisades, and Duane Arnold nuclear power plants are expected to be restarted, while Diablo Canyon continues operations instead of the planned decommissioning. DOE notably approved a $1.52 billion loan to support the restart of the Palisades nuclear plant in Michigan.

As such, the domestic SWU demand in the open markets rises faster in the near- and medium-term and further increase the imbalance due to limited domestic SWU supply.

### 1.1.1.2 U.S. Demand in Enriched Uranium

As of August 1, 2023, the United States had 93 operating commercial nuclear reactors at 54 nuclear power plants in 28 states., which collectively require approximately 15 million separative work units (MSWU) of enriched uranium per year. This demand is driven primarily by light water reactors (LWRs) using low-enriched uranium enriched up to 5 wt% U-235.

In the near term, demand is expected to remain relatively stable, supported by reactor life extensions. According to the World Nuclear Association Reference Scenario (WNA 2023), demand remains around 15 MSWU for the next 5 years. For the Reference Scenario, demand increases gradually to attain 16.4 MSWUs by 2040. This steady trend reflects a stable market

environment where domestic needs grow incrementally, possibly driven by planned nuclear deployments, including Small Modular Reactors (SMR) and Advanced Nuclear Reactors (AMR), and gradual capacity expansion.

The Upper Scenario by WNA forecasts more significant increases from 15 MSWUs in 2025 to 17.9 MSWUs by 2040. This projection likely assumes favorable policy decisions due to a rising demand for nuclear energy. It also reflects scenarios in which advanced reactor deployment accelerates a shift toward domestic fuel sourcing at a larger scale.

In contrast, the Lower Scenario presents a declining demand trend, with levels dropping from around 15 MSWUs in 2025 to just 11.1 MSWUs in 2040. This scenario reflects constrained or adverse conditions, such as reduced reactor fleet growth.

In comparison, according to the World Nuclear Association, the global demand for SWUs (Reference Scenario) will increase throughout the years. The global demand is projected to grow steadily from 2026 to 2040. Starting at 57 MSWU in 2026, the demand rises each year, reaching 104 MSWU/year by 2040. The growth remains relatively moderate in the early years but accelerates noticeably after 2030, with particularly significant increases between 2035 and 2040. This consistent rise in demand indicates a growing need due to the nuclear expansion in East and South Asia and the deployment of SMRs in 2040s. In the Upper scenario, the enrichment requirements tripled by the end of the forecasting period, with a demand of 148 MSWU/year in 2040. In the Lower scenario, the growth rate is lower reaching 69 MSWU/year by the end of 2040. At the present time, many owners and operators of nuclear power plants in the U.S. view themselves as being largely dependent on a single indigenous enricher, Urenco USA, and exportations of Enriched Uranium Product (EUP) from abroad.

#### 1.1.1.3 Decline in Russian SWU Supply and the Push to Strengthen Domestic Supply

The key source of uncertainty is the future level of supplies from Russia in the open market – both in the near and long term. The U.S. Congress bill limiting the importation of uranium from Russia became a law on May 13, 2024 (Congress.gov 2024). The law specifically bans unirradiated low-enriched uranium (i.e., uranium that has not been in a reactor) that is produced in Russia or by a Russian entity from being imported into the United States. No Russian EUP will be available to U.S. utilities after 2028.

In this context of reduction of importation of Russian EUP, open market utilities[1] seek to cover their future SWU/EUP needs with non-Russian supplies. As of today, the United States is not self-sufficient and is heavily dependent on Russian SWU. The U.S. imports approximately 22-27% of its enriched uranium from Russia as shown in Figure 1-2, making it the largest foreign supplier of nuclear fuel to the U.S. Overall, U.S. utilities purchased ~4 million Russian-origin SWU in 2023 (EIA 2024). In order to develop the domestic supply of SWU, the U.S. Congress appropriated for Fiscal Year 2024 $2.72 billion in domestic fuel cycle funding. As a global supplier of uranium enrichment service enrichment services, OE was selected by DOE with five other companies to compete for 10-year contracts totaling $2.7 billion for the supply of LEU.

If the current Russian supply ends based on the Russia Ban as noted above (Reuters 2024) (WNA 2023), the U.S. will potentially face shortfalls and it is unclear if Kazakhstan and Uzbekistan would follow suit with Russia. It is also unclear if European or World assets could make up the difference if Russia drops out of the global market or demands significant costs for supplies.

[1] Utilities located in countries not fully supplied by Russia and China

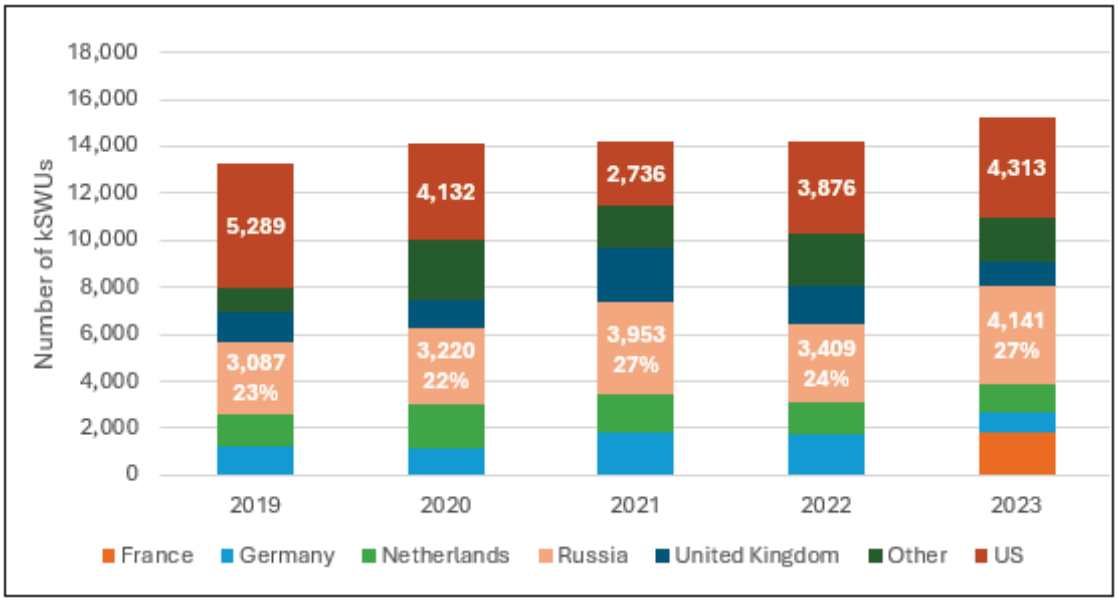



**Figure 1-2 Purchases of Enrichment Services by Origin Country and Year (2019–2023)**

#### 1.1.1.4 Commercial Considerations of Proposed Actions and the No-Action Scenario

Considering these various factors, and particularly the decline in Russian supply, the demand for Western SWU in the U.S. is likely to increase.

The Proposed Action is the construction of the Facility, while the no-action alternative is not constructing the Facility. Should the Proposed Action be brought to fruition, it would result in the establishment of a new reliable domestic source of enriched uranium services (at least 7.4 MSWU produced domestically in the U.S.). Unlike larger incumbents with substantial U.S. operations, OE's participation would be additive and complementary to existing market activities, while replacing the Russian supply.

The Facility's ramp-up starting in 2031 will contribute to a new domestic supply of enrichment capacity, complementing Urenco's existing operations, and supporting efforts to replace Russian supply, and therefore strengthen the U.S. nuclear fuel supply chain and, over time, will help meet the growing demand for enriched uranium driven by the deployment of new units.

## 1.2 THE PROPOSED ACTION

Orano Enrichment USA, LLC (OE) will apply for a U.S. NRC license under 10 CFR 70, 10 CFR 30, and 10 CFR 40 for a gaseous centrifuge enrichment facility (the Facility). The NRC license grants OE the authority to possess and use special nuclear material (SNM), source material, and byproduct material for purposes of enrichment. The Facility would have a maximum annual enrichment capacity of 7.4 million Separative Work Units (SWU). This Proposed Action will result the construction and operation of the Facility in Oak Ridge, Tennessee on a parcel of land formerly owned by the Department of Energy (Figure 1-3 and Figure 1-4).

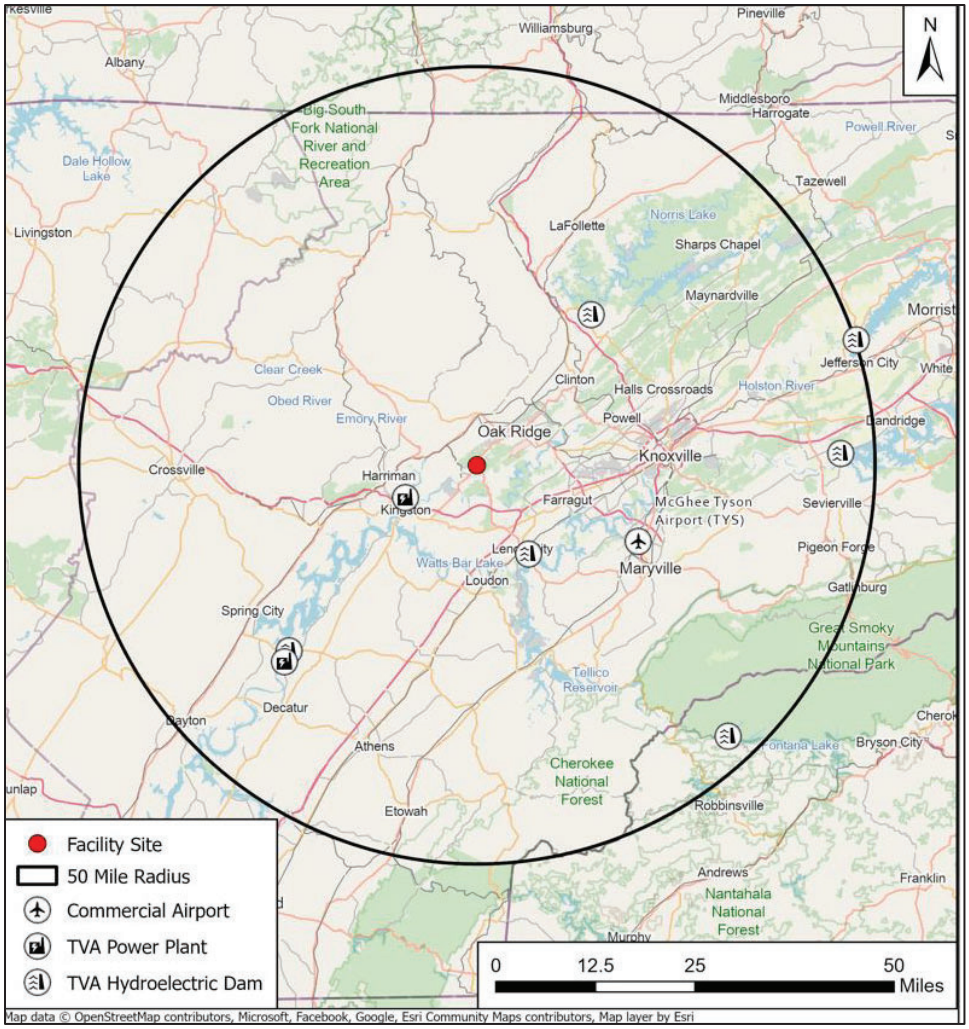



**Figure 1-3 Oak Ridge, Tennessee Regional Map**

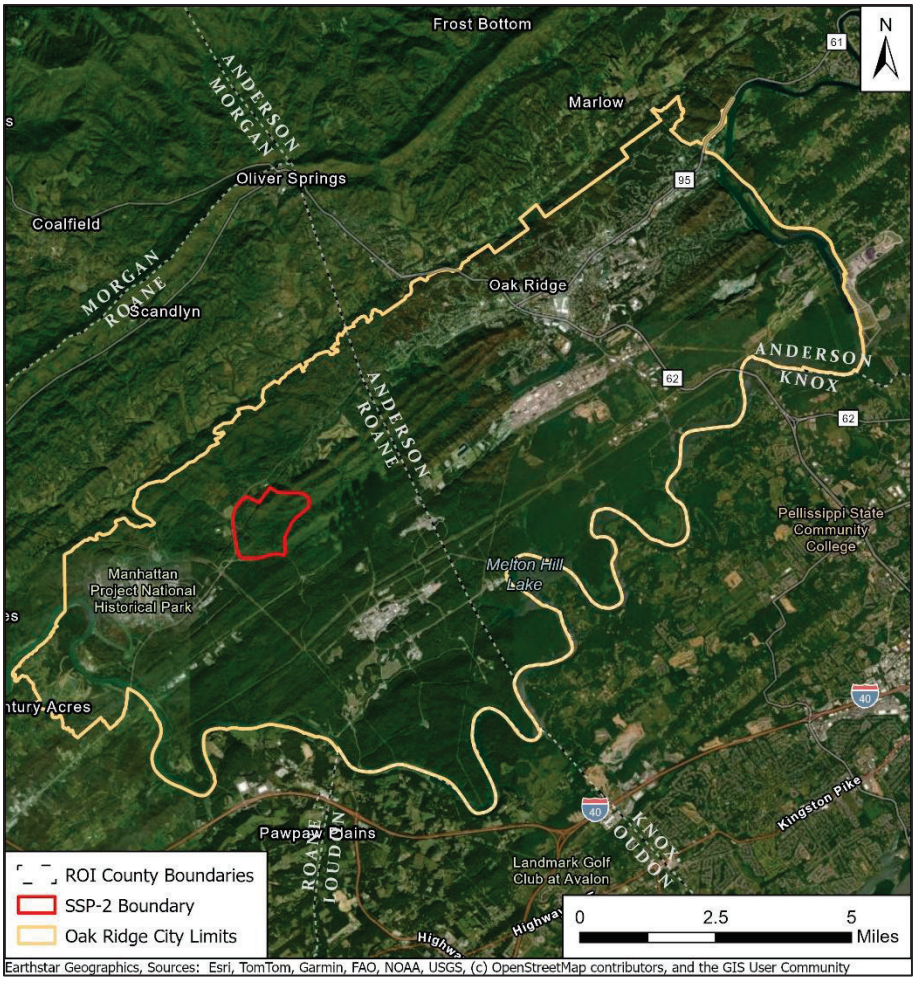



**Figure 1-4 Location of SSP-2 in relation to Oak Ridge.**

The Facility will supply low-enriched uranium (LEU), up to and including 10% enrichment in $^{235}U$ for use in nuclear fuel applications. The Facility will be located approximately 6.7 miles southwest of the city center of Oak Ridge, TN in Roane County on an approximate 600-acre site (the Site) (Figure 1-5).

The Site will be acquired from the Department of Energy (DOE) via the Industrial Development Board of Oak Ridge (DOE 2024). The Site is comprised of a subsection of the Oak Ridge Reservation – Self Sufficiency Parcel – 2 (SSP-2). Tracts 1A and 1B will be transferred to OE while Tracts 1C, 1D, and 2 will be retained by the DOE (Figure 1-5). There are two historical cemeteries located on SSP-2 (Smith(Gallaher) Cemetery AEC #11 and Hembree Cemetery). DOE will maintain ownership of these two cemeteries; they will be partitioned off with public access maintained. Knoxville is located approximately 24 mi directly east of the site. Tract 1C encompasses the Gallaher (Smith) Cemetery and Tract 1D encompasses Hembree Cemetery. Tract 2 encompasses the White Wing Scrap Yard, ET-3, ET-4, and Bear Creek, all of which are retained by the DOE. The Facility will utilize gas centrifuge enrichment technology. This technology has been used safely and successfully in commercial operations for the last 50 years. This is the same technology that the OE parent company has been safely implementing at the Georges Besse 2 Facility, that commenced operations in December 2010, at the Tricastin site in

France. This ER is part of an application for a 40-year license to construct and operate the Facility with the intention of operating the Facility for 60 years.

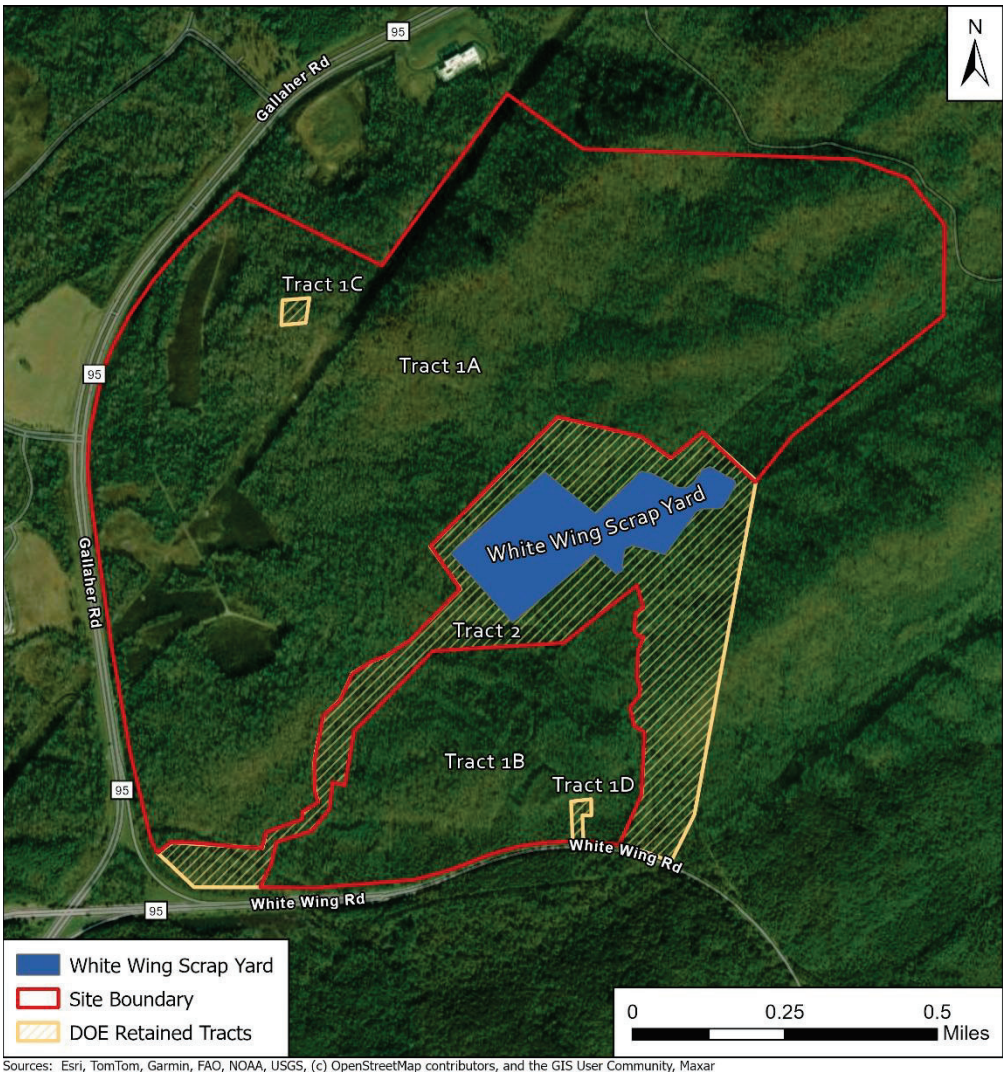



**Figure 1-5 SSP-2 Tracts**

Using a gas centrifuge process, the Facility would produce uranium enriched up to 10 percent by weight in the isotope uranium-235, with a planned maximum target production of 7.4 million separative work units (SWUs) per year. Upon license approval, facility construction would begin in 2028 continuing through 2039. The Facility will operate for a 40 year license period, with decommissioning activities beginning in 2072 and be completed by 2079. Decommissioning involves the sequential shutdown of the Separation Building Modules (SBMs) resulting in a gradual decrease in production. A summary of the major steps comprising the proposed action is shown Table 1-1.

**Table 1-1 Schedule**

| Milestone | Start | Completion |
|---|---|---|
| NRC 10 CFR Part 70 License Application | March 2026 | March 2027 |
| Construction | September 2027 | December 2039 |
| Operation | January 2032 | December 2091 |
| Decommissioning | January 2072 | December 2079 |

## 1.3 APPLICABLE REGULATORY REQUIREMENTS, PERMITS, AND REQUIRED CONSULTATIONS

OE has prepared this ER to meet the requirements specified in 10 CFR 51, Subpart A, particularly those requirements set forth in 10 CFR 51.45(b)-(e). OE notified the NRC of the intent to file an application to obtain a license for a uranium enrichment facility and associated materials licenses (Antognelli 2025). OE agreed to be designated as a Non-Federal Representative with oversight from the NRC throughout Section 7 of the Endangered Species Act process.

This section lists and summarizes the status of Federal, State, local, and other permits and consultations required for the construction and operation of the Facility which includes possession and use of special nuclear material. The applicable law, ordinance, or regulation that governs each permit and/or consultation is also identified.

Table 1-2 lists the permits and other approvals required to possess and use special nuclear material as well as construction and operation of the Facility.

As discussed in Table 1-3, OE made informal contact with the U.S. Fish and Wildlife Service (USFWS), Tennessee State Historic Preservation Office (SHPO), Tennessee Wildlife Resources Agency (TWRA), U.S. Army Corps of Engineers (USACE), and Tennessee Department of Environment and Conservation (TDEC). The purpose of these informal consultations was to inform the agencies about the project and to coordinate project planning. Copies of regulatory agency consultations and responses are provided in Appendix 1A, Regulatory Correspondence.

## Table 1-2 Permits and Approvals Required for Construction and Operation

| Authorizing Entity | Permit/ Approval or Regulatory Scope | Description | Permittee | Required Prior to Activity | Notes |
|---|---|---|---|---|---|
| NRC National Environmental Policy Act (NEPA) | Record of Decision NRC License | NEPA applies to all major federal actions: federal projects or any project requiring a federal permit, receiving federal funding, or located on federal land. | Orano | Facility Construction | Needed to start foundations and specific construction of facilities that NRC has jurisdiction over. These building would be any that have a potential for radiological release. |
| DOE NEPA | Record of Decision DOE | NEPA applies to all major federal actions: federal projects or any project requiring a federal permit, receiving federal funding, or located on federal land. | Orano | Site Clearing / Grading Facility Construction | Phase 1) would allow property deed to be modified to allow for tree clearing and grading. Phase 2) would follow property deed to be modified to allow construction |
| U.S. Army Corps of Engineers (USACE), Nashville District | Clean Water Act (CWA Section 404) | Impacts to Wetlands and Waters of the U.S. 33 US Code 1344 - Permits for dredged or fill material | Orano | Earthwork | 404 Permit from the USACE and ARAP permit from TDEC required prior to earthwork. |
| TDEC-Aquatic Resource Alteration Permit (ARAP)/401 Water Quality Certification (WQC) | ARAP/401 WQC | Tied to USACE 404 wetland impacts permit. | Orano | Earthwork | 404 Permit from the USACE and ARAP permit from TDEC required prior to earthwork. |
| U.S. Fish and Wildlife Service, Southeast Region 4 | Endangered Species Act-Section 7 Consultation (16 USC Chapter 35) | Impacts to Protected Species, Protected Species Habitat, and/or Critical Habitat. 16 US Code 35 - Endangered Species | Orano | Site Clearing | Orano has been in contact with USFWS and has submitted Biological Assessment to NRC and USFWS. |
| Section 106 Review | Advisory Council on Historic Preservation (ACHP)- National Historic Preservation Action Section 106: SHPO and Tribes-Lead agency to consult with tribes | Impacts to historical and/or cultural sites. | No Permit Required. Tied to USACE 404 and TDEC ARAP permits. USACE to coordinate with SHPO. | Earthwork | |
| Nuclear Regulatory Commission (NRC) | New Fuel Cycle Facility License | License to operate and maintain a uranium enrichment facility. | Orano | | |
| Property Transfer | DOE | Transfer of property from DOE to Orano | No Permit Required. | Site Clearing | Transfer of ownership required prior to earthwork activities |

| Authorizing Entity | Permit/ Approval or Regulatory Scope | Description | Permittee | Required Prior to Activity | Notes |
|---|---|---|---|---|---|
| Tennessee Department of Environment and Conservation (TDEC) Air Permit | Permit to Construct TBD - Title V, Minor Source, or Permit By Rule | Permit for air emissions | Orano | Foundations for emitting equipment | |
| Tennessee Department of Transportation (TDOT) | Commercial Entrance Permit | equired for any new access to a state managed highway | Kiewit | Site Clearing | Construction of access road and/or heavy haul road |
| TDEC - Waste Division | Waste Disposal | Hazardous Waste Permit | Kiewit: Construction Orano: Operational | Prior to generation of hazardous waste. | Kiewit would ideally like before dirt work but it's more about when Haz-waste is stored during construction. At least a waste management plan/section completed as part of the Environmental Management Plan (Kiewit Plan) |
| TDEC Water Division : Tennessee Pollutant Discharge Elimination System (TPDES) | Hydrostatic Test Water Discharge Permit (TNG670000) | Hydrostatic Test Water Discharge | Kiewit | Discharge of hydrostatic test water to surface. | Two weeks prior to test. |
| TDEC - Water Division: TPDES | Stormwater (SWPPP) Permits (TNR100000) | Construction Stormwater | Kiewit | Site Clearing | Notice of Intent submitted two weeks prior to site clearing |
| TDEC - Water Division: TPDES | Stormwater (SWPPP) Permits (TNR050000) | Industrial Stormwater | Orano | Commissioning | Notice of Intent submitted two weeks prior to operation |
| U.S. Fish and Wildlife Service, Southeast Region 4 | Migratory Bird Treaty Act Consultation (16 USC Chapter 7, Subchapter II) | Impacts to Migratory Bird Species and their Habitat 16 US Code 710 - Migratory Bird Treaty Act | No Permit Required. | Site Clearing | May affect land clearing schedule and working in the breeding season or non-breeding season |
| U.S. Fish and Wildlife Service, Southeast Region 4 | Bald and Golden Eagle Protection Act (16 USC 668-668d) | Impacts to Bald Eagles and/or their Habitats 16 US Code Subchapter II - Protection of Bald and Golden Eagles | No Permit Required. | Site Clearing | If a nest is found prior to site clearing, Kiewit will have to consult with USFWS (possibly have to leave tree with nest and put a buffer zone) to mitigate. |

| Authorizing Entity | Permit/ Approval or Regulatory Scope | Description | Permittee | Required Prior to Activity | Notes |
|---|---|---|---|---|---|
| Federal Aviation Administration | FAA Determination of No Hazard | Notice of Proposed Construction and Determination of No Hazard if over 200 feet in elevation | Kiewit | Construction | Notification 30 days prior to construction. |
| U.S. Environmental Protection Agency (EPA) - Region VI Dallas, TX | Construction Spill Prevention Control and Countermeasure (SPCC) Plan (40 CFR 112) | Use and/or Storage or Petroleum Greater than 1,320 gallons | No Permit Required. | Site Clearing | Required once 1,320 gallons of petroleum is stored on-site. |
| U.S. Environmental Protection Agency (EPA) - Region VI Dallas, TX | Operational Spill Prevention Control and Countermeasure (SPCC) Plan (40 CFR 112) | Use and/or Storage or Petroleum Greater than 1,320 gallons | No Permit Required. | Site Clearing | Required once 1,320 gallons of petroleum is stored on-site. |
| EPA | Emergency Planning and Community Right to Know (EPCRA) | Chemical Registration/Reporting | No Permit Required. | Construction | On behalf of TDM, the SERC serves as the repository for required EPCRA hazardous chemical inventory reports (Tier II) reports. If a Tennessee facility has any hazardous chemicals present onsite in quantities greater than the reporting threshold, the facility must prepare an annual Tier II chemical inventory report for the chemicals exceeding the reporting threshold. Reporting details can be found here: https://erplan.net/eplan/home.htm |
| Tennessee Valley Authority (TVA) | Utility Relocation | Coordination with TVA for utility connections and ROW access | No Permit Required. | Site Clearing | TVA will have to relocate existing powerlines prior to site clearing. |
| City of Oak Ridge Planning & Development | Land Disturbance Permit | Application for commercial land disturbance permit. Land Disturbance Permit is tied to new commercial build, non-residential review and does not have to be issued separately for a new build (non-residential). | Orano | Site Clearing | Land Disturbance Permit is good for 6 months. Reapplication in required if grading activities extend. |
| City of Oak Ridge Planning & Development | Building Permit | Permit to construct new commercial building (non- residential). May require a Commercial Plan Review. | Orano | Construction | |

| Authorizing Entity | Permit/ Approval or Regulatory Scope | Description | Permittee | Required Prior to Activity | Notes |
|---|---|---|---|---|---|
| City of Oak Ridge Planning & Development | Electrical, Mechanical, and Plumbing Permits | Trade permits have to be submitted to City of Oak Ridge licensed and all would be needed for new build non-residential. Electrical, mechanical, and plumbing permits are available from the City's Planning and Development Department Code Enforcement Division located in the Municipal Building. | Kiewit | Construction | Complete Building Permit for new build non- residential before sending the trades to acquire trade permits. |
| City of Oak Ridge Planning & Development | Zoning Approval | Required for construction of a nuclear fuel fabrication facility. Verify if this applies to UEF. | No Permit Required. | Construction | Further coordination needed with City of Oak Ridge to determine if a zoning change is needed. |
| City of Oak Ridge Planning & Development | Fire Safety Permit | Compliance with fire safety regulations. Initial and regular inspections required for fire suppression systems. | Orano | Construction | |
| City of Oak Ridge Planning & Development | Temporary Sign Permit | Permit to place temporary signage | Kiewit | Site Clearing | City of Oak Ridge stated verbally that they don't require a temporary sign for construction. |

## Table 1-3 Log for Documenting Interactions with Federal and State Agencies

| Date | Agency | Meeting Type | Agency Participants | OE Participants |
|---|---|---|---|---|
| 5-2-25 | USFWS 25-01 | Introductory Interactions- Information of USFWS needs and processes to identify threatened / endangered species / ecological communities covered by the Endangered Species Act. | Nicole Sikula, Dep Field Sup.<br>Robbie Sykes, Const. Plan Coor<br>Steve Alexander, Ecologist,<br>USFWS – TN Office, Cookeville, TN. | Damon Brewer<br>Lou Qualls<br>Eric Patterson<br>Gary Mays |
| 5-12-25 | USFWS 25-01 | Initial Engagement – Process and Information Requirements | Nicole Sikula, Dep Field Sup<br>Robbie Sykes, Const Plan Coord.<br>Steve Alexander, Ecologist | Damon Brewer<br>Lou Qualls<br>Eric Patterson<br>Gary Mays |
| 5-20-25 | USACE 25-01 | Initial Engagement – Process and Information Requirements 404 Permit and wetlands | Cara Beverly<br>USACE Field Office<br>Lenoir City | Damon Brewer<br>Lou Qualls<br>Eric Patterson<br>Gary Mays |
| 6-6-25 | TDEC – Water | Initial Engagement – Process and Information Requirements | Michael Atchely, Dep Dir Water Resources<br>Valerie McFall (consultant) TDEC TDEC, Knoxville office | Damon Brewer<br>Lou Qualls<br>Gary Mays |
| 6-25-25 | USNRC | NFR Designation and Biological Assessment Development | Robert Sun, Branch Chief<br>Briana Arlene, Consultation Coordinator | Damon Brewer, Lou Qualls, Gary Mays, Peter Vescovi |
| 6-30-25 | USACE & TDEC | General discussions regarding (1) findings from water delineation report for the IEF site on WOTUS and WOTS results and (2) possible mitigation efforts on impacted streams, WWCs, and wetlands. | Cara Beverly<br>USACE Field Office<br>Lenoir City<br><br>Valerie McFall (consultant) TDEC TDEC, Knoxville office | Damon Brewer<br>Lou Qualls, Gary Mays, Eric Patterson, and Mike Gunderson<br>Alvaro Monclaeano, Patrick Jacobs, and Robert Townsend<br>Josh Rowe and S. Rowe |
| 7-23-25 | TDEC – Archaeology Office | Initial Engagement – Process for Submitting Archaeology Report and Follow-up Discussions | Jennifer Barnett,<br>TDEC Cultural Resources Consultant Manager Archaeology Office | Gary Mays, |
| 9-3-25 | USACE & TDEC | Site Review of Water Resources (stream, wetlands, wet-weather conveyances) in area and immediately surrounding area of site footprint (~300 acres) | Cara Beverly<br>USACE Field Office<br>Lenoir City<br><br>Valerie McFall (consultant) TDEC TDEC, Knoxville office | Damon Brewer, Lou Qualls, Erica McGuire, Eric Patterson, Patrick Jacobs, Josh Rowe |
| 9-26-2025 | USACE | Additional site review of WWC-14 and relative reach | Cara Beverly<br>USACE Field Office<br>Lenoir City | Damon Brewer, Keith Lampert, Josh Rowe |
| 10-14-2025 | TDEC | Receipt of Jurisdictional Waters Report | Chris Pracheil Environmental Consultant, Knoxville Environmental Field Office TDEC Division of Water Resources | |

| Date | Agency | Meeting Type | Agency Participants | OE Participants |
|---|---|---|---|---|
| 11-21-2025 | USACE | Receipt of Preliminary Jurisdictional Determination | Cara Beverly<br>USACE Field Office<br>Lenoir City | |
| 11-21-2025 | USFW | Discussion of draft Biological Assessment and proposed mitigation strategies | Steven Alexander, Ecologist<br>Daniel Elbert | Damon Brewer |
| 11-24-2025 | USFW | Draft Biological Assessment submitted for comment and review | | Damon Brewer |
| 12-22-2025 | SHPO | Discuss Phase I Archeological Study and path forward for 3 Potentially Eligible Properties | Kelly Reid<br>Jennifer Barnett | Leah Alexander, DOE<br>Abby Hill, DOE<br>Anne Wallace, DOE<br>Stacey Imboden, NRC<br>Beau Goldstein, NRC<br>Damon Brewer |

## Appendix 1A: Regulatory Correspondence

The following documents are included in this appendix:

1. Email between Gary Mays (Boston Government Solutions) and Cara C Beverly (U.S. Army Corps of Engineers), Subject: Request for Introductory Meeting on 404 Process in Support of ORANO's Planned Uranium Enrichment Facility, Dates: May 14, 2025 and May 16, 2025. (3 pages)
2. Email between Gary Mays (Boston Government Solutions) to Michail Atchley (Deputy Director – Technical Services at Knoxville Environmental Field Office), Subject: Request for Introductory Meeting on TDEC Requirements in Support of ORANO's Planned Uranium Enrichment Facility, Date: May 23, 2025, June 2, 2025, June 4, 2025. (6 pages)
3. Email between Gary Mays (Boston Government Solutions) and Valerie McFall (Environmental Consultant – Knoxville Environmental Field Office), Subject: Followup Meeting on ORANO Fuel Enrichment Site and Roane county – Oak Ridge, Date: June 19, 2025. (2 pages)
4. Email from Gary Mays (Boston Government Solutions) to Jennifer Barnett (Cultural Resources Consultant Manager, Tennessee Division of Archaeology), Subject: Contact Information – ORANO Fuel Enrichment Project in Oak Ridge, Date: July 23, 2025. (2 pages)
5. Email from Gary Mays (Boston Government Solutions) to Damon Brewer (Orano), Subject: TDEC – Archaeology Contact and Biological Assessment, Date: July 25, 2025. (2 pages)
6. Email between Gary Mays (Boston Government Solutions) and Nicole Sikula (Deputy Field Supervisor – U.S. Fish and Wildlife Service), Subject: 2017, Date: August 12, 2025. (5 pages)
7. Letter dated August 19, 2025 from Lou Qualls (Boston Government Solutions) to Hon. Wade Creswell (Roane County Executive), Orano Roane County Engagement. (2 pages).
8. Letter dated September 12, 2025 from Lou Qualls (Boston Government Solutions) to Randall Hermann (City Manager, City of Oak Ridge), Orano – Oak Ridge Engagement. (2 pages).
9. Letter dated October 14th, 2025 from Chris Pracheil (TDEC Division of Water Resources) to Surveying and Mapping, LLC, Re: Jurisdictional Waters Report (DWR IF No. 34410) Oak Ridge Property – SAM. (5 pages)
10. Letter dated November 21, 2025 from Casy Ehom (Deputy Chief, Regulatory Division Nashville District) to Damon Brewer (Orano), Re: File No.LRN-2025-00585, Orano Site, Oak Ridge, Roane County, Tennessee (Latitude: 35.953056, -84.35774). (28 pages)
11. Email between Alexander Steven (U.S. Fish and Wildlife Service) and Damon Brewer (Orano), Subject: Comment #1 on the Draft Biological Assessment, Date: January 6, 2026. (12 pages).

**From:** Beverly, Cara C CIV USARMY CELRN (USA)
**To:** Gary Mays
**Subject:** EXTERNAL: RE: Request for Introductory Meeting on 404 Process in Support of ORANO"a Planned Uranium Enrichment Facility
**Date:** Friday, May 16, 2025 2:28:27 PM

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Received. Let me know when you all are available for the call.

Respectfully,

Cara Beverly
Biologist- Section 408 Coordinator
U.S. Army Corps of Engineers
Nashville District
Regulatory Division

Phone: (865) 304-1413

---

**From:** Gary Mays <gmays@BGS-LLC.com>
**Sent:** Friday, May 16, 2025 2:19 PM
**To:** Beverly, Cara C CIV USARMY CELRN (USA) <cara.c.beverly@usace.army.mil>
**Subject:** [Non-DoD Source] FW: Request for Introductory Meeting on 404 Process in Support of ORANO'a Planned Uranium Enrichment Facility

One more time.

Please confirm if you receive this.

Thanks.

Gary Mays
Technical Manager
Boston Government Services, LLC

gmays@bgs-llc.com
Cell: 865-599-5303
Fax: (865) 272-3125
105 Mitchell Road, Suite 101
Oak Ridge, TN 37830
BGS-LLC.com

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**From:** Gary Mays
**Sent:** Wednesday, May 14, 2025 5:29 PM

**To:** cara.c.beverly@usace.army.mil
**Cc:** BREWER Damon (ORANO) <damon.brewer@orano.group>; Lou Qualls <aqualls@BGS-LLC.com>; Eric Patterson <epatterson@BGS-LLC.com>
**Subject:** Request for Introductory Meeting on 404 Process in Support of ORANO'a Planned Uranium Enrichment Facility

Dear Ms. Beverly:

I work for Boston Government Services (BGS) - an engineering, technology, and cybersecurity solutions company. BGS is supporting ORANO USA in the preparation of their Environmental Report as part of the NRC licensing process for their new uranium enrichment facility to be located in Oak Ridge, TN. See the link below for the formal announcement by DOE in September 2024. The proposed facility will supply enriched uranium for use in commercial nuclear power plants including advanced reactors and will employ gas centrifuge enrichment technology.

The parcel of land to be ultimately transferred from the Department of Energy (DOE) for the facility is shown in the attached file. This parcel is referred to as the SSP-2 Parcel. The gray-shaded area depicts the land to be transferred, approximately 627 acres. We are in the early phases of engaging both federal and state agencies relating to permits and consultancies that may be required. This proposed project may require authorization from the USACE as part of the 404 process and our submission of a Jurisdictional Determination as we understand it.

We would very much like to have an introductory, online meeting with you and your team to better understand this overall process, information needed for your determination, and any other suggestions you may have. Would it be possible to set something up early next week. On our end, we would plan to 2-3 BGS staff and our ORANO USA contact, Damon Brewer.

I had left a voice mail earlier on this subject and since was provided your email address.

Please let me know if you have questions, need more information, or want to discuss possible times and dates.

Thank you.

Link to announcement:

Oak Ridge Multibillion Dollar Nuclear Project: Largest Investment in Tennessee History | Department of Energy


| | |
|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101<br>Oak Ridge, TN 37830<br>BGS-LLC.com |



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| | |
|---|---|
| **From:** | Michael Atchley |
| **To:** | Gary Mays |
| **Cc:** | Lou Qualls; Eric Patterson; Valerie McFall |
| **Subject:** | Re: Request for Introductory Meeting on TDEC Requirements in Support of ORANO"a Planned Uranium Enrichment Facility |
| **Date:** | Wednesday, June 4, 2025 3:56:34 PM |
| **Attachments:** | image002.png<br>Outlook-cid_image0.png |

Hi Gary,

Yes this Friday will work. Valerie McFall the lead technical Consultant for the Knoxville Field Office will attend along with myself. It will be best if the meeting is after 9am. I assume you will be sending us a Microsoft Teams request?

I look forward to meeting you and helping anyway we can. Valerie's email is in the cc above.

Thanks,
Michael

**Michael Atchley** | Deputy Director - Technical Services
Knoxville Environmental Field Office
Division of Water Resources
3711 Middlebrook Pike
Knoxville, TN 37921
P: 865-202-8134
Michael.Atchley@tn.gov
We value your feedback! Please complete our customer satisfaction survey.

---

**From:** Gary Mays <gmays@BGS-LLC.com>
**Sent:** Monday, June 2, 2025 3:04 PM
**To:** Michael Atchley <Michael.Atchley@tn.gov>
**Cc:** Lou Qualls <aqualls@bgs-llc.com>; Eric Patterson <epatterson@bgs-llc.com>
**Subject:** [EXTERNAL] RE: Request for Introductory Meeting on TDEC Requirements in Support of ORANO'a Planned Uranium Enrichment Facility

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Please exercise caution. DO NOT open attachments or click links from unknown senders or unexpected email - STS-Security

Michael, thanks for getting back to me.

- I don't believe that ORANO is planning on any treated discharge. The only related issue would be from stormwater runoff. There is some excavation planned for the facility based on the site topology.
- We believe that we may need to submit info to TDEC for a hydrologic determination.
- As a point of information, there are 2 small streams on the overall parcel of land, but these 2 streams as well as a scrapyard area are not going to be transferred to ORANO and will remain DOE property.

We can discuss the above items further at the meeting – yes, we would plan for it to be virtual. Right now, Thu of this week is out for several on our team. Would Friday of this week or early next week work for you once you check with you team?

Feel free to call to discuss meeting arrangements or topics as needed.

FYI – I have attached a map for the proposed site that I sent earlier.

Thanks.


| | |
|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101<br>Oak Ridge, TN 37830<br>BGS-LLC.com |


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**From:** Michael Atchley <Michael.Atchley@tn.gov>
**Sent:** Monday, June 2, 2025 1:43 PM
**To:** Gary Mays <gmays@BGS-LLC.com>
**Cc:** Lou Qualls <aqualls@bgs-llc.com>; Eric Patterson <epatterson@bgs-llc.com>
**Subject:** Re: Request for Introductory Meeting on TDEC Requirements in Support of ORANO'a Planned Uranium Enrichment Facility

Hi Gary,

Thank you for reaching out. Is ORANO looking to apply for an NPDES permit for treated discharge? I am asking to know who is needed for this meeting on TDECs end. Also, to make sure the proper staff from TDEC can attend are you able to do a virtual meeting?

Thanks,
Michael

**Michael Atchley** | Deputy Director - Technical Services
Knoxville Environmental Field Office
Division of Water Resources
3711 Middlebrook Pike
Knoxville, TN 37921
P: 865-202-8134
Michael.Atchley@tn.gov
We value your feedback! Please complete our customer satisfaction survey.

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**From:** Gary Mays <gmays@BGS-LLC.com>
**Sent:** Monday, June 2, 2025 1:28 PM
**To:** Michael Atchley <Michael.Atchley@tn.gov>
**Cc:** Lou Qualls <aqualls@bgs-llc.com>; Eric Patterson <epatterson@bgs-llc.com>
**Subject:** [EXTERNAL] RE: Request for Introductory Meeting on TDEC Requirements in Support of ORANO'a Planned Uranium Enrichment Facility

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Mr. Atchely, just following up from the email below to discuss your availability for an introductory regarding ORANO's planned uranium Enrichment Facility.
I had left a voicemail as well.

Thanks.

| | |
|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303 |

Fax: (865) 272-3125
105 Mitchell Road, Suite 101
Oak Ridge, TN 37830
BGS-LLC.com

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**From:** Gary Mays
**Sent:** Friday, May 23, 2025 2:22 PM
**To:** Michael.Atchley@tn.gov
**Cc:** Lou Qualls <aqualls@BGS-LLC.com>; Eric Patterson <epatterson@BGS-LLC.com>
**Subject:** Request for Introductory Meeting on TDEC Requirements in Support of ORANO'a Planned Uranium Enrichment Facility

Dear Mr. Atchley:

I work for Boston Government Services (BGS) - an engineering, technology, and cybersecurity solutions company. BGS is supporting ORANO USA in the preparation of their Environmental Report as part of the NRC licensing process for their new uranium enrichment facility to be located in Oak Ridge, TN. See the link below for the formal announcement by DOE in September 2024. The proposed facility will supply enriched uranium for use in commercial nuclear power plants including advanced reactors and will employ gas centrifuge enrichment technology.

The parcel of land to be ultimately transferred from the Department of Energy (DOE) for the facility is shown in the attached file. This parcel is referred to as the SSP-2 Parcel. The gray-shaded area depicts the land to be transferred, approximately 627 acres. We are in the early phases of engaging both federal and state agencies relating to permits and consultancies that may be required. This proposed project may require authorization from TDEC and a Hydrologic Determination as we understand it.

We would very much like to have an introductory, online meeting with you and your team to better understand this overall process, information needed for your determination, and any other suggestions you may have. Would it be possible to set something up next week. On our end, we would plan to 2-3 BGS staff and our ORANO USA contact, Damon Brewer.

Earlier this week we had an initial engagement meeting with the USACE, Ms. Cara Beverly, regarding permits and information they would need to make a Hydrologic Determination.

Please let me know if you have questions, need more information, or want to discuss possible times and dates.

Link to announcement:

Oak Ridge Multibillion Dollar Nuclear Project: Largest Investment in Tennessee History | Department of Energy

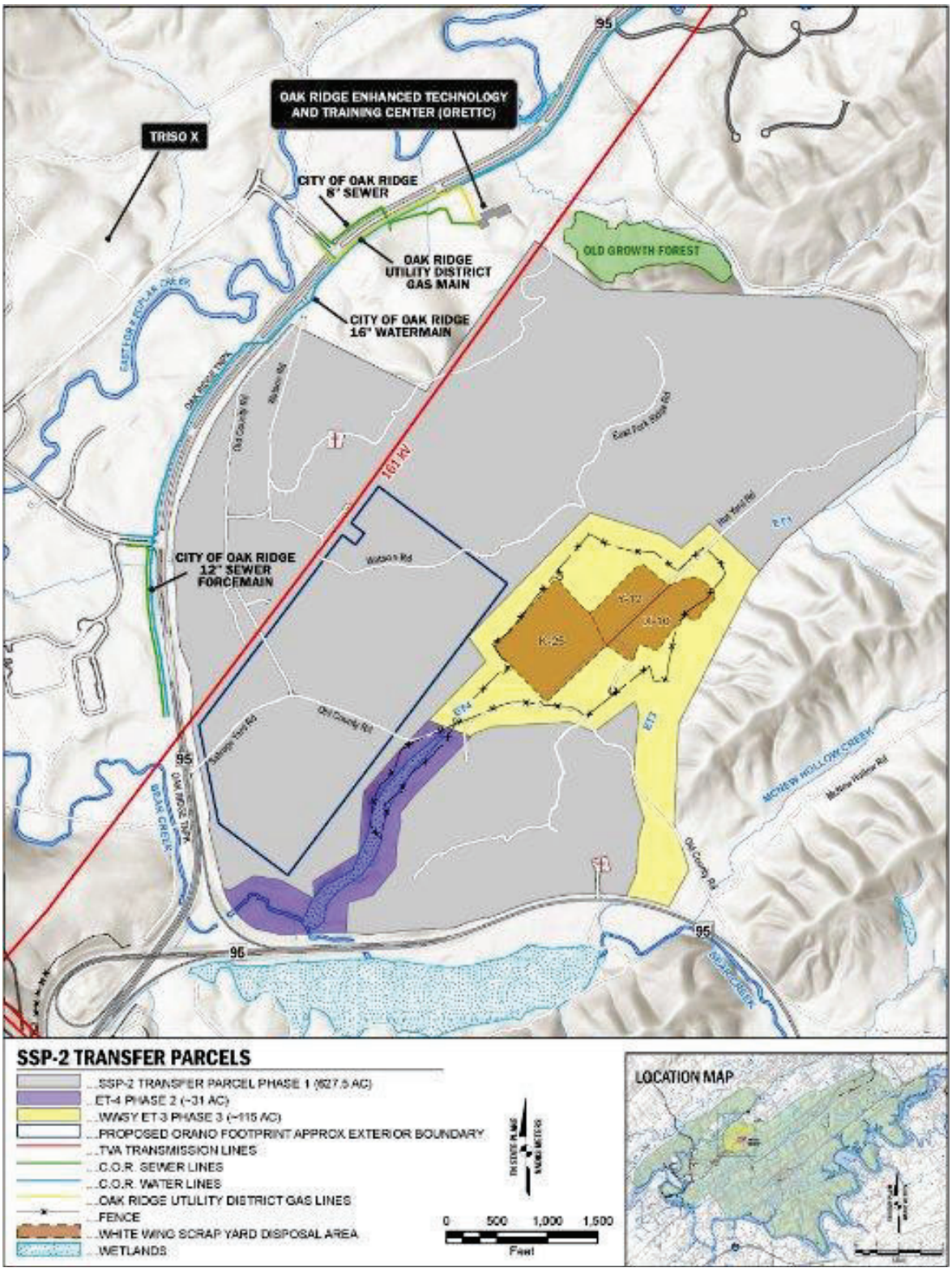
Thank you.


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|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101<br>Oak Ridge, TN 37830<br>BGS-LLC.com |



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Proposed Site for ORANO USA
IKE Uranium Enrichment Facility



**From:** Valerie McFall
**To:** Gary Mays; Beverly, Cara C CIV USARMY CELRN (USA); Michael Atchley
**Subject:** RE: Followup Meeting on ORANO Fuel Enrichment Site at Roane County - Oak Ridge
**Date:** Friday, June 20, 2025 7:06:01 AM
**Attachments:** image002.png

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Mr. Mays,

I am available on Friday, June 27th and Monday, June 30th.

Will you email me the hydrologic determination (HD) report? I will have one of our QHPs review the report. The Division of Water Resources reviews the HDs for accuracy.

Thank you,

logo

Valerie McFall | Environmental Consultant
Division of Water Resources
Knoxville Environmental Field Office
3711 Middlebrook Pike
Knoxville, TN 37921
p. 865-606-3696
Valerie.McFall@tn.gov
www.tn.gov/environment

Please tell us how we're doing! Please take 5-10 minutes to complete **TDEC's Customer Service Survey**.

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**From:** Gary Mays <gmays@BGS-LLC.com>
**Sent:** Thursday, June 19, 2025 3:42 PM
**To:** Beverly, Cara C CIV USARMY CELRN (USA) <cara.c.beverly@usace.army.mil>; Michael Atchley <Michael.Atchley@tn.gov>; Valerie McFall <Valerie.McFall@tn.gov>
**Subject:** [EXTERNAL] Followup Meeting on ORANO Fuel Enrichment Site at Roane County - Oak Ridge

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Cara, Michael, and Valerie,

Thanks to each of you for the initial engagement meetings that our team (ORANO USA and BGS) had with both of your organizations recently. They were most helpful. We have received results from the water delineation report on the site and have developed some

additional visuals that illustrate what water resources may be impacted based on current plans.

We would like to have a TEAMS meeting with both organizations prior to the July 4 holiday if possible, about 30-45 minutes, to discuss this additional information. We would like to have it during the latter part of next week on either Thu (June 26) or Fri (June 27). Monday – June 30 would work as well.

If each of you could please identify any availabilities that you might have during the above-noted options, I would appreciate it. If those options are not viable, please identify what would work best for you. I'll work to coordinate with everyone.

Thanks in advance for your help. Let me know if you have any questions.


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|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101<br>Oak Ridge, TN 37830<br>BGS-LLC.com |



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**From:** Gary Mays
**To:** Lou Qualls; Eric Patterson
**Subject:** FW: Contact Information - ORANO Fuel Enrichment Project in Oak Ridge

---

Lou and Eric – FYI – see email below. I followed up with Jennifer Barnett at TDEC based on info from Travis Hurdle. I briefly explained our supporting ORANO and connection with Travis. She said my call could be considered as an initial engagement and once the report is submitted, they would expect to follow up with questions, etc. Nothing else to be done at this time.

She is the TDEC Cultural Resources Consultant Manger for federal programs review – SHPO archaeological services.


| | |
|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101<br>Oak Ridge, TN 37830<br>BGS-LLC.com |



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**From:** Gary Mays
**Sent:** Wednesday, July 23, 2025 11:52 AM
**To:** Jennifer.Barnett@tn.gov
**Subject:** Contact Information - ORANO Fuel Enrichment Project in Oak Ridge

Jennifer, it was great to talk with you today and get your guidance moving forward on future interactions on this project.

My contact information is noted below.

We anticipate receiving the Phase 1 archeology report from Travis mid-August. After reviewing it and discussions with Travis, we will plan on submitting the report to your online system. At that point, I'll contact you to provide a "heads up" that we have done so.


| | |
|---|---|
| Gary Mays<br>Technical Manager | gmays@bgs-llc.com |

| | |
|---|---|
| Boston Government Services, LLC | Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101<br>Oak Ridge, TN 37830<br>BGS-LLC.com |


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**From:** Gary Mays
**To:** BREWER Damon (ORN-CORP)
**Cc:** Lou Qualls; Eric Patterson
**Subject:** TDEC - Archaeology Contact and Biological Assessment

---

Damon – two items:

- In reviewing documentation on consultancies for other applicants in the area, there was a suggestion that the applicant engage their state historic preservation office. I talked with our lead from CRA who is doing the archeological survey, and he gave me a contact at TDEC's Archeology Office. I talked with her briefly on Wednesday to see if we needed to set up an engagement meeting. Her contact info and brief summary of the call is below. NO ACTION required at this time.
    - **Jennifer Barnett**| Cultural Resource Consultant Manager
      Federal Programs Archaeologist
      Tennessee Division of Archaeology
      1216 Foster Avenue
      Cole Building #3
      Nashville, TN 37243
      p. 615-687-4780
      Jennifer.Barnett@tn.gov
      tn.gov/archaeology
    - Notes from 7/23/25 Call
        - I gave her brief background on project – she appreciated the heads up.
        - She indicated that once the CRA report is submitted, they likely will have questions and set up a meeting at that time.
        - She noted that this call would serve as an initial "engagement meeting" – no need for a meeting with a larger group at this time like we had with USACE and UWFWS.
        - She suggested that at the time the report is uploaded to their site that we also submit a detailed cover letter on the project to provide background information on the project. I can prepare a draft of that for at that time.
        - Our CRA contact – Travis Hurley – has access to the TDEC site to upload the report.

- Regarding the Biological Assessment Report – the title page and other "up front" info is typical of what we prepare for BGS reports. I am assuming that ORANO will (1) want to put an ORANO-based title page and "up front" material prior to sending

to NRC and (2) address the highlighted sections (just 2 or 3) I called to your attention. Let us know if we need to revise the report to address any comments or add the ORANO info.

Thanks.


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|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101<br>Oak Ridge, TN 37830<br>BGS-LLC.com |



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**From:** Gary Mays
**To:** Sikula, Nicole R
**Cc:** Eric Patterson; Elbert, Daniel C; Alexander, Steven
**Subject:** Update on Orano Progress / Follow-up Meeting

Nicole, Orano is in the process of conducting their final reviews of their ER and BA. They asked me to contact you regarding setting up a follow-up meeting to our initial discussions in May on the overall project to discuss (1) status of the BA and (2) plans to submit it by the end of October.

When would be a convenient time over the next 2 weeks for you and your team to meet via TEAMS with Orano to discuss the status of the BA and plans for submitting it? Right now, the only date we would be unavailable is Wed - Oct 15.

On another matter, what is the status on your new BO on bats?

Thanks for your time.


| | |
|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101<br>Oak Ridge, TN 37830<br>BGS-LLC.com |



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**From:** Sikula, Nicole R <nicole_sikula@fws.gov>
**Sent:** Tuesday, August 12, 2025 4:44 PM
**To:** Gary Mays <gmays@BGS-LLC.com>
**Cc:** Eric Patterson <epatterson@bgs-llc.com>; Elbert, Daniel C <daniel_elbert@fws.gov>; Alexander, Steven <steven_alexander@fws.gov>
**Subject:** Re: [EXTERNAL] 2017

Thanks for the helpful information and context. We can do an environmental review of the project, review our records, and get back to you if we need to gather more information.

Nicole Sikula
Deputy Field Supervisor
*Tennessee Ecological Services Field Office*
*South Atlantic-Gulf Interior Region*
U.S. Fish and Wildlife Service
Work: 931-431-2700

---

**From:** Gary Mays <gmays@BGS-LLC.com>
**Sent:** Tuesday, August 12, 2025 3:18 PM
**To:** Sikula, Nicole R <nicole_sikula@fws.gov>
**Cc:** Eric Patterson <epatterson@bgs-llc.com>; Elbert, Daniel C <daniel_elbert@fws.gov>
**Subject:** RE: [EXTERNAL] 2017

Nicole, perhaps the best thing to do is for us to note what your plans are – to release a new BO soon and consult with USFWS on its recommendations, etc., in the future.

Just for context, in 2020 DOE carved out about 80 acres of land from the original SSP-2 site in Oak Ridge (~900 acres), which is where the ORANO facility is to be built, to locate a training center on. It opened in 2022. DOE prepared an EA, the equivalent of a BA, and interacted with the USFWS. So, this is the context of my earlier referencing comments.

Yes, please keep us posted on your new BO on bats.

Thanks again for your help.

Gary Mays
Technical Manager
Boston Government Services, LLC

gmays@bgs-llc.com
Cell: 865-599-5303
Fax: (865) 272-3125
105 Mitchell Road, Suite 101
Oak Ridge, TN 37830
BGS-LLC.com

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**From:** Sikula, Nicole R <nicole_sikula@fws.gov>
**Sent:** Tuesday, August 12, 2025 3:57 PM
**To:** Gary Mays <gmays@BGS-LLC.com>
**Cc:** Eric Patterson <epatterson@bgs-llc.com>; Elbert, Daniel C <daniel_elbert@fws.gov>
**Subject:** Re: [EXTERNAL] 2017

Hi Gary,
You can reference the 2017 BO if you have a copy of it. We don't usually see project proponents referencing other ER's or BO's for their conservation measures. You can just propose the measures that will avoid and minimize impacts to bats while also being practical and feasible for the project. If we need to further minimize take, we can discuss it more with you after we review the project.

Nicole Sikula
Deputy Field Supervisor
*Tennessee Ecological Services Field Office*
*South Atlantic-Gulf Interior Region*
U.S. Fish and Wildlife Service
Work: 931-431-2700

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**From:** Gary Mays <gmays@BGS-LLC.com>
**Sent:** Tuesday, August 12, 2025 2:45 PM
**To:** Sikula, Nicole R <nicole_sikula@fws.gov>
**Cc:** Eric Patterson <epatterson@bgs-llc.com>; Elbert, Daniel C <daniel_elbert@fws.gov>
**Subject:** RE: [EXTERNAL] 2017

Nicole, thank you for your prompt response. That certainly explains why I could not find it.

Would it still be acceptable to note measures other projects in the area had planned to take regarding bats in their ERs based on the 2017 BO and referencing the 2017 document in general while noting as you described below that USFWS is in final stages of preparing an updated BO? In some instances, we can incorporate information by reference from other ERs.

We currently are in the final stages of preparing a draft ER for the ORANO project and will expect to respond to comments over the next few months. It is likely that ORANO could update the ER with the new BO prior to submitting to NRC.

Thanks again.



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|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101 |

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**From:** Sikula, Nicole R <nicole_sikula@fws.gov>
**Sent:** Tuesday, August 12, 2025 3:25 PM
**To:** Gary Mays <gmays@BGS-LLC.com>
**Cc:** Eric Patterson <epatterson@bgs-llc.com>; Elbert, Daniel C <daniel_elbert@fws.gov>
**Subject:** Re: [EXTERNAL] 2017

Hi Gary,
The 2017 Bat Conservation Strategy and Biological Opinion expired in 2022. We are in the final stages of updating the Strategy for Tennessee with its new Programmatic Biological Opinion that will be good for ten years. If you are interested in using this Recovery-focused consultation option when it becomes available, let us know and we can discuss it to see if its a good fit. It is an option that promotes conservation of bats to aide in their recovery. We will post it when it is finalized and we can give you a heads up when it is.

Nicole Sikula
Deputy Field Supervisor
*Tennessee Ecological Services Field Office*
*South Atlantic-Gulf Interior Region*
U.S. Fish and Wildlife Service
Work: 931-431-2700
Mobile: 931-254-9617

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**From:** Gary Mays <gmays@BGS-LLC.com>
**Sent:** Tuesday, August 12, 2025 2:04 PM
**To:** Sikula, Nicole R <nicole_sikula@fws.gov>
**Cc:** Eric Patterson <epatterson@bgs-llc.com>
**Subject:** [EXTERNAL] 2017

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Nicole, I was one of the individuals who was on the May 2 call regarding ORANO's proposed fuel enrichment project in Oak Ridge. Damon Brewer of ORANO and Lou Qualls of BGS were also on the call with you and Robbi Sykes. You had noted to contact you with questions regarding the Biological Assessment, etc. One of the references I have found in other Environmental Reports for other facilities in the immediate areas is the following:

**U.S. Fish and Wildlife Service (USFWS). "Conservation Strategy for Forest-dwelling Bats in Tennessee. Tennessee Ecological Services Field Office." 2017.**

I have been unable to find this document on the USFWS and TDEC websites nor the internet. The one link I did find indicated that USFWS had reworked its website and to search it. So, is it possible to still get a copy of the report? I did not find any indication that it had been updated. I have found similar documents for bats for other states.

Any help/guidance you could provide would be greatly appreciated. Thanks in advance for your help.


| | |
|---|---|
| Gary Mays<br>Technical Manager<br>Boston Government Services, LLC | gmays@bgs-llc.com<br>Cell: 865-599-5303<br>Fax: (865) 272-3125<br>105 Mitchell Road, Suite 101<br>Oak Ridge, TN 37830<br>BGS-LLC.com |


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BOSTON GOVERNMENT SERVICES
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August 19, 2025

The Honorable Wade Creswell
Roane County Executive
200 East Race Street, Suite 1
Kingston, TN 37763
865-376-5578 (Office)

**SUBJECT: Orano Roane County Engagement**

Dear Mr. Creswell,

On behalf of Orano-US LLC (Orano), Boston Government Solutions, LLC (BGS) is performing an Environmental Report on an approximately 600-acre site identified as Self-Sufficiency Parcel 2, along State Route 95, north of the intersection of State Route 58, in Oak Ridge, Roane County, Tennessee. The property is currently owned by the U.S. Department of Energy and is under review for transfer.

Orano, a nuclear services company, is in the process of licensing a nuclear fuel enrichment facility to produce enriched uranium fuel for use in commercial reactors. The Environmental Report will include information necessary for the U.S. Nuclear Regulatory Commission (NRC) to conduct an environmental analysis and make a decision regarding approval or denial of the requested license.

On July 16, 2025, Mr. Damon Brewer, a representative of Orano, and I met with you at your office to discuss any potential questions, issues, or concerns that Roane County may have related to the project. The topics discussed included the following:

1) School System
2) Police Department
3) Fire Department
4) Local Hospitals
5) Traffic
6) Housing
7) Emergency Planning
8) Use of local landfills for construction materials

With respect to emergency planning, it was noted that Roane County is a participant in the "State of Tennessee Multi-Jurisdictional Emergency Response Plan for The United States Department of Energy Oak Ridge Reservation Revision 4.2, May 4, 2023," and as such is familiar with the materials and hazards associated with a uranium fuel enrichment facility. Roane County public services and hospitals are fully equipped, trained, and prepared to respond to any potential events at the site.

We were informed that Roane County does not own an open landfill for disposal of new waste and advised that Orano would need to contract with a commercial landfill operation for disposal of construction waste.

All other issues discussed were believed to have either positive, small and temporary, or no impacts on Roane County and its citizens.

If you agree with these conclusions from our meeting, and do not need any additional information at this time, please sign and return this letter for its inclusion in the Environmental Report submission. If you would like to make any edits or additions, or if you would like to discuss additional topics, please let me know and we will meet with you at your earliest convenience.

Best Regards,

Lou Qualls

Lou Qualls
Senior Vice President
Boston Government Solutions

**Signature:**

**Email:** aqualls@bgs-llc.com

Wade Creswell

Hon. Wade Creswell
Roane County Executive

**Signature:**

**Email:** wade.creswell@roanecountytn.gov

BOSTON GOVERNMENT SERVICES
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MISSION-FOCUSED SOLUTIONS

September 12, 2025

Mr. Randall Hemann
City Manager, City of Oak Ridge
200 South Tulane Avenue
Oak Ridge, TN 37830

**SUBJECT: Orano – Oak Ridge Engagement**

Dear Mr. Hemann,

On behalf of Orano-US LLC (Orano), Boston Government Solutions, LLC (BGS) is performing an Environmental Report on an approximately 600-acre site identified as Self-Sufficiency Parcel 2, along State Route 95, north of the intersection of State Route 58, in Oak Ridge, Roane County, Tennessee. The property is currently owned by the U.S. Department of Energy and is under review for transfer.

Orano, a nuclear services company, is in the process of licensing a nuclear fuel enrichment facility to produce enriched uranium fuel for use in commercial reactors. The Environmental Report will include information necessary for the U.S. Nuclear Regulatory Commission (NRC) to conduct an environmental analysis and make a decision regarding approval or denial of the requested license.

On September 2, 2025, Mr. Damon Brewer, a representative of Orano, and I met with Oak Ridge representatives to discuss any potential questions, issues, or concerns that Roane County may have related to the project. Attendees included the following:

**Randall W. Hemann, City Manager**
City of Oak Ridge

**Tim Suter, Director of Emergency Services**
Roane County

**Travis Solomon, Fire Chief**
City of Oak Ridge Fire Department

**Amy Fitzgerald Ph.D., Government Affairs and Information Services Director**
City of Oak Ridge

Additional fire and emergency personnel.

The topics discussed included the following:

1) **School System** (~300 new full-time jobs after construction into the area)
2) **Police Department** (The site will be fenced and secured with Orano security personnel)
3) **Fire Department** (Orano will implement fire safety programs, have fire response training, and will work in coordination with local responders)
4) **Local Hospitals** (Area hospitals are familiar with the materials used in the enrichment process through their relationships with DOE sites. Additional engagement in the specific site details and response needs will be communicated prior to plant operations.)
5) **Traffic** (Orano will submit information to TDOT and request that a traffic light be installed.)
6) **Housing** (The housing market in Roane County is already a tight market. Rolling construction builds in Oak Ridge may continue this trend during construction of the Orano facility. Three hundred new jobs will be created and many of those are expected to be filled with local personnel.)
7) **Use of local landfills for construction materials** (Orano will use commercial contracts for material disposal)
8) **Emergency Planning**
    a. With respect to emergency planning, it was noted that the City of Oak Ridge is a participant in the "State of Tennessee Multi-Jurisdictional Emergency Response Plan for The United States Department of Energy Oak Ridge Reservation Revision 4.2, May 4, 2023," and as such, is familiar with the materials and hazards associated with a uranium fuel enrichment facility. Roane County public services and hospitals are fully equipped, trained, and prepared to respond to any potential events at the site.

All other impacts discussed were believed to be positive, small and temporary, or of no impact to the City of Oak Ridge and its citizens.

If you agree with these conclusions from our meeting, and do not need any additional information at this time, please sign and return this letter for its inclusion in the Environmental Report submission. If you would like to make any edits or additions, or if you would like to discuss additional topics, please let me know and we will meet with you at your earliest convenience.

Thank you again for the opportunity to meet with you and the Oak Ridge team.

Best Regards,

Lou Qualls, Ph.D., SVP
Boston Government Services, LLC

Mr. Randall Hemann, City Manager
City of Oak Ridge

**STATE OF TENNESSEE**
**TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION**
**KNOXVILLE ENVIRONMENTAL FIELD OFFICE**
3711 MIDDLEBROOK PIKE
KNOXVILLE, TENNESSEE 37921

PHONE (865) 594-6035 STATEWIDE 1-888-891-8332 FAX (865) 594-6105

October 14th, 2025

Surveying and Mapping, LLC
9047 Executive Park, Suite 120
Knoxville, TN 37923

Re: Jurisdictional Waters Report (DWR ID No. 34410)
Oak Ridge Property - SAM
East Fork Poplar Creek Watershed, Roane County

The Tennessee Department of Environment and Conversation, Division of Water Resources (TDEC-DWR) has reviewed the *Jurisdictional Waters Report* for Oak Ridge Property - SAM in Roane County, TN. This report was prepared by Civil & Environmental Consultants, Inc. and submitted on your behalf to our office on August 4th, 2025, with updates provided on September 26th, 2025, and October 13th, 2025, in support of jurisdictional hydrologic determinations of water features associated with the above referenced site. As part of our review, TDEC staff members Chris Pracheil and Doug Lawrence visited the site on September 3rd, 2025. These water features are located on property located at 35.95238° / -84.35476 ° (Lat/Long), off Oak Ridge Turnpike, Roane County TN. Please note that all geographic coordinates provided in this letter have a limited precision and should be considered approximate.

Based on the information and documentation submitted in the report, our observations on-site, and the Division's rules and guidance regarding hydrologic determinations, the Division accepts the jurisdictional determination of the assessed water features as documented in the submitted report and as portrayed on *Table 1 Wetlands* and *Table 2 Streams,* and *Table 3 Wet Weather Conveyances / Non Relatively Permanent Waters.* These findings as presented in the report and accompanying information are summarized and displayed in the tables below and the attached map from the report.

**Hydrologic Determination of Assessed Water Features**
**Campbell Hollow Road, Sevierville, Sevier County, TN**

**Table 1 - Wetlands**

| Report ID | Type | Test Pit Coordinates | Acres | Field ID | CEC's Opinion of Regualtion |
|---|---|---|---|---|---|
| WTL-G | PFO | 35.9501012, -84.3580732 | 0.01 | WTL-4A | NON-JURISDICTIONAL WOTUS / ISOLATED WOTS |
| WTL-I | PFO | 35.9544666, -84.3631945 | 0.12 | WTL-6 | WOTUS/WOTS |
| WTL-J | PFO | 35.9547513, -84.3595335 | 0.32 | WTL-D | NON-JURISDICTIONAL WOTUS / ISOLATED WOTS |
| WTL-K | PFO | 35.9553332, -84.3566892 | 0.03 | WTL-E | WOTUS/WOTS |
| | | **Total Acre** | 0.48 | | |

**Table 2 – Streams**

| Report ID | Start Coordinates | End Coordinates | Length (l.f.) | Field ID | CEC's Opinion of Regualtion |
|---|---|---|---|---|---|
| STR-09 | 35.9571792, -84.3473174; 35.9530652, -84.3577531 | 35.9543726, -84.3516845 ; 35.9543237, -84.3632671 | 4036 | STR-16 | WOTUS/WOTS |
| STR-10 | 35.9550993, -84.3608774 | 35.9549600, -84.3613319 | 146 | STR-14 | WOTUS/WOTS |
| STR-11 | 35.9544353, -84.3590119 | 35.9544621, -84.3593812 | 112 | STR-18 | WOTUS/WOTS |
| STR-12 | 35.9552625, -84.3567100 | 35.9532501, -84.3579043 | 925 | STR-20 | WOTUS/WOTS |
| STR-13 | 35.9556312, -84.3561538 | 35.9549321, -84.3568646 | 345 | STR-22 | WOTUS/WOTS |
| STR-14 | 35.9555432, -84.3512978 | 35.9552856, -84.3512019 | 101 | STR-24 | WOTUS/WOTS |
| STR-15 | 35.9570974, -84.3508499 | 35.9566538, -84.3504031 | 221 | STR-26 | WOTUS/WOTS |
| STR-16 | 35.9579726, -84.3480775 | 35.9571489, -84.3486665 | 358 | STR-28 | WOTUS/WOTS |
| | | **Total Stream** | **6246** | | |

**Table 3 – Wet Weather Conveyances / Non Relatively Permanent Waters**

| Report ID | Start Coordinates | End Coordinates | Length (l.f.) | Field ID | CEC's Opinion of Regualtion |
|---|---|---|---|---|---|
| WWC-08 | 35.9486679, -84.3612519 | 35.9483552, -84.3623823 | 359 | WWC-08 | Non- WOTS/Non-WOTUS |
| WWC-09 | 35.9513114, -84.3606966 | 35.9519075, -84.3630171 | 728 | WWC-7 | Non- WOTS/Non-WOTUS |
| WWC-10 | 35.9547327, -84.3590605 | 35.9546774, -84.3592276 | 53 | WWC-10 | Non- WOTS/Non-WOTUS |
| WWC-11 | 35.9559349, -84.3567958 | 35.9556824, -84.3565454 | 119 | WWC-20 | Non- WOTS/Non-WOTUS |
| WWC-12 | 35.9557693, -84.3564556 | 35.9554085, -84.3567088 | 152 | WWC-18 | Non- WOTS/Non-WOTUS |
| WWC-13* | 35.9561096, -84.3555906 | 35.9556312, -84.3561538 | 257 | WWC-16 | Non- WOTS |
| WWC-14* | 35.9543726, -84.3516845 | 35.9530652, -84.3577531 | 2457 | WWC-12 | Non- WOTS |
| WWC-15 | 35.9554401, -84.3496823 | 35.9543621, -84.3516682 | 792 | WWC-14 | Non- WOTS/Non-WOTUS |
| WWC-16* | 35.9572675, -84.3460947 | 35.9571792, -84.3473174 | 374 | WWC-24 | Non- WOTS |
| WWC-17* | 35.9585594, -84.3477330 | 35.9579726, -84.3480775 | 237 | WWC-26 | Non- WOTS |
| WWC-18 | 35.9567038, -84.3535256 | 35.9557550, -84.3530399 | 384 | WWC-24A | Non- WOTS/Non-WOTUS |
| WWC-19 | 35.9556637, -84.3526909 | 35.9548693, -84.3520939 | 351 | WWC-24B | Non- WOTS/Non-WOTUS |
| WWC-20 | 35.9560671, -84.3543504 | 35.9548412, -84.3546706 | 461 | WWC-22 | Non- WOTS/Non-WOTUS |
| | | **Total WWC/NRPW** | **6725** | | |

It is important to note that the Division's evaluation and concurrence is restricted to only the water feature identified within the submitted report and as depicted on the attached map. Only the water features listed above were assessed as part of this hydrologic determination, therefore this correspondence is not intended to represent a comprehensive water resource inventory of the entire site. It is the property owner's responsibility to consider and report any additional water features within the property boundaries that may be affected by any construction activities associated with future development.

Any alterations to jurisdictional streams, wetlands, or open water features may only be performed under the coverage of, and conformance to, a valid *Aquatic Resource Alteration Permit (ARAP)* issued by the Division. ARAP applications and provisions are available on-line at https://www.tn.gov/environment/permit-permits/water-permits1/aquatic-resource-alteration-permit--arap-.html.

Alterations to Wet Weather Conveyances typically may be performed without application or notification to the Division, provided they conform to the provisions found under *Tennessee Code Annotated § 69-3-108 (q)*.

Please note that coverage under the *General NPDES Permit for Stormwater Discharges from Construction Activities (CGP)* will be needed if the proposed land disturbance activity for this project is one acre or more in size. Information and applications regarding the Division's construction storm water program can be found online. A completed Notice of Intent form, an application fee, and a storm water pollution prevention plan should be submitted to the above address for review and coverage under this permit prior to any land disturbance.

Discharges and alterations to sinkholes may require the submittal of an application and written authorization under the provisions of TDEC Rules. Information and applications regarding the Underground Injection Control program may be seen online at https://www.tn.gov/environment/permit-permits/water-permits1/underground-injection-control-permit.html. Physical alterations or re-routing of surface hydrology to a sinkhole may require coverage under the *Class V Injection Control Permit*.
Hydrologic determinations are advised and governed by Tennessee Department of Environment and

Conservation (TDEC) rules and regulations, and therefore only apply to the State's permitting process. Because these and other various water features on-site may potentially also be considered jurisdictional Waters of the United States, any alterations to them should only be performed after consultation with the U.S. Army Corps of Engineers.

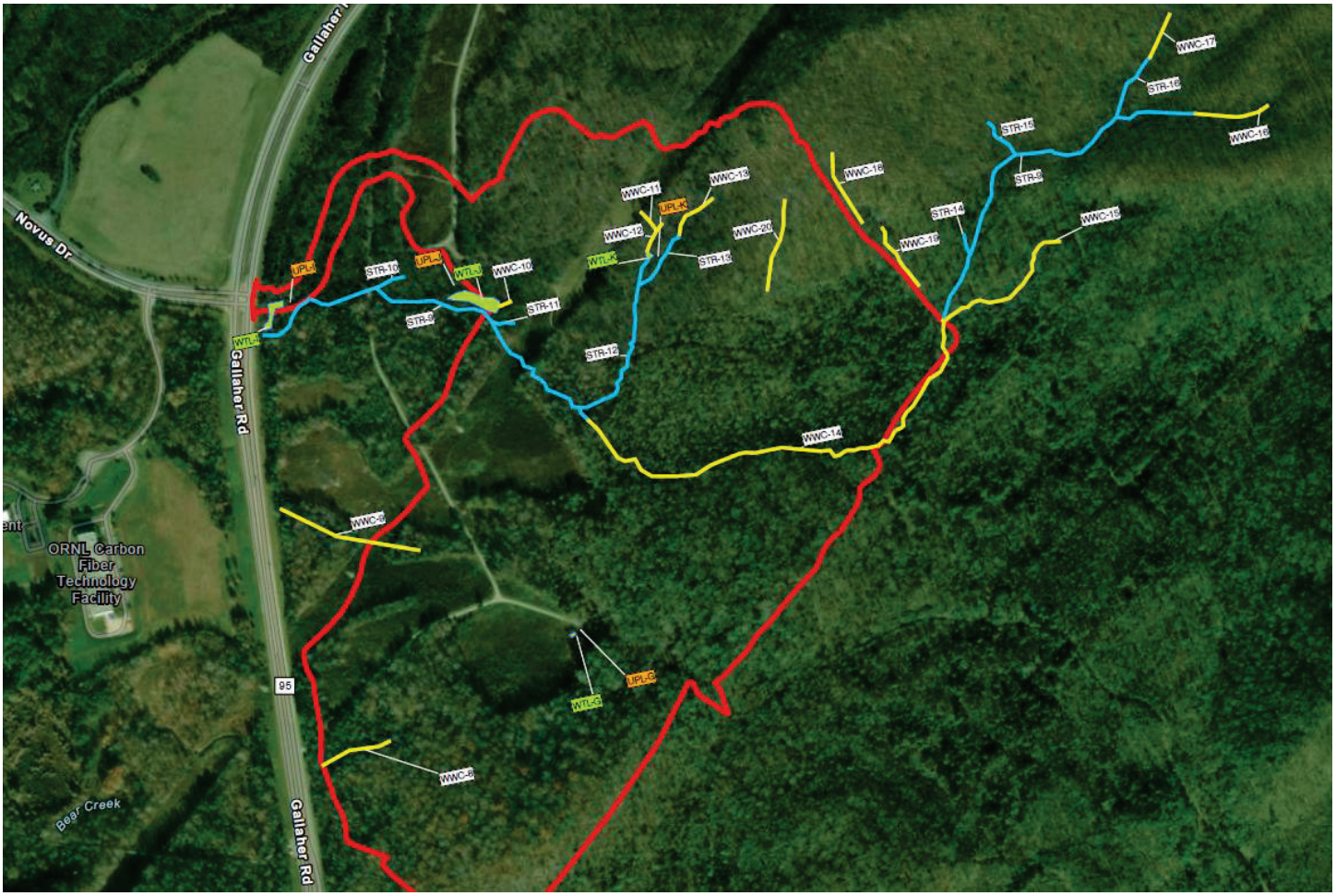
We appreciate the opportunity to assess the jurisdictional status of these water features prior to site plan finalization and initiation of construction activities. Because natural variation and human activities can alter hydrologic conditions, the Division reserves the right to reassess the status of the water features in the future. Thank you for your interest in water quality in Tennessee. Please contact Chris Pracheil at 865-296-2161 or by email at christopher.pracheil@tn.gov if you have any questions.

Respectfully,

Chris Pracheil
Environmental Consultant, Knoxville Environmental Field Office
TDEC Division of Water Resources

Enclosures: Attachment 1 - Hydrologic Features Area Map

Cc: File copy
Mr. Josh Rowe, Civil & Environmental Consultants, LLC.: tmattioli@cecinc.com
USACE, Nashville District: NashvilleRegulatory@usace.army.mil




Attachment 1: Hydrologic Features Map

(Map taken from Jurisdictional Waters Report Oak Ridge Property - SAM by CEC Inc.)

Oak Ridge, Roane County, TN

**DEPARTMENT OF THE ARMY**
NASHVILLE DISTRICT, CORPS OF ENGINEERS
REGULATORY DIVISION
3701 BELL ROAD
NASHVILLE, TENNESSEE 37214

November 21, 2025

SUBJECT: File No.LRN-2025-00585, Orano Site, Oak Ridge, Roane County, Tennessee (Latitude: 35.953056, -84.35774)

Orano
4747 Bethesda Avenue
Suite 1001
Bethesda, MD 20814

Dear Mr. Brewer:

This letter is in regard to your report entitled "Jurisdictional Waters Report, Oak Ridge Property-SAM, Oake Ridge, Roane County, Tennessee, June 24, 2025" (JD Report), which documented potential waters of the United States on a review area of approximately 350 acres. This project has been assigned File No. LRN-2025-00585, please refer to this number in any future correspondence.

The U.S. Army Corps of Engineers (USACE) has regulatory responsibilities pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403). Under Section 10, the USACE regulates any work in, or affecting, navigable waters of the U.S. It appears the review area does not include navigable waters of the U.S. and would not be subject to the provisions of Section 10. Under Section 404, the USACE regulates the discharge of dredged and/or fill material into waters of the U.S., including wetlands.

**a. Preliminary Jurisdictional Determination:** Based on a field review on September 3, 2025, and September 26, 2025, five reaches of stream totaling 2,584 linear feet and 0.12 acres of wetlands were documented within the review area. This office has determined these features **may** be jurisdictional waters of the U.S. in accordance with 33 C.F.R. 331.2 and a PJD has been prepared. The PJD is non-binding, cannot be appealed and only provides a written indication that waters of the U.S, including wetlands, may be present on-site. For purposes of computation of impacts, compensatory mitigation requirements and other resource protection measures, a permit decision made on the basis of a PJD will treat all waters that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This determination is only valid for the review area shown on the attached map entitled "LRN-2025-00585, ORANO AJD/PJD Location Map", attached to this letter.

Enclosed with this letter is a copy of the PJD. If you agree with the findings of this PJD and understand your options regarding the same, please sign and date the form and return it to this office within 30 days of receipt of this letter. You should submit the signed copy to the following address:

U.S. Army Corps of Engineers
Nashville District
3701 Bell Rd.
Nashville, TN 37214
Attn: Cara Beverly

**b. Approved Jurisdictional Determination**: Also enclosed is an approved jurisdictional determination for aquatic resources identified as WWC-8, WWC-9, WWC-10, WWC-11, WWC-12, WWC-12A, WWC-13, WWC-14, WWC-15, WWC-16, WWC-17, WWC-18, WWC-19, WWC-20, STR-9A, STR-9B, STR-9C, STR-12, STR-12A, STR-13, STR16, WTL-G, WTL-J, and WTL-K. The rationale for this determination is provided in the attached Approved Jurisdictional Determination form. The approved jurisdictional determination expires five years from the date of this letter, unless new information warrants revision of the determination before the expiration date, or the District Engineer identifies specific geographic areas with rapidly changing environmental conditions that merit re-verification on a more frequent basis. This approved jurisdictional determination is only valid for the footprint of the waters listed above as shown on the map labeled “LRN-2025-00585, ORANO AJD/PJD Location Map”

If you object to this decision, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeals Process (NAP) fact sheet and Request for Appeal (RFA) form. If you request to appeal this decision you must submit a completed RFA form to the Great Lakes and Ohio River Division, Division Office at the following address:

Regulatory Appeal Review Officer
ATTN: Ms. Suzanne Chubb
Army Engineer Division
550 Main Street, Room 10-780
Cincinnati, OH 45202-3222
TEL (513) 218-1243

In order for an RFA to be accepted by the USACE, the USACE must determine that it is complete, that it meets the criteria for appeal under 33 CFR Part 331.5, and that it has been received by the Division Office within 60 days of the date listed on the RFA form. Should you decide to submit an RF A form, it must be received at the above

address by January 20, 2025. **It is not necessary to submit an RFA form to the Division Office if you do not object to the decision in this letter**.

The delineation included herein has been conducted to identify the location and extent of the aquatic resources for purposes of the Clean Water Act for the particular site identified in this request. This delineation may not be valid for the Wetland Conservation Provisions of the Food Security Act of 1985, as amended. If you or your tenant are USDA program participants, or anticipate participation in USDA programs, you should discuss the applicability of an NRCS Certified Wetland Determination with the local USDA service center, prior to starting work.

We appreciate your awareness of the USACE regulatory program. If you have any questions, you may contact me or Cara Beverly at (865) 304-1413 or by e-mail at cara.c.beverly@usace.army.mil.

Sincerely,

Casey Ehorn
Deputy Chief, Regulatory Division
Nashville District

Enclosures

Electronic Copies Furnished:

Mr. Josh Rowe (CEC)
Mr. Patrick Jacobs (Kiewit)

U.S. Army Corps of Engineers (USACE)

# PRELIMINARY JURISDICTIONAL DETERMINATION (PJD)

For use of this form, see Sec 404 CWA, Sec 10 RHA, Sec 103 MPRSA; the proponent agency is CECW-COR.

*Form Approved -*
*OMB No. 0710-0024*
*Expires 2024-04-30*

**DATA REQUIRED BY THE PRIVACY ACT OF 1974**

**Authority** Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Program of the U.S. Army Corps of Engineers; Final Rule for 33 CFR Parts 320-332.

**Principal Purpose** The information that you provide will be used in evaluating your request to determine whether there are any aquatic resources within the review area that may be subject to federal jurisdiction under the regulatory authorities referenced above.

**Routine Uses** This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public, and may be made available as part of a public notice or FOIA request as required by federal law. Your name and property location where federal jurisdiction is to be determined will be included in any resulting jurisdictional determination (JD), which may be made available to the public on the District's website and/or on the Headquarters USACE website.

**Disclosure** Submission of requested information is voluntary; however, if information is not provided, the request for a JD cannot be evaluated nor can a PJD be issued.

**The Agency Disclosure Notice (ADN)**

The public reporting burden for this collection of information, 0710-0024, is estimated to average 25 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

## SECTION I - BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: 2025-11-20

B. NAME AND ADDRESS OF PERSON REQUESTING PJD:
Orano, C/O Mr. Damon Brewer, 4747 Bethesda Avenue, Suite 1001, Bethesda, MD 20814

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:
LRN-2025-00585; ORANO

D. PROJECT LOCATION AND BACKGROUND INFORMATION:
(*USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES*)

State: Tennessee County/Parish/Borough: Roane City: Oak Ridge

Center coordinates of site (*lat/long in degree decimal format*): Latitude: 35.953056 ° Longitude: -84.35774 °

Universal Transverse Mercator:

Name of nearest waterbody: East Fork Poplar Creek

E. REVIEW PERFORMED FOR SITE EVALUATION (*CHECK ALL THAT APPLY*):

☐ Office (*Desk*) Determination. Date:

☒ Field Determination

Date(s): September 3, 2025

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

| | Site Number | Latitude (*decimal degrees*) | Longitude (*decimal degrees*) | Estimated amount of aquatic resource in review area (*acreage and linear feet, if applicable*) | Type of aquatic resource (*i.e., wetland vs. non-wetland waters*) | Geographic authority to which the aquatic resource "may be" subject (*i.e., Section 404 or Section 10/404*) |
|---|---|---|---|---|---|---|
| | STR-9 | 35.953201 | -84.357902 | 2,004 linear feet | non-wetland | Section 404 |

| | Site Number | Latitude (*decimal degrees*) | Longitude (*decimal degrees*) | Estimated amount of aquatic resource in review area (*acreage and linear feet, if applicable*) | Type of aquatic resource (*i.e., wetland vs. non-wetland waters*) | Geographic authority to which the aquatic resource "may be" subject (*i.e., Section 404 or Section 10/404*) |
|---|---|---|---|---|---|---|
| | STR-10 | 35.955099 | -84.360877 | 146 linear feet | non-wetland | Section 404 |
| | STR-11 | 35.954435 | -84.359011 | 112 linear feet | non-wetland | Section 404 |
| | STR-14 | 35.955543 | -84.351297 | 101 linear feet | non-wetland | Section 404 |
| | STR-15 | 35.957097 | -84.350849 | 221 linear feet | non-wetland | Section 404 |
| | WTL-I | 35.954466 | -84.363194 | 0.12 acre | wetland | Section 404 |

1) The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.

2) In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "preconstruction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD or no JD whatsoever, which do not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the USACE has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD or reliance on no JD whatsoever; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of USACE permit authorization based on a PJD or no JD whatsoever constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the USACE will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there *"may be"* waters of the U.S. and/or that there *"may be"* navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

F. SUPPORTING DATA. Data reviewed for PJD (*check all that apply)*

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

☒ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:

Map: Maps submitted by consultant in email dated November 4, 2025

☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.

☒ Office concurs with data sheets/delineation report.

☐ Office does not concur with data sheets/delineation report.

Rationale: _____

☐ Data sheets prepared by the USACE:

_____

☐ Corps navigable waters' study:

☐ U.S. Geological Survey Hydrologic Atlas:

☒ USGS NHD data.

☒ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name:

Bethel Valley, TN 1:24K Quad

☒ USDA Natural Resources Conservation Service Soil Survey.

Citation: Submitted in "Jurisdictional Waters Report- Oak Ridge Property-SAM, Oak Ridge, Roane County, Tennessee" dated June 24, 2025.

☒ National Wetlands Inventory map(s).

Cite Name: Submitted in "Jurisdictional Waters Report- Oak Ridge Property-SAM, Oak Ridge, Roane County, Tennessee" dated June 24, 2025.

☐ State/Local Wetland Inventory map(s):

☒ FEMA/FIRM maps:

Submitted in "Jurisdictional Waters Report- Oak Ridge Property-SAM, Oak Ridge, Roane County, Tennessee" dated June 24, 2025.

☐ 100-year Floodplain Elevation is: _____. (National Geodectic Vertical Datum of 1929)

☒ Photographs: ☐ Aerial (*Name & Date*):

or ☒ Other (*Name & Date*): Photos provided in "Jurisdictional Waters Report- Oak Ridge Property-SAM, Oak Ridge, Roane County, Tennessee" dated June 24, 2025 and USACE photos from September 3, 2025, and September 26, 2025, site visits.

☐ Previous determination(s). File no. and date of response letter:

☐ Other information (*please specify*):

**IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the USACE and should not be relied upon for later jurisdictional determinations.**

| Name of Regulatory Staff Member Completing PJD | Date | Signature of Regulatory Staff Member Completing PJD |
|---|---|---|
| Cara C. Beverly | 2025-11-21 | Cara Beverly |
| Name of Person Requesting PJD | Date | Signatureof Person Requesting PJD *(REQUIRED, unless obtaining the Signature is Impracticable* |
| | | |

[1] Districts may establish timeframes for requester to return signed PJD forms. If the requester does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, NASHVILLE DISTRICT
3701 BELL ROAD
NASHVILLE, TENNESSEE 37214

CERLN-RD 21 November 2025

MEMORANDUM FOR RECORD

SUBJECT: US Army Corps of Engineers (Corps) Pre-2015 Regulatory Regime Approved Jurisdictional Determination in Light of *Sackett v. EPA*, 143 S. Ct. 1322 (2023) ,[1] [LRN-2025-00585]

BACKGROUND. An Approved Jurisdictional Determination (AJD) is a Corps document stating the presence or absence of waters of the United States on a parcel or a written statement and map identifying the limits of waters of the United States on a parcel. AJDs are clearly designated appealable actions and will include a basis of JD with the document.[2] AJDs are case-specific and are typically made in response to a request. AJDs are valid for a period of five years unless new information warrants revision of the determination before the expiration date or a District Engineer has identified, after public notice and comment, that specific geographic areas with rapidly changing environmental conditions merit re-verification on a more frequent basis.[3] For the purposes of this AJD, we have relied on section 10 of the Rivers and Harbors Act of 1899 (RHA),[4] the Clean Water Act (CWA) implementing regulations published by the Department of the Army in 1986 and amended in 1993 (references 2.a. and 2.b. respectively), the 2008 *Rapanos-Carabell* guidance (reference 2.c.), and other applicable guidance, relevant case law and longstanding practice, (collectively the pre-2015 regulatory regime), and the *Sackett* decision (reference 2.d.) in evaluating jurisdiction.

This Memorandum for Record (MFR) constitutes the basis of jurisdiction for a Corps AJD as defined in 33 CFR §331.2. The features addressed in this AJD were evaluated consistent with the definition of “waters of the United States” found in the pre-2015 regulatory regime and consistent with the Supreme Court's decision in *Sackett*. This AJD did not rely on the 2023 “Revised Definition of ‘Waters of the United States,’” as amended on 8 September 2023 (Amended 2023 Rule) because, as of the date of this decision, the Amended 2023 Rule is not applicable in this state due to litigation.

1. SUMMARY OF CONCLUSIONS.

[1] While the Supreme Court’s decision in *Sackett* had no effect on some categories of waters covered under the CWA, and no effect on any waters covered under RHA, all categories are included in this Memorandum for Record for efficiency.
[2] 33 CFR 331.2.
[3] Regulatory Guidance Letter 05-02.
[4] USACE has authority under both Section 9 and Section 10 of the Rivers and Harbors Act of 1899 but for convenience, in this MFR, jurisdiction under RHA will be referred to as Section 10.

a. Provide a list of each individual feature within the review area and the jurisdictional status of each one (i.e., identify whether each feature is/is not a water of the United States and/or a navigable water of the United States).

| Resource | Measurement (linear feet or acre) | Jurisdictional Status | Authority |
|---|---|---|---|
| WWC-8 | 359 linear feet | Non-jurisdictional | N/A |
| WWC-9 | 728 linear feet | Non-jurisdictional | N/A |
| WWC-10 | 53 linear feet | Non-jurisdictional | N/A |
| WWC-11 | 119 linear feet | Non-jurisdictional | N/A |
| WWC-12 | 111 linear feet | Jurisdictional | Section 404 |
| WWC-12A | 42 linear feet | Non-jurisdictional | N/A |
| WWC-13 | 257 linear feet | Jurisdictional | Section 404 |
| WWC-14 | 2,457 linear feet | Non-jurisdictional | N/A |
| WWC-15 | 792 linear feet | Non-jurisdictional | N/A |
| WWC-16 | 374 linear feet | Jurisdictional | Section 404 |
| WWC-17 | 237 linear feet | Jurisdictional | Section 404 |
| WWC-18 | 384 linear feet | Non-jurisdictional | N/A |
| WWC-19 | 351 linear feet | Non-jurisdictional | N/A |
| WWC-20 | 461 linear feet | Non-jurisdictional | N/A |
| STR-9A | 84 linear feet | Non-jurisdictional | N/A |
| STR-9B | 1,539 linear feet | Non-jurisdictional | N/A |
| STR-9C | 410 linear feet | Jurisdictional | Section 404 |
| STR-12 | 793 linear feet | Jurisdictional | Section 404 |
| STR-12A | 132 linear feet | Jurisdictional | Section 404 |
| STR-13 | 602 linear feet | Jurisdictional | Section 404 |
| STR-16 | 358 linear feet | Jurisdictional | Section 404 |
| WTL-G | 0.01 acre | Non-jurisdictional | N/A |
| WTL-J | 0.32 acre | Non-jurisdictional | N/A |
| WTL-K | 0.03 acre | Jurisdictional | Section 404 |

2. REFERENCES.

a. Final Rule for Regulatory Programs of the Corps of Engineers, 51 FR 41206 (November 13, 1986).

b. Clean Water Act Regulatory Programs, 58 FR 45008 (August 25, 1993).

c. U.S. EPA & U.S. Army Corps of Engineers, Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States & Carabell v. United States* (December 2, 2008)

d. *Sackett v. EPA*, 598 U.S. _, 143 S. Ct. 1322 (2023)

3. REVIEW AREA. [Review area includes approximately 350 acres in Oak Ridge, Roane County, Tennessee (Latitude: 35.954372, Longitude: -84.351684) Bethel Valley, TN 1:24K Quad

4. NEAREST TRADITIONAL NAVIGABLE WATER (TNW), INTERSTATE WATER, OR THE TERRITORIAL SEAS TO WHICH THE AQUATIC RESOURCE IS CONNECTED. [Clinch River.][5]

5. FLOWPATH FROM THE SUBJECT AQUATIC RESOURCES TO A TNW, INTERSTATE WATER, OR THE TERRITORIAL SEAS

<table>
<tr><td>Resource Name</td><td colspan="8">Flows Into</td><td>TNW</td></tr>
<tr><td>WWC-8</td><td colspan="8">East Fork Poplar Creek</td><td>Clinch River</td></tr>
<tr><td>WWC-9</td><td colspan="4">Unnamed Tributary</td><td colspan="4">East Fork Poplar Creek</td><td>Clinch River</td></tr>
<tr><td>WWC-11</td><td rowspan="2">WWC-12</td><td rowspan="2">STR-12A</td><td rowspan="3">STR-12</td><td rowspan="3">STR-9</td><td rowspan="3">Unnamed Tributary</td><td rowspan="3">East Fork Poplar Creek</td><td rowspan="3">Clinch River</td></tr>
<tr><td>WWC-12A</td></tr>
<tr><td>WWC-13</td><td colspan="2">STR-13</td></tr>
<tr><td>WWC-16</td><td>STR-9C</td><td rowspan="2">STR-9B</td><td rowspan="2">WWC-14</td><td rowspan="3">STR-9A</td><td rowspan="3">STR-9</td><td rowspan="3">Unna-med Tribut ary</td><td rowspan="3">East Fork Poplar Creek</td><td rowspan="3">Clinch River</td></tr>
<tr><td>WWC-17</td><td>STR-16</td></tr>
<tr><td>WWC-15</td><td colspan="3">WWC-14</td></tr>
<tr><td>WWC-10</td><td colspan="9">WTL-J (Feature has no outlet and does not connect to downstream resources)</td></tr>
<tr><td>WWC-18</td><td colspan="9" rowspan="3">N/A (Features do not connect to downstream resources)</td></tr>
<tr><td>WWC-19</td></tr>
<tr><td>WWC-20</td></tr>
<tr><td>WTL-G</td><td colspan="9">N/A (Feature has no outlet and does not connect to downstream resources)</td></tr>
</table>

[5] This MFR should not be used to complete a new stand-alone TNW determination. A stand-alone TNW determination for a water that is not subject to Section 9 or 10 of the Rivers and Harbors Act of 1899 (RHA) is completed independently of a request for an AJD. A stand-alone TNW determination is conducted for a specific segment of river or stream or other type of waterbody, such as a lake, where upstream or downstream limits or lake borders are established.

6. SECTION 10 JURISDICTIONAL WATERS[6]: Describe aquatic resources or other features within the review area determined to be jurisdictional in accordance with Section 10 of the Rivers and Harbors Act of 1899. Include the size of each aquatic resource or other feature within the review area and how it was determined to be jurisdictional in accordance with Section 10.[7] [N/A]

7. SECTION 404 JURISDICTIONAL WATERS: Describe the aquatic resources within the review area that were found to meet the definition of waters of the United States in accordance with the pre-2015 regulatory regime and consistent with the Supreme Court's decision in *Sackett*. List each aquatic resource separately, by name, consistent with the naming convention used in section 1, above. Include a rationale for each aquatic resource, supporting that the aquatic resource meets the relevant category of "waters of the United States" in the pre-2015 regulatory regime. The rationale should also include a written description of, or reference to a map in the administrative record that shows, the lateral limits of jurisdiction for each aquatic resource, including how that limit was determined, and incorporate relevant references used. Include the size of each aquatic resource in acres or linear feet and attach and reference related figures as needed.

    a. TNWs (a)(1): [N/A]

    b. Interstate Waters (a)(2): [N/A]

    c. Other Waters (a)(3): [N/A]

    d. Impoundments (a)(4): [N/A]

    e. Tributaries (a)(5):

[6] 33 CFR 329.9(a) A waterbody which was navigable in its natural or improved state, or which was susceptible of reasonable improvement (as discussed in § 329.8(b) of this part) retains its character as "navigable in law" even though it is not presently used for commerce, or is presently incapable of such use because of changed conditions or the presence of obstructions.
[7] This MFR is not to be used to make a report of findings to support a determination that the water is a navigable water of the United States. The district must follow the procedures outlined in 33 CFR part 329.14 to make a determination that water is a navigable water of the United States subject to Section 10 of the RHA.

| The feature or features described in the below table are natural, man-altered, or man-made water bodies that flow directly or indirectly into a TNW. See section 5 for flow path information. The feature or features have been determined to meet the relatively permanent standard. The feature or features typically flow year-round or have continuous flow at least seasonally. The OHWM (Ordinary High Water Mark) represents the lateral limits of jurisdiction per 33CFR328.4. The OHWM was determined using field indicators in RGL 05-05. The upstream and downstream limits of these feature or features are identified on the attached figure. | | |
|---|---|---|
| Resource Name | Size | Rationale |
| Relevant Reach 1 (RR1) comprises of STR-16/WWC-17 | 595 LF Total (358 LF/ 237 LF) | RR1 is 1st order stream and had strong indicators of relatively permanent flow at the downstream limit of the tributary before reaching WWC-17. RR1 was determined to be 66% relatively permanent waters (RPW) (358 LF) and 34% non-relatively permanent waters (NRPW) (237 LF). RR1 was determined to be a relevant reach from the headwater of WWC-17 to the confluence with STR-9B. USACE reviewed the entirety of the reach which was all within the review area.<br><br>This determination is supported by surface flow, pooling, and saturation, observed in the downstream portion of the of the reach during the September 3, 2025, field visit in addition to documentation provided by CEC indicating the downstream portion of the reach is a RPW. Baseflow was observed during the site visit.<br><br>During the September 3, 2025, field visit USACE also observed the following OHWM indicators: bed and bank, sorting, wracking, disturbance of leaf litter, scour, and changes in the character of the soil were observed within the channel.<br><br>Based on the direct observations noted above, climatic conditions discussed in this form and within the administrative record, and documentation provided by CEC, USACE has determined utilizing a weight of evidence approach that the feature from the headwater to the downstream confluence with STR-9B, RR1 is |

| | | |
|---|---|---|
| | | a RPW feature which flows at least seasonally. Based on the information above we have determined that the resource meets the definition of “waters of the United States”. |
| Relevant Reach 2 (RR2) comprises of STR-9C/WWC-16 | 784 LF Total (410 LF/ 317 LF) | RR2 is 1st order stream and had strong indicators of relatively permanent flow at the downstream limit of the tributary before reaching WWC-13. RR2 was determined to be 74% relatively permanent waters (RPW) (345 LF) and 26% non-relatively permanent waters (NRPW) (257 LF). RR2 was determined to be a relevant reach from the headwater of WWC-13 to the confluence with STR-12. USACE reviewed the entirety of the reach which was all within the review area.<br><br>This determination is supported by surface flow, pooling, and saturation, observed in the downstream portion of the of the reach during the September 3, 2025, field visit in addition to documentation provided by CEC indicating the downstream portion of the reach is a RPW. Baseflow was observed during the site visit.<br><br>During the September 3, 2025, field visit USACE also observed the following OHWM indicators: bed and bank, sorting, wracking, disturbance of leaf litter, scour, and changes in the character of the soil were observed within the channel.<br><br>Based on the direct observations noted above, climatic conditions discussed in this form and within the administrative record, and documentation provided by CEC, USACE has determined utilizing a weight of evidence approach that the feature from the headwater to the downstream confluence with STR-12, RR2 is a RPW feature which flows at least seasonally. Based on the information above we have determined that the resource meets the definition of “waters of the United States”. |

| | | |
|---|---|---|
| Relevant Reach 4 (RR4) Relevant Reach 4 (RR4) comprises of STR-13/WWC-13 | 602 LF Total (345 LF/ 257 LF) | RR4 is 1st order stream and had strong indicators of relatively permanent flow at the downstream limit of the tributary before reaching WWC-13. RR4 was determined to be 74% relatively permanent waters (RPW) (345 LF) and 26% non-relatively permanent waters (NRPW) (257 LF). RR4 was determined to be a relevant reach from the headwater of WWC-13 to the confluence with STR-12. USACE reviewed the entirety of the reach which was all within the review area.<br><br>This determination is supported by surface flow, pooling, and saturation, observed in the downstream portion of the of the reach during the September 3, 2025, field visit in addition to documentation provided by CEC indicating the downstream portion of the reach is a RPW. Baseflow was observed during the site visit.<br><br>During the September 3, 2025, field visit USACE also observed the following OHWM indicators: bed and bank, sorting, wracking, disturbance of leaf litter, scour, and changes in the character of the soil were observed within the channel.<br><br>Based on the direct observations noted above, climatic conditions discussed in this form and within the administrative record, and documentation provided by CEC, USACE has determined utilizing a weight of evidence approach that the feature from the headwater to the downstream confluence with STR-12, RR4 is a RPW feature which flows at least seasonally. Based on the information above we have determined that the resource meets the definition of “waters of the United States”. |
| Relevant Reach 5 (RR5) comprises of | 1,036 LF Total (793 LF/132 LF/111 LF) | RR5 is a 2nd order stream and had strong indicators of relatively permanent flow throughout the majority of the tributary downgradient of WTL-K to the confluence with RR3(STR-9A/WWWC-14/STR-9B). |

| | | |
|---|---|---|
| STR-12/STR-12A/WTL-K/WWC-12 | | RR5 was determined to be 88% relatively permanent waters (RPW)(STR-12/STR-12A) and 12% non-relatively permanent waters (NRPW) (WWC-12). RR5 was determined to be a relevant reach from the confluence of WWC-11 and WWC-12A. USACE reviewed the entirety of the reach which was all within the review area.<br><br>This determination is supported by surface flow, pooling, and saturation, observed in the majority of the of the reach during the September 3, 2025, field visit in addition to documentation provided by CEC indicating the downstream portion of the reach is a RPW. Baseflow was observed during the site visit.<br><br>During the September 3, 2025, field visit USACE also observed the following OHWM indicators: bed and bank, sorting, wracking, disturbance of leaf litter, scour, and changes in the character of the soil were observed within the channel.<br><br>Based on the direct observations noted above, climatic conditions discussed in this form and within the administrative record, and documentation provided by CEC, USACE has determined utilizing a weight of evidence approach that the feature from the headwater to the downstream confluence with RR3 is a RPW feature which flows at least seasonally. Based on the information above we have determined that the resource meets the definition of “waters of the United States”. |

f. The territorial seas (a)(6): [N/A]

g. Adjacent wetlands (a)(7):

The feature or features listed in the below table meet the definition of "wetlands" per 33 C.F.R. 328.3 and 40 C.F.R.120.2 and were delineated using the 1987 Corps of Engineers Wetlands Delineation Manual and the appropriate supplement. The feature or features below have a continuous surface connection because they directly abut a jurisdictional water (they are not separated by uplands, a berm, dike or similar feature).

| Resource Name | Size | Rationale |
|---|---|---|
| Wetland K | 0.03 acres | This determination is supported by field verification ON September 3, 2025, that the wetland is adjacent and directly abutting STR-12A/WWC-12 (Relevant Reach).<br><br>See Section 7e of this MFR for documentation of the jurisdictional status of the adjacent water body. STR-12A/WWC-12/STR-12 (Relevant Reach).<br><br>Based on the information above we have determined that the resource meets the definition of "waters of the United States." |

8. NON-JURISDICTIONAL AQUATIC RESOURCES AND FEATURES

a. Describe aquatic resources and other features within the review area identified as "generally non-jurisdictional" in the preamble to the 1986 regulations (referred to as "preamble waters").[8] Include size of the aquatic resource or feature within the review area and describe how it was determined to be non-jurisdictional under the CWA as a preamble water.

| Resource Name | Size | Criteria | Rationale |
|---|---|---|---|
| WTL-G | 0.01 acre | Waterfilled depressions created in dry land incidental to construction activity and pits excavated in dry land for the purpose of | This determination is supported by field visit conducted September 3, 2025.<br><br>Based on review of onsite conditions (no inlet/outlet and topographic relief) and available soil data from the National Regulatory Viewer, it was determined that the depression wetland resulted from prior |

[8] 51 FR 41217, November 13, 1986.

| | | | |
|---|---|---|---|
| | | obtaining fill, sand, or grave | construction (roadway/clearing and grading) that occurring the vicinity of WTL-G.<br><br>Based on the information above, we have determined that this resource does not meet the definition of "waters of the United States." |

b. Describe aquatic resources and features within the review area identified as "generally not jurisdictional" in the *Rapanos* guidance. Include size of the aquatic resource or feature within the review area and describe how it was determined to be non-jurisdictional under the CWA based on the criteria listed in the guidance.

| Resource Name | Size | Criteria | Rationale |
|---|---|---|---|
| WWC-8 | 359 linear feet | Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) | During field visit on September 3, 2025, it was noted that the feature lacked bed and bank, and leaf litter was prevalent throughout the feature indicating infrequent and low volume flow. The erosional feature is present based on surrounding landform and topography.<br><br>Based on the information above, we have determined that this feature is considered "generally not jurisdictional" under the Rapanos guidance and therefore does not meet the definition of "waters of the United States." |
| WWC-9 | 728 linear feet | Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or | During field visit on September 3, 2025, it was noted that the feature lacked bed and bank, leaf litter was prevalent throughout the feature and sparse vegetation was noted within the feature. The noted observations indicate that the feature has infrequent and low volume flows. The erosional feature is present |

| | | | |
|---|---|---|---|
| | | short duration flow) | based on surrounding landform and topography.<br><br>Based on the information above, we have determined that this feature is considered “generally not jurisdictional” under the Rapanos guidance and therefore does not meet the definition of “waters of the United States.” |
| WWC-10 | 53 linear feet | Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) | During field visit on September 3, 2025, it was noted that the feature had a weak bed and bank presence, and sparse vegetation was noted within the feature. The noted observation indicates that the feature has infrequent and low volume flows. The erosional feature is present due to surround slopes and conveys little flow to WTL-J (Non-jurisdictional). There is no hydrologic connection beyond WTL-J.<br><br>Based on the information above, we have determined that this feature is considered “generally not jurisdictional” under the Rapanos guidance and therefore does not meet the definition of “waters of the United States.” |
| WWC-11 | 119 linear feet | Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) | During field visit on September 3, 2025, it was noted that the feature had a poorly defined bed and bank and presence of leaf litter throughout the feature. The noted observations indicate that the feature has infrequent and low volume flows. The erosional feature results from surrounding slopes and flows into RR5 (WWC-12/WTL-K/STR-12A/STR-12) |

| | | | |
|---|---|---|---|
| | | | (Jurisdictional Relevant Reach) noted in Section 7(e).<br><br>Based on the information above, we have determined that this feature is considered "generally not jurisdictional" under the Rapanos guidance and therefore does not meet the definition of "waters of the United States." |
| WWC-12A | 42 linear feet | Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) | During field visit on September 3, 2025, it was noted that the feature had a poorly defined bed and bank and presence of leaf litter throughout the feature. The noted observations indicate that the feature has infrequent and low volume flows. The erosional feature results from surrounding slopes and flows into RR5 (WWC-12/WTL-K/STR-12A/STR-12) (Jurisdictional Relevant Reach) noted in Section 7(e).<br><br>Based on the information above, we have determined that this feature is considered "generally not jurisdictional" under the Rapanos guidance and therefore does not meet the definition of "waters of the United States." |
| WWC-15 | 792 linear feet | Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) | During field visit on September 3, 2025, it was noted that the feature had a poorly defined bed and bank (missing in areas), and leaf litter was prevalent throughout the feature. The noted observations indicate that the feature has infrequent and low volume flows. The erosional feature is present based on surrounding slopes and connects to RR3 (STR-9A/WWC-14/STR-9B) noted in Section 8(f). |

| | | | |
|---|---|---|---|
| | | | Based on the information above, we have determined that this feature is considered "generally not jurisdictional" under the Rapanos guidance and therefore does not meet the definition of "waters of the United States." |
| WWC-18 | 384 linear feet | Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) | During field visit on September 3, 2025, it was noted that the feature lacked bed and bank, and leaf litter was prevalent throughout the feature indicating infrequent and low volume flow. The erosional feature is present based on surrounding landform and topography and is not connected to any other feature.<br><br>Based on the information above, we have determined that this feature is considered "generally not jurisdictional" under the Rapanos guidance and therefore does not meet the definition of "waters of the United States." |
| WWC-19 | 351 linear feet | Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) | During field visit on September 3, 2025, it was noted that the feature lacked bed and bank, and leaf litter was prevalent throughout the feature indicating infrequent and low volume flow. The erosional feature is present based on surrounding landform and topography and is not connected to any other feature.<br><br>Based on the information above, we have determined that this feature is considered "generally not jurisdictional" under the Rapanos guidance and therefore does not meet the definition of "waters of the United States." |

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|---|---|---|---|
| WWC-20 | 461 linear feet | Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) | During field visit on September 3, 2025, it was noted that the feature lacked bed and bank, and leaf litter was prevalent throughout the feature indicating infrequent and low volume flow. The erosional feature is present based on surrounding landform and topography and does not connect to any other features.<br><br>Based on the information above, we have determined that this feature is considered "generally not jurisdictional" under the Rapanos guidance and therefore does not meet the definition of "waters of the United States." |

c. Describe aquatic resources and features identified within the review area as waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA. Include the size of the waste treatment system within the review area and describe how it was determined to be a waste treatment system. [N/A.]

d. Describe aquatic resources and features within the review area determined to be prior converted cropland in accordance with the 1993 regulations (reference 2.b.). Include the size of the aquatic resource or feature within the review area and describe how it was determined to be prior converted cropland. [N/A.]

e. Describe aquatic resources (i.e. lakes and ponds) within the review area, which do not have a nexus to interstate or foreign commerce, and prior to the January 2001 Supreme Court decision in "*SWANCC*," would have been jurisdictional based solely on the "Migratory Bird Rule." Include the size of the aquatic resource or feature, and how it was determined to be an "isolated water" in accordance with *SWANCC*. [N/A.]

f. Describe aquatic resources and features within the review area that were determined to be non-jurisdictional because they do not meet one or more categories of waters of the United States under the pre-2015 regulatory regime consistent with the Supreme Court's decision in *Sackett* (e.g., tributaries that are

non-relatively permanent waters; non-tidal wetlands that do not have a continuous surface connection to a jurisdictional water).

Linear features:

The feature or features listed in the below table are natural, man-altered, or manmade water body that flow directly or indirectly into a traditional navigable water (TNW). The tributary or tributaries have been determined to not meet the relatively permanent standard. The tributary or tributaries generally flow only in response to precipitation. The OHWM (Ordinary High Water Mark) represents the lateral limits of jurisdiction per 33CFR328.4. The OHWM was determined using field indicators in RGL 05-05. The upstream and downstream limits of the tributary or tributaries are identified on the attached figure.

| Resource Name | Size (LF) | Rationale |
|---|---|---|
| Relevant Reach 3 (RR3) STR-9A/WWC-14/STR-9B | 4,080 LF Total (84LF/2,457LF/ 1,539LF) | The OHWM is present based on field documentation of:<br>• Bed and bank<br>• Clear, natural line impressed on the bank<br>• Changes in the character of soil<br>• Destruction of terrestrial vegetation<br>• Vegetation matted down, bent, or absent<br>• Leaf litter disturbed or washed away<br><br>The tributary has been determined to be a non-relatively permanent water, because the majority of its length 60% does not flow at least seasonally. Flow appears to go subsurface were STR-9B transitions to WWC-14.<br><br>This feature is not relatively permanent based on field documentation noted below that represents 60% of the relevant reach.<br>• No evidence of base flow, subsurface flow, groundwater connection<br>• Fibrous roots in the channel<br>• Vegetation growing in the channel<br>• Undisturbed leaf litter<br><br>Consultant Site Visit Date: February 24, 2025<br>Active Flow Observed: No flow noted in WWC-14 |

| | | |
|---|---|---|
| | | APT Data: Wet Season, Normal Conditions, Mild Drought Conditions<br><br>Corps Site Visit Date: September 3, 2025<br>Base Flow Observed: No flow observed in WWC-14<br>APT Data: Dry Season, Normal Conditions, Normal Drought Conditions<br><br>100% of this tributary feature is within the review area.<br><br>Additionally, USACE utilized Tennessee Department of Environment and Conservation's (TDEC) Hydrologic Determination Field Data Sheet, Version 1.5, for the WWC-14 portion of the reach and it scored 18. The feature did not have any primary indicators, and the score was heavily based on geomorphology scores. |

Non-linear features:

The feature or features listed in the below table meet the definition of "wetlands" per 33 C.F.R. 328.3 and 40 C.F.R. 120.2 and were delineated using the 1987 Corps of Engineers Wetlands Delineation Manual and the appropriate supplement. The feature or features below do not have a continuous surface connection because they do not directly abut a jurisdictional water (they are separated by uplands, a berm, dike or similar feature).

| Resource Name | Size | Rationale |
|---|---|---|
| WTL-J | 0.32 acres | This determination is supported by field verification that the wetland is not adjacent to a jurisdictional water. During site USACE site visit conducted on September 3, 2025, it was noted that the wetland is geographically isolated from the nearest jurisdictional water (STR-9) by uplands.<br><br>Based on the information above we have determined that the subject resource does not meet the definition of "waters of the United States." |

9. DATA SOURCES. List sources of data/information used in making determination. Include titles and dates of sources used and ensure that information referenced is available in the administrative record.

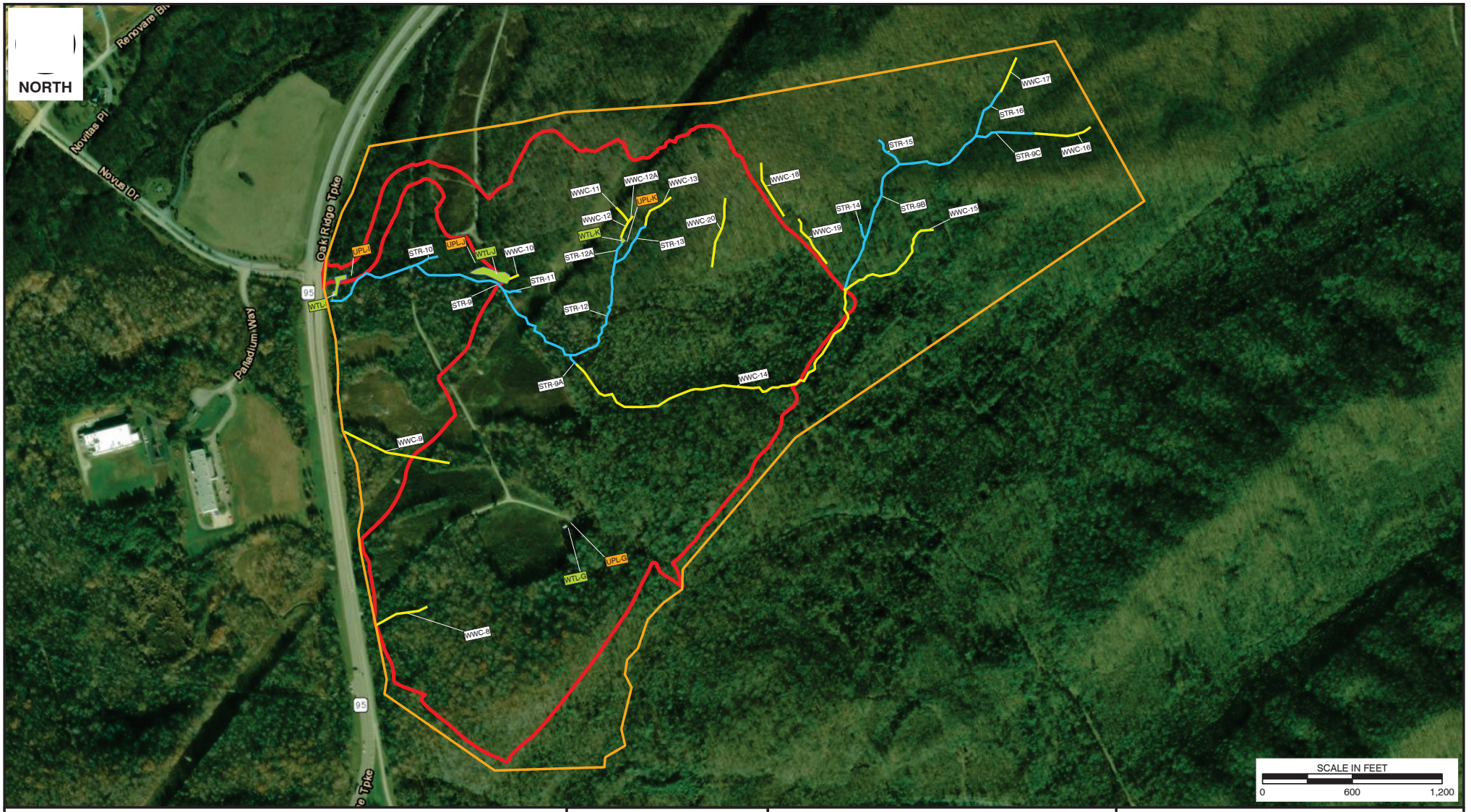
   a. [USACE site visits conducted September 3, 2025, and September 26, 2025.]

   b. [USACE Antecedent Precipitation Tool Version 3.0 accessed November 17, 2025.]

   c. [National Regulatory Viewer accessed on November 20, 2025.]

10. OTHER SUPPORTING INFORMATION. [TDEC Hydrologic Determination dated October 14, 2025.]

11. NOTE: The structure and format of this MFR were developed in coordination with the EPA and Department of the Army. The MFR's structure and format may be subject to future modification or may be rescinded as needed to implement additional guidance from the agencies; however, the approved jurisdictional determination described herein is a final agency action.




**LEGEND**

- WETLANDS
- LIMITS OF DISTURBANCE
- INTERMITTENT/PERENNIAL STREAM; RELATIVELY PERMANENT WATER
- WET WEATHER CONVEYANCE; NON-RELATIVELY PERMANENT WATER
- JURISDICTIONAL ASSESSMENT AREA

ENGINEERING, SURVEYING AND LANDSCAPE ARCHITECTURE IN THE STATE OF NORTH CAROLINA WILL BE PROVIDED BY CEC SURVEYING AND LANDSCAPE ARCHITECTS OF NC, PLLC. SERVICES IN PUERTO RICO WILL BE PROVIDED BY CEC ENGINEERS & CONSULTANTS, LLC. LANDSCAPE ARCHITECTURE SERVICES IN THE STATE OF OHIO WILL BE PROVIDED BY CEC LANDSCAPE ARCHITECTS, LLC.

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# LIMITS OF DISTURBANCE
# ORANO - OAK RIDGE SITE
# OAK RIDGE, ROANE COUNTY, TENNESSEE

## POST VERIFICATION MAP

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DRAWN BY: | JPR | CHECKED BY: | | APPROVED BY: | | FIGURE NO: | 1 |
| DATE: | 11/4/2025 | SCALE: | 1" = 600' | PROJECT NO: | 355-723 | | |

*Hand Signature on file

P:\350-000\355-723\GIS\Maps\355-723_EC_01_Base_Map\355-723_EC_01_Base_Map.aprx [Fig5_JDWaters_PostVer.pdf] 11/3/2025 5:09 PM (jrowe)

## NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

| Applicant: Orano | File Number: LRN-2025-00585 | Date: November 21, 2025 |
|---|---|---|

| Attached is: | | See Section below |
|---|---|---|
| | INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission) | A |
| | PROFFERED PERMIT (Standard Permit or Letter of permission) | B |
| | PERMIT DENIAL WITHOUT PREJUDICE | C |
| | PERMIT DENIAL WITH PREJUDICE | D |
| x | APPROVED JURISDICTIONAL DETERMINATION | E |
| x | PRELIMINARY JURISDICTIONAL DETERMINATION | F |

**SECTION I**

The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at https://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/appeals/ or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C. PERMIT DENIAL WITHOUT PREJUDICE: Not appealable
You received a permit denial without prejudice because a required Federal, state, and/or local authorization and/or certification has been denied for activities which also require a Department of the Army permit before final action has been taken on the Army permit application. The permit denial without prejudice is not appealable. There is no prejudice to the right of the applicant to reinstate processing of the Army permit application if subsequent approval is received from the appropriate Federal, state, and/or local agency on a previously denied authorization and/or certification.

D: PERMIT DENIAL WITH PREJUDICE: You may appeal the permit denial
You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information for reconsideration

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice means that you accept the approved JD in its entirety and waive all rights to appeal the approved JD.

- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

- RECONSIDERATION: You may request that the district engineer reconsider the approved JD by submitting new information or data to the district engineer within 60 days of the date of this notice. The district will determine whether the information submitted qualifies as new information or data that justifies reconsideration of the approved JD. A reconsideration request does not initiate the appeal process. You may submit a request for appeal to the division engineer to preserve your appeal rights while the district is determining whether the submitted information qualifies for a reconsideration.

F: PRELIMINARY JURISDICTIONAL DETERMINATION: Not appealable
You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also, you may provide new information for further consideration by the Corps to reevaluate the JD.

**POINT OF CONTACT FOR QUESTIONS OR INFORMATION:**

| | |
|---|---|
| If you have questions regarding this decision you may contact:<br><br>Nashville District, U.S. Army Corps of Engineers<br>Regulatory Branch<br>ATTN: Cara Beverly<br>3701 Bell Road<br>Nashville, Tennessee, 37214<br>(865) 986-7296; cara.c.beverly@usace.army.mil | If you have questions regarding the appeal process, or to submit your request for appeal, you may contact:<br><br>Regulatory Appeal Review Officer<br>ATTN: Ms. Suzanne Chubb<br>Army Engineer Division<br>550 Main Street, Room 10-780<br>Cincinnati, OH 45202-3222<br>(513) 218-1243 |

**SECTION II – REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT**

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. Use additional pages as necessary. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15-day notice of any site investigation and will have the opportunity to participate in all site investigations.

| | |
|---|---|
| _____<br>Signature of appellant or agent. | Date: |
| Email address of appellant and/or agent: | Telephone number: |

**From:** Alexander, Steven
**To:** BREWER Damon (ORN-CORP)
**Subject:** RE: Comment #1 on the Draft Biological Assessment
**Date:** Tuesday, January 6, 2026 9:02:43 AM
**Attachments:** image008.png
image012.png
image013.png
image014.png
image015.png
image016.png
image017.png
image018.png
image020.png
image021.png

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Damon –

No. Just update your draft BA. The deed restrictions are only applicable on the SSP2 property excluding the Orano site.

Steven R. Alexander
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steven_alexander@fws.gov
www.fws.gov
https://www.fws.gov/office/tennessee-ecological-services
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---

**From:** BREWER Damon (ORANO) <damon.brewer@orano.group>
**Sent:** Tuesday, January 6, 2026 7:54 AM
**To:** Alexander, Steven <steven_alexander@fws.gov>
**Subject:** RE: Comment #1 on the Draft Biological Assessment

Steve,

Do I need to add that for your review?

For my clarification. The deed restrictions you spoke of were that no work could be done, the property would be transferred as is and nothing could be done without deed changes. The purpose of our BA and work with the DOE is to get these restrictions lifted.

**Damon Brewer**
Project Manager
**IKE Program**
Orano Enrichment USA

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Suite 1001
Bethesda, MD 20814
https://www.orano.group/usa/project-ike-enrichment





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**From:** Alexander, Steven <steven_alexander@fws.gov>
**Sent:** Tuesday, January 6, 2026 8:47 AM
**To:** BREWER Damon (ORN-CORP) <damon.brewer@orano.group>
**Subject:** Comment #1 on the Draft Biological Assessment

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Damon –

The draft BA can be revised to include: we concurred/completed with NLAA findings for the listed and proposed bat species on the section 7 consultation with DOE for the WWSY. On July 24, 2025, we also concurred with DOE's findings during the informal

consultation with DOE on the transfer of SSP2 – this resulted in deed restrictions on the proposed transfer to the ORIDB.

Steven R. Alexander
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**From:** BREWER Damon (ORANO) <damon.brewer@orano.group>
**Sent:** Tuesday, January 6, 2026 7:03 AM
**To:** Alexander, Steven <steven_alexander@fws.gov>
**Subject:** RE: [EXTERNAL] draft biological assessment

Steve,

Ok. I wasn't sure if anything was missing from the biological assessment. I thought we had to issue a draft for review and then a final. I will follow your lead. Let me know what days you have available for a meeting and we can schedule it.

Thanks

**Damon Brewer**
Project Manager
**IKE Program**
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**From:** Alexander, Steven <steven_alexander@fws.gov>
**Sent:** Monday, January 5, 2026 3:49 PM
**To:** BREWER Damon (ORN-CORP) <damon.brewer@orano.group>
**Cc:** Sykes, Robbie <robbie_sykes@fws.gov>
**Subject:** RE: [EXTERNAL] draft biological assessment

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Nothing for the time being. We'll have 135 days to finalize our Biological Opinion but I don't think it will take that long. I suggest we set up a meeting towards the end of January/early February to discuss progress.

Steve

Steven R. Alexander
Ecologist
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**From:** BREWER Damon (ORANO) <damon.brewer@orano.group>
**Sent:** Monday, January 5, 2026 2:33 PM
**To:** Alexander, Steven <steven_alexander@fws.gov>
**Subject:** RE: [EXTERNAL] draft biological assessment

Steve,

Good news, I think. What do we need to do next?

**Damon Brewer**
Project Manager
**IKE Program**
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**From:** Alexander, Steven <steven_alexander@fws.gov>
**Sent:** Monday, January 5, 2026 3:23 PM
**To:** BREWER Damon (ORN-CORP) <damon.brewer@orano.group>
**Subject:** RE: [EXTERNAL] draft biological assessment

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Hi Damon. Hope you had a nice Christmas and Happy New Years. I believe we've got everything we need to start the formal consultation. If you have any questions, let me know (and I'll do the same).

Steve

Steven R. Alexander
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https://www.fws.gov/office/tennessee-ecological-services
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**From:** BREWER Damon (ORANO) <damon.brewer@orano.group>
**Sent:** Thursday, December 18, 2025 7:07 AM
**To:** Alexander, Steven <steven_alexander@fws.gov>
**Subject:** FW: [EXTERNAL] draft biological assessment

Steven,

Try this.

**Damon Brewer**
Project Manager
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**From:** Patrick.Jacobs <Patrick.Jacobs@kiewit.com>
**Sent:** Wednesday, December 17, 2025 5:44 PM
**To:** BREWER Damon (ORN-CORP) <damon.brewer@orano.group>
**Cc:** Gregory.VanVolkenbur <Gregory.VanVolkenburg@kiewit.com>; Jason.Uhlenhake <Jason.Uhlenhake@kiewit.com>; Robert.Townsend1 <Robert.Townsend1@kiewit.com>
**Subject:** RE: [EXTERNAL] draft biological assessment

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Hi Damon

See if this works for them. It is the shapefile for the limits of disturbance.

Also,

CEC got the invertebrate samples back yesterday so we should a good functional score for all the streams out there very soon.

Thanks

**Patrick Jacobs, P.G.**
Environmental Engineer

**KIEWIT ENGINEERING GROUP INC.**
585 N Dairy Ashford, Suite 100, Houston, TX 77079
480-369-9202

kiewit.com

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---

**From:** Jason.Uhlenhake <Jason.Uhlenhake@kiewit.com>
**Sent:** Wednesday, December 17, 2025 7:51 AM
**To:** Robert.Townsend1 <Robert.Townsend1@kiewit.com>; Patrick.Jacobs <Patrick.Jacobs@kiewit.com>
**Subject:** Fw: [EXTERNAL] draft biological assessment

Robert,

Can you look into this please?

Thanks,
Jason

---

**From:** Gregory.VanVolkenbur <Gregory.VanVolkenburg@kiewit.com>
**Sent:** Tuesday, December 16, 2025 5:45:48 PM
**To:** Jason.Uhlenhake <Jason.Uhlenhake@kiewit.com>
**Cc:** Damon.Brewer-PTR <damon.brewer@orano.group>
**Subject:** Fw: [EXTERNAL] draft biological assessment

Hi Jason,

Good afternoon. Can you please look into this item?

Thanks,
Greg

Kiewit

**Greg Van Volkenburg**
Project Engineering Manager

**KIEWIT ENGINEERING GROUP INC.**
585 N. Dairy Ashford, Suite 100, Houston, TX 77079
(531) 241-1229 Direct
(832) 514-8760 Cell
kiewit.com

---

**From:** BREWER Damon (ORANO) <damon.brewer@orano.group>

**Sent:** Tuesday, December 16, 2025 7:11 AM
**To:** Gregory.VanVolkenbur <Gregory.VanVolkenburg@kiewit.com>
**Subject:** FW: [EXTERNAL] draft biological assessment

Greg,

Can you help me with the below concern?

**Damon Brewer**
Project Manager
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**From:** Alexander, Steven <steven_alexander@fws.gov>
**Sent:** Tuesday, December 2, 2025 11:37 AM
**To:** BREWER Damon (ORN-CORP) <damon.brewer@orano.group>
**Subject:** RE: [EXTERNAL] draft biological assessment

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Good Morning Damon. The coordinate system for the polygon and point .shp files are not correct. There are no data within the respective attribute tables.

Steve

Steven R. Alexander
Ecologist

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**From:** BREWER Damon (ORANO) <damon.brewer@orano.group>
**Sent:** Tuesday, November 25, 2025 2:04 PM
**To:** Alexander, Steven <steven_alexander@fws.gov>
**Subject:** RE: [EXTERNAL] draft biological assessment

Steven,

Does this work?

**Damon Brewer**
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**IKE Program**
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**From:** Alexander, Steven <steven_alexander@fws.gov>
**Sent:** Monday, November 24, 2025 12:05 PM
**To:** BREWER Damon (ORN-CORP) <damon.brewer@orano.group>
**Subject:** RE: [EXTERNAL] draft biological assessment

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Thanks Damon. I downloaded the file this morning. I was wondering whether you had geospatial data for the project footprint in a shapefile format (ArcGIS).

Steve

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---

**From:** BREWER Damon (ORANO) <damon.brewer@orano.group>
**Sent:** Monday, November 24, 2025 9:40 AM
**To:** Alexander, Steven <steven_alexander@fws.gov>; Elbert, Daniel C <daniel_elbert@fws.gov>

**Subject:** [EXTERNAL] draft biological assessment

**This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.**

Steven and Daniel,

The draft Biological Assessment is too large to email. Please find a link below for a shared drive. Let me know if you have trouble accessing it. Please provide feedback at your convenience

https://oranousa.ftptoday.com/share/_9ZQIjkjy9UauRTKE6oyPJZOJ4rXEj57l7AcMJJ165FZ

Thanks

**Damon Brewer**
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**IKE Program**
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# Chapter 2: Alternatives

**TABLE OF CONTENTS**


2.0 ALTERNATIVES ..... 2-1

2.1 DETAILED DESCRIPTION OF THE ALTERNATIVES ..... 2-1

2.1.1 No-Action Alternative ..... 2-1

2.1.2 Proposed Action ..... 2-2

2.1.3 Reasonable Alternatives ..... 2-11

2.1.4 Alternative Sites ..... 2-12

2.1.5 Alternative Technologies ..... 2-15

2.1.6 Radionuclides And Other Hazardous Materials ..... 2-16

2.1.7 Facility Support Systems ..... 2-16

2.2 ALTERNATIVES CONSIDERED BUT ELIMINATED ..... 2-16

2.2.1 Conclusions ..... 2-17

2.3 CUMULATIVE EFFECTS ..... 2-18

2.4 COMPARISON OF THE PREDICTED ENVIRONMENTAL IMPACT ..... 2-18

## LIST OF TABLES

Table 2-1: Chemical Hazard Classification(1) ..... 2-8
Table 2-2: Seismological and Climatological Comparison of Potential Sites ..... 2-14
Table 2-3: Site Selection Criteria Comparison of Final Potential Sites ..... 2-16
Table 2-4 Impact Comparison of Proposed Action and Alternative Scenarios ..... 2-19

## LIST OF FIGURES

Figure 2-1 Overview Map of Within 50 Miles of the Proposed Action (Site) ..... 2-2
Figure 2-2 Map within 5 miles of the Site ..... 2-4
Figure 2-3 Layout of the Facility ..... 2-5

# 2.0 ALTERNATIVES

## 2.1 DETAILED DESCRIPTION OF THE ALTERNATIVES

### 2.1.1 No-Action Alternative

The no-action alternative for the Facility would be not to build the Facility. Under the no-action alternative, the NRC would not approve the license application to construct and operate the Facility. Accordingly, the Site currently owned by the U.S. Department of Energy (DOE) as part of the Oak Ridge National Laboratory (ORNL) would be free to continue the current uses of the property or pursue alternative uses of the property. In the absence of NRC approval of the Facility license, utility customers would be required to meet their uranium enrichment service needs through existing suppliers. In the United States, this would mean that the one operating commercial enrichment facility: the National Enrichment Facility operated by Urenco at Eunice, New Mexico would be the only domestic facility currently available to serve this purpose. The projected Nuclear Generating Capacity is anticipated to double by 2050 for North America, of which the U.S.A. accounts for 86.3%; whereas, the Annual Enrichment Forecast, is expected to be static or only have minor increases. This implies a significant enrichment services shortfall for the U.S. for the projected nuclear generating capacity. This shortfall would force enrichment services to be obtained from international markets and/or significantly curtail the nuclear generating capacity in the U.S.

Even with Urenco and potentially other domestic suppliers operating, it would not guarantee security of supply, particularly in view of forecasted installed nuclear generating capacity and uranium enrichment requirements.

Under the no-action alternative, a decision by the NRC not to approve the Facility license application would reduce the projected domestic enrichment capacity and therefore limit the diversity, security, and surety of the U.S. enrichment supply. This alternative, therefore, would not serve the recognized need of the U.S. government to promote energy and national security through the development of additional, secure, reliable, and economical domestic enrichment capacity; nor would it serve the need of utility customers to ensure Russian-free, secure and diverse supplies of enrichment services. Unlike larger incumbents with substantial U.S. operations, OE's participation would be additive and complementary to existing market activities, while replacing the Russian supply.

The no-action alternative will be detrimental for the US and state of Tennessee and the utility customers, thus having a negative socioeconomic impact overall. The remaining environmental impacts for the no-action alternative will have no impact.

## 2.1.2 Proposed Action

The proposed action is to construct and operate a uranium enrichment facility the that would possess byproduct material, source material and special nuclear material (SNM) authorized by an NRC Materials Licensed issued under 10 CFR 30, 10 CFR 40 and 10 CFR 70.

### 2.1.2.1 Site

The Site is situated in Roane County, Tennessee, on the southeastern side of the Oak Ridge Turnpike (State Route 95) located on Self-Sufficiency Parcel 2 (SSP-2) on the ORNL Reservation. The approximately 600 ac. site is currently owned by the DOE. The approximate center of the Facility is located at latitude 35 degrees, 57 minutes, 4 seconds North and longitude 84 degrees, 21 minutes, 26 seconds West (Figure 2-1).

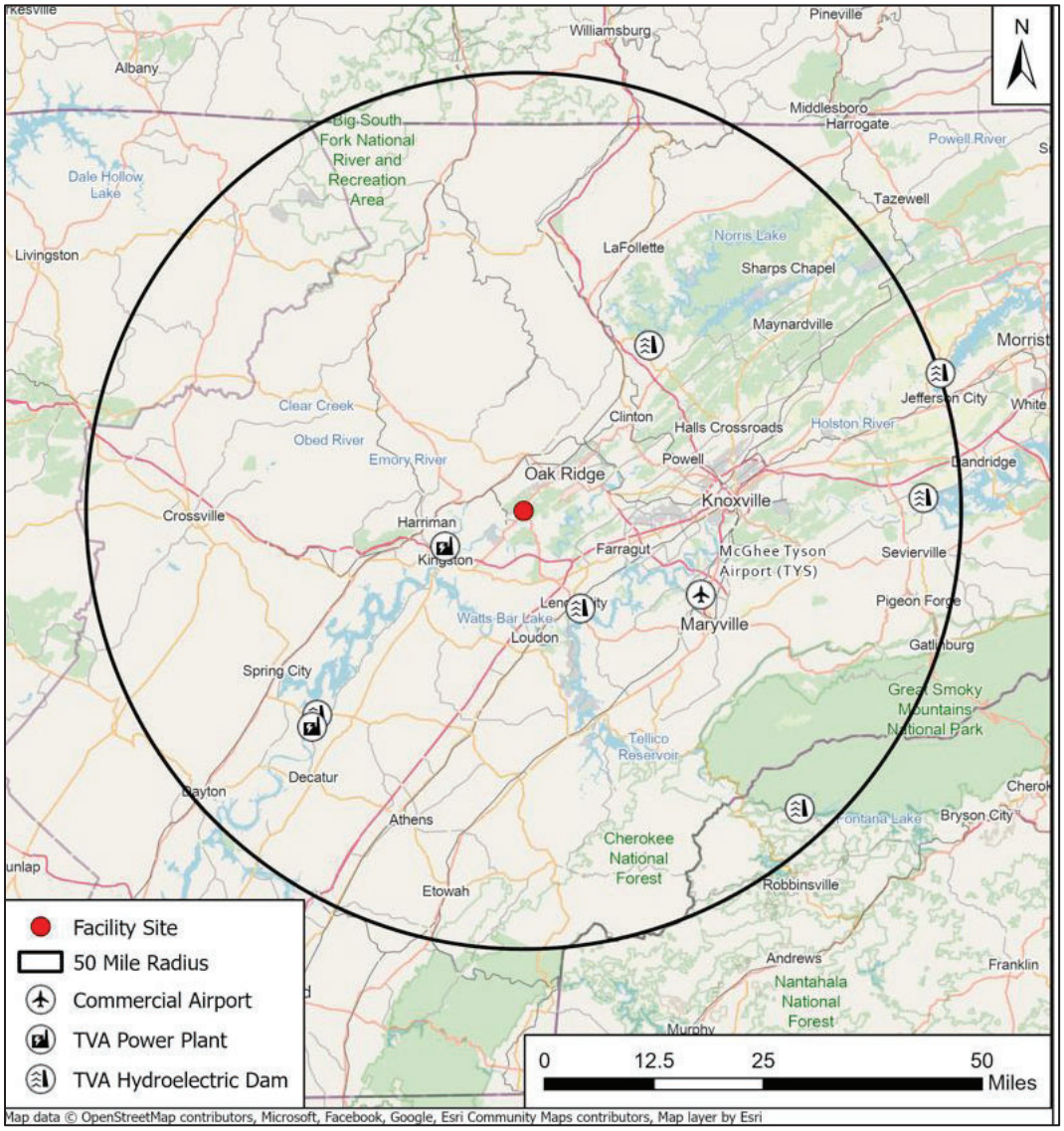



**Figure 2-1 Overview Map of Within 50 Miles of the Proposed Action (Site)**

There is one right-of-way or easement for Tennessee Valley Authority (TVA) utility lines traversing the northern portion of the property from southwest to northeast. Tennessee State Route 58 and

State Route 95 form the western and southern boundary of the site. Based on a detailed investigation of the site in 1993 (DOE 1993), Oak Ridge Reservation (ORR) Site 129 corresponds exactly with the center point of the Facility. This site is underlain by the East Fork (K–25 Site) section of the Chickamauga Group. Vegetation is old-field successional forest with a few large oaks. White pine is now invading and rapidly reproducing. There are a few holly trees, along with red maple and oak sprouts. Dirt roads provide site access from Tennessee State Routes 58 and 95, while other dirt roads provide access throughout the proposed site. The site is comprised of the Interior Low Plateaus province which is about 300 by 300 miles in size and covers most of central Tennessee and central Kentucky. Along its boundary with the Appalachian Plateau province (in Kentucky and Tennessee) is a west-facing escarpment that is composed of sandstones of early Pennsylvanian age.

The Interior Low Plateaus Province is underlain predominantly by Ordovician and Mississippian carbonate rocks onto which moderate karst (topography) is developed. Karst is created by large-scale dissolution of these carbonate rocks resulting in the formation of numerous large caverns. One example of the result of this process is Mammoth Cave, the largest documented cavern in the world, located within Mammoth Cave National Park in west-central Kentucky. The (ORR), which includes the Site, is located in the Valley and Ridge Physiographic Province, 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). Although major thrust faults are numerous in the vicinity of the study area, 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 1973, 139 earthquakes have been recorded within 62 miles of the site with the highest magnitude of 4.7 occurring on November 30, 1973, 0.62 miles northeast of Alcoa, Tennessee (USGS 2025a) (USGS 2025b), which is 24.6 miles southeast from the Facility.

The nearest offsite agricultural farm is approximately 3.9 mi to the south-southwest of the site. The nearest feedlot and dairy operations are about 18.4 mi south-southwest of the site. Self-Sufficiency Parcel 2 (SSP-2) is part of the Oak Ridge National Laboratory (ORNL) Reservation. A portion of Self-Sufficiency Parcel 2 (SSP-2a) has been consigned to NNSA in support of the Oak Ridge Enhanced Technology and Training Center (ORETTC) and the Enhanced Emergency Response Facility (EERF). These two facilities are located approximately 0.8 mi north of the Facility. The ORNL Carbon Fiber Technology Center is located approximately 0.5 mi west of the Facility. NAC Philotechnics is located approximately 0.9 mi northwest of the Facility and X-Energy's TRISO-X facility will be located approximately 1.0 mi northwest of the Facility. Clinch River nuclear SMR owned by TVA is located approximately 4.6 mi southeast of the Site.

The city of Oak Ridge (incorporated in 1959) is located approximately 6.4 mi northeast of the Site (Figure 2-2). The nearest residence is 1.2 mi northeast of the Site. Public use areas include a hiking trail north and west of the proposed site referred to as North Boundary Greenway. Figure 2-3 shows the site property boundary and the general layout of the buildings on the Facility site. Refer to Figure 2-2 for the location of highways relative to the site.

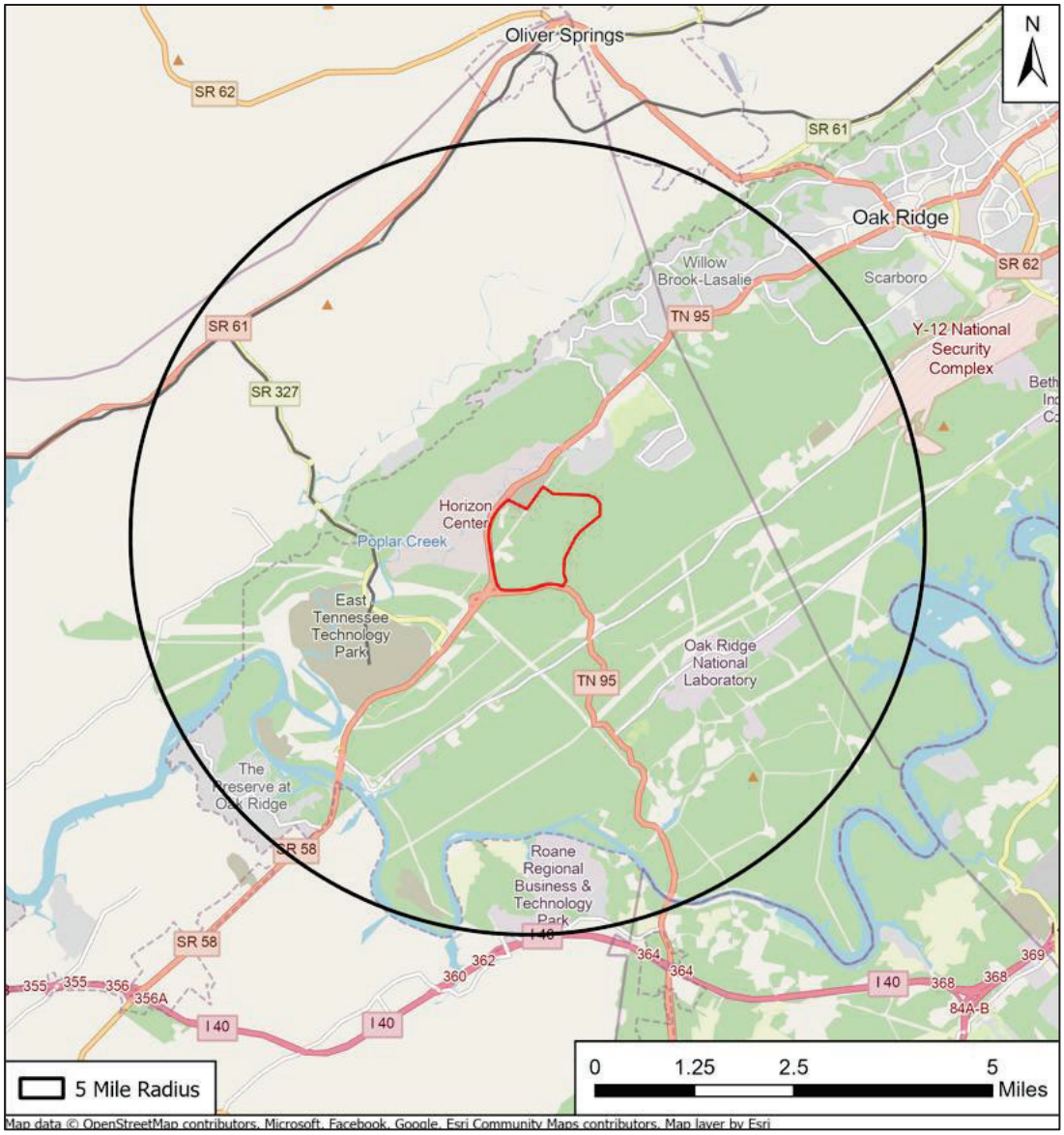



**Figure 2-2 Map within 5 miles of the Site**

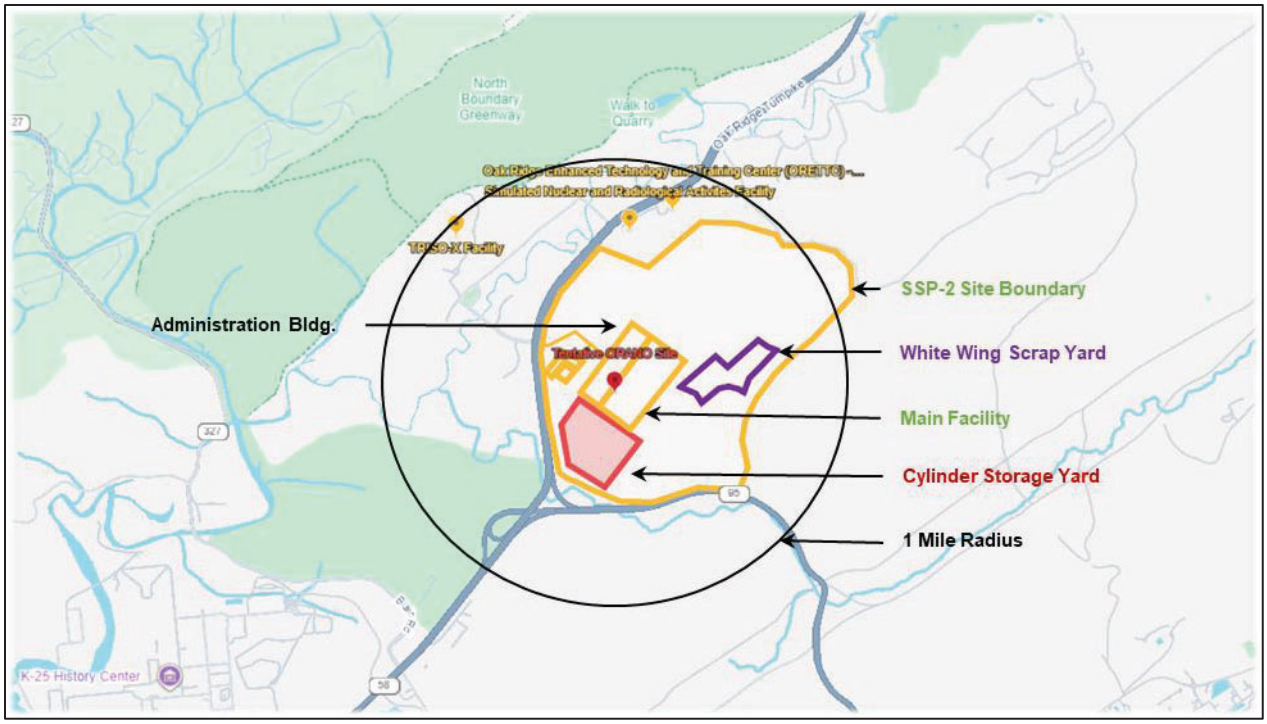



**Figure 2-3 Layout of the Facility**

### 2.1.2.2 Facility

The Facility is designed to separate a feed stream containing the naturally occurring proportions of uranium isotopes into a product stream consisting of enriched $^{235}U$ and a uranium stream depleted of the $^{235}U$ isotope. The following is a summary description of the Facility process, buildings and related operation. The Facility Integrated Safety Analysis Summary (ISAS) contains a detailed description of Facility characteristics, including design and operating parameters.

The feed material for the enrichment process is uranium hexafluoride ($UF_6$), with a natural composition of isotopes $^{234}U$, $^{235}U$, and $^{238}U$. The enrichment process involves the mechanical separation of isotopes using a fast-rotating cylinder (centrifuge) and is based on a difference in centrifugal forces due to differences in the molecular weight of the uranic isotopes. No chemical or nuclear reactions take place. The feed, product, and depleted uranium streams are all in the form of $UF_6$.

The $UF_6$ feed arrives from conversion facilities as a solid under partial vacuum in 48-in diameter transportation cylinders. Product material is collected in 30-in diameter containers and transported to a fuel fabricator. The depleted $UF_6$ material is collected in 48-in diameter containers and removed for temporary storage onsite.

The Facility design capacity is 7.4 million separative work units (MSWU) per year.

The principal Facility operational structures are shown in Figure 2-3 and might include the following:

- **Separations Building Modules (SBMs)** – four buildings - that each contain two centrifuge cascade modules and a Process Service Corridor that connects the modules to $UF_6$ Annexes

- **$UF_6$ Annexes** (handling areas), where feed, product take-off, and tails take-off stations exist to feed the cascades and withdraw product and tails
- **Blending, Sampling, and Preparation Building (BSPB),** where liquid sampling, blending and transfer, cylinder defrost, precise weighing, and cylinder inspection and preparation are performed
- **Technical Support Building (TSB)** that provides radiological support areas for the Facility such as liquid effluents treatment, solid waste processing, decontamination, chemical analysis, and maintenance functions
- **Operation Support Building (OSB)** that features showers, changing areas, medical and security services, and a break area
- **Centrifuge Assembly Building (CAB)** where centrifuges are assembled and tested prior to their installation in the SBMs
- **Cylinder Receipt and Shipping Building (CRSB)** which centralizes the receipt and shipping of cylinders and other goods via overland trucks and cylinder flow to and from the Facility from the Cylinder Storage Pads
- **Feed Storage Pad** that is used store feed cylinders prior to their use in the Facility
- **Empty / Tails Cylinder Storage Pad** that is used to store empty and tails cylinders
- **Full Product Cylinder Storage Pad** that is used to pre-stage product cylinders prior to their shipment to customers
- **Electrical Services Buildings (ESBs)** – two buildings – which provide a range of power management, conversion, and backup diesel generation capabilities
- **Mechanical Services Buildings (MSBs)** – two buildings – which provide pumping, cooling, and process air capabilities
- **Administration Building** where most of the Facility's office space, conference rooms, dining, and administrative functions are performed. This building's security space serves as the single point of personnel entry to the Facility and performs site security functions
- **ISO Storage Pad** that supplements the CAB with secured parts storage
- **Guard House** that provides a vehicle entry point to the Facility for private vehicles and trucks
- **Gasoline and Diesel Fueling Station (GDFS)** provides a fuel stop for Facility vehicles.

The Facility itself occupies about 100 acres of the western side of the approximately 600-acre Site. A main access road provides access to the Facility from the Oak Ridge Turnpike immediately to the west.

#### 2.1.2.3 Operations on the Site

The Facility uses various operations and process systems to ensure safe and efficient operations. The principal process systems include:

- **Decontamination System** that is designed to remove radioactive contamination - in the form of uranium compounds from contaminated materials and equipment

- **Liquid Effluent Collection and Treatment System** that collects and treats potentially contaminated liquid effluents that are generated in a variety of operations and processes
- **Solid Waste Collection System** that collects solid waste and prepares it for offsite disposal
- **Gaseous Effluent Ventilation System** that operates in the MSBs, $UF_6$ Annexes, and BSPB/TSB to route and treat potentially contaminated gaseous streams that may require treatment before discharge to the atmosphere

#### 2.1.2.4 Radionuclides and Other Hazardous Materials

The Facility uses or produce various types and quantities of hazardous chemical materials. Table 2-1 lists the hazardous chemicals associated with the Facility operation and their associated hazards.

The Facility will monitor both non-radiological and radiological parameters. Descriptions of the monitoring stations and the parameters measured are described in other sections of this Environmental Report as follows:

- Meteorology (Section 3.6)
- Water Resources (Section 3.4)
- Radiological Effluents (Section 6.1)
- Physiochemical (Section 6.2)
- Ecological (Section 6.3)

#### 2.1.2.5 Facility Support Systems

The Oak Ridge municipal water services will provide water to the site. Electrical service to the site will be provided by TVA. The projected demand is approximately 40 MW. The Oak Ridge wastewater system will handle sanitary sewage treatment services for all onsite sanitary and noncontaminated liquid wastes.

Identified, onsite pipelines include 8 to 12 in diameter, underground steel water lines connected to Oak Ridge municipal water services. An above ground electrical line runs from a point near State Route 95 to the TVA Switchyard located on the west side of the site. There are no known existing onsite underground storage tanks or sewer systems. A large, high-tension power line currently bisects the Site beginning on SR-95 just north of the SR-58 and SR-95 intersection and running northeast to the southeast of the ORETTC facility. This power line will be moved to the west boundary of the Site and will conform to SR-95. TVA will perform an Environmental Assessment for the relocation of the power line. There are no gas lines on the site. The nearest gas pipelines are adjacent to State Route 95 near ORETTC and near ORNL Carbon Fiber Technology Center on the other side of State Route 95.

**Table 2-1: Chemical Hazard Classification[1]**

| Chemical / CAS No. | Formula | Phase(s)[2] | Radioactive | Toxic | Corrosive | Water Reactive | Flammable | Combustible | Oxidizer | Other | AEGL-3 / ERPG-3 / PAC-3 | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Uranium Hexafluoride[3] / 7783-81-5 | $UF_6$ | S/L/G | x | x | x | x | | | | | 36 mg/m$^3$ | |
| Uranic Compounds / 12134-48-4, 10049-14-6, 1344-59-8 | $UO_2F_2$, $UF_4$, $U_3O_8$, | S/L | x | x | x | x | | | | | Not Listed $UF_6$ Limit applies 36 mg/m$^3$ | $UF_6$ reaction byproducts, deposits & in solution |
| Hydrogen Fluoride / 7664-39-3 | HF | G | | x | x | x | | | | | 44 ppm or 36 mg/m$^3$ | $UF_6$ reaction byproduct, HF in contact with certain metals can release $H_2$ |
| Sodium Fluoride / 7681-49-4 | NaF | S | | | | | | | | x | 1100 mg/m$^3$ | granules |
| Aluminum Oxide (activated) / 1344–28-1 | $Al_2O_3$ | S | | | | | | | | x | 240 ppm or 1000 mg/m$^3$ | irritant, powder / granules |
| Carbon (activated) / 7440-44-0 | C | S | | | | x | x | x | | | 2000 mg/m$^3$ | powder / granules |
| Paper, Polymers / None | | S | | | | | | x | | | Not Listed | ventilation filter media, anti-contamination clothing, ion exchange resin, etc. |
| Potassium Hydroxide / 1310-58-3 | KOH | S | | x | x | x | | | | | 54 mg/m$^3$ | |
| Phosphate / 149340-16-1 | | S | | | | | | | | x | | surfactant, irritant, P-3 Plastoclin 4100 B |
| Scrap Metals | | S | x | | | | | | | | | contaminated scrap / parts |
| Citric Acid / 77-92-9 | $C_6H_8O_4$ | S/L | | | x | | | | | | Not Listed | crystals & solution (5-10%) LEL: 0.28 kg/m$^3$ |
| Sodium Hydroxide / 1310-73-2 | NaOH | S/L | | x | x | | | | | | 50 mg/m$^3$ | powder & solution (0.1N) |
| Hydrocarbon Oils / Greases | varies | S/L | | | | | | x | | | | |
| Hydrocarbon Sludges | varies | S/L | | | | | | x | | | | |
| Perfluoropolyether Fluids | varies | L | | | | | | | | x | | irritant, long chain perfluorocarbons |

| Chemical / CAS No. | Formula | Phase(s)[2] | Radioactive | Toxic | Corrosive | Water Reactive | Flammable | Combustible | Oxidizer | Other | AEGL-3 / ERPG-3 / PAC-3 | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Methylene Chloride / 75-09-2 | $CH_2Cl_2$ | L | | | | | | | | x | 6900 ppm or 23,967 mg/m$^3$ | health hazard, LEL: 12% |
| Polydimethylsiloxane / None | varies | L | | | | | x | x | | | Not Listed | DNFSB-TECH-33 - Red Oil Explosion |
| Hydrocarbon / Polar Solvents & Liquids | varies | L | | | | | x | | | | | gasoline, ethanol, acetone, toluene, petroleum ether, paint, cutting oils |
| Nitric Acid / 7697-37-2 | $HNO_3$ | L | | x | x | x | | | x | | 92 ppm or 237 mg/m$^3$ | (50-70%) weight concentration |
| Hydrofluoric Acid / 7664-39-3 | HF ($H_2O$) | L | | x | x | x | | | | | 44 ppm or 36 mg/m$^3$ | 38% weight concentration |
| Hydrogen Peroxide / 7722-84-1 | $H_2O_2$ | L | | x | x | | | x | x | | 100 ppm or 139 mg/m$^3$ | |
| Sulfuric Acid / 7664-93-9 | $H_2SO_4$ | L | | x | x | x | | | x | | 160 mg/m$^3$ | |
| Phosphoric Acid / 7664-38-2 | $H_3PO_4$ | L | | x | x | | | x | | | 150 mg/m$^3$ | (10-25%) weight concentration, Corrosives in contact with metals may evolve flammable hydrogen gas |
| Diesel Fuel / 68334-30-5, 68476-30-2, 68476-31-3, 68476-34-6, 77650-28-3 | varies | L | | | | | x | x | | | 6000 mg/m$^3$ | generator / vehicle fuel |
| Deionized Water / 7732-18-5 | $H_2O$ | L | | | | | | | | | Not Listed | |
| Hydrofluorocarbons | varies | L/G | | | | | | | | x | | refrigerant, irritant |
| Nitrogen / 7727-37-9 | $N_2$ | L/G | | | | | | | | x | 869,000 ppm or 995,174 mg/m$^3$ | asphyxiant, test / purge gas |
| Propane / 74-98-6 | $C_3H_8$ | L/G | | | | | x | | | | 33,000 ppm or 59,508 mg/m$^3$ | test gas, LEL: 23,000 ppm |
| Hydrogen / 1333-74-0 | $H_2$ | G | | | | | x | | | | 400,000 ppm or 32,720 mg/m$^3$ | test gas, LEL: 40,000 ppm |

| Chemical / CAS No. | Formula | Phase(s)[2] | Radioactive | Toxic | Corrosive | Water Reactive | Flammable | Combustible | Oxidizer | Other | AEGL-3 / ERPG-3 / PAC-3 | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acetylene / 74-86-2 | $C_2H_2$ | G | | | | | x | | | | 400,000 ppm or 426,012 mg/m$^3$ | welding gas, LEL: 25,000 ppm |
| Oxygen / 7782-44-7 | $O_2$ | G | | | | | | | x | | Not Listed | test gas / welding gas |
| Argon / 7440-37-1 | Ar | G | | | | | | | | x | 400,000 ppm or 653,546 mg/m$^3$ | asphyxiant, test / welding gas |
| Helium / 7440-59-7 | He | G | | | | | | | | x | 400,000 ppm or 65,482 mg/m$^3$ | asphyxiant, test gas |

**Notes**:
1. Hazardous material classifications per the International Fire Code (IFC). Radioactive classification has also been included although not identified as a specific IFC classification.
2. Lists the phases applicable based on facility use of chemical; S – solid, L – liquid, G – gas/vapor.
3. Solid $UF_6$ cylinders also have ullage space containing vapor $UF_6$ and traces of HF, air, non-condensables and U non-volatiles (<1% total weight)
4. Polydimethylsiloxane in the presence of nitric acid can lead to a Red Oil Explosion. Refer to DNFSB-TECH-33

## 2.1.3 Reasonable Alternatives

### 2.1.3.1 Process Used to Formulate Alternatives

#### 2.1.3.1.1 Proposed Action Objectives

OE established three site selection objectives to reflect the diverse requirements that the enrichment facility needed to meet. The three objectives were related to technical, environmental, and operational requirements of the project.

- Technical requirement objective reflects the need of the site and area to be seismically and structurally stable, have sufficient area for safety, have adequate electricity and water supply, an adequate workforce, and have a straight-forward mechanism for land transfer.
- Environmental objective reflects the need to have an environmentally acceptable site that avoids large environmental impacts. This objective also reflects adjacent land use compatibility and the quality of services and community infrastructure.
- Operational objective includes low-level radioactive waste disposal options, transportation capabilities, business environment, and support from the public.

#### 2.1.3.1.2 Site Evaluation Criteria

A set of site criteria were established to identify alternative sites for the enrichment facility.

The four criteria used to identify regions of the U.S. that may be suitable for an enrichment facility were:

1) peak ground acceleration,
2) tornado frequency,
3) hurricane frequency, and
4) severe winter weather.

Three regions of the contiguous U.S. were identified as having suitable characteristics for an enrichment facility and included portions of the mid-Atlantic states, portions of the southwest, and portions of the inter-mountain west. Areas to be avoided because of high PGA included the west coast, major portions of the intermountain west, portions of the lower Midwest, portions of South Carolina and Tennessee, and portions of the Northeast. Areas to be avoided because of high tornado/wind risk included most of the central U.S., much of the Ohio Valley, portions of Pennsylvania, central and northern portions of the Gulf Coast states, and Georgia. Areas to be avoided because of the high incidence of hurricanes included portions of states along the Atlantic and Gulf coasts. Areas to be avoided because of a potential for heavy snow, ice conditions, and high winds included most states bordering Canada and portions of northern Great Plains states.

The alternatives included those that were practical or feasible from a technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of OE. Each alternative site identified by OE was evaluated using the following criterion:

1) Seismic History,
2) Geology,
3) Redundant Electrical Power Supply,

4) Flooding Potential,
5) Prior Land Contamination,
6) Availability of Existing Site Data,
7) Threatened and Endangered Species Near or On-Site,
8) Sensitive Properties (e.g., National Parks, Cemeteries, Archeological sites),
9) Climate and Meteorology, and
10) Wetlands within the Facility Footprint.

A team of technical specialists, project managers, and environmental specialists worked together to develop, review and assess each site. Technical staff and others participated in reiterative reviews to ensure that the approach was technically credible and defensible.

### 2.1.4 Alternative Sites

The selection the location identified sites that would meet technical specifications, business and sustainable development standards, safety requirements, and minimize damage to the biological and physical environment and protection of historic, cultural, and natural resources. The environmentally preferred alternative would not necessarily be the same as the proposed action or chosen alternative because of many factors, including cost/benefit analyses, mitigating factors, and legal considerations.

An initial review was done to identify regions that met fundamental operating requirements (i.e., transportation distances, power requirement availability, labor availability, economic aspects), geotechnical, and meteorological conditions to minimize the impacts of normal operational events as well as reasonably foreseeable accidents

Four criteria used to identify suitable alternative locations were: (1) peak ground acceleration, (2) tornado frequency and high winds, (3) hurricane frequency, and (4) severe weather (namely, ice, snow and rain) (Table 2-2).

Peak ground acceleration (PGA) was selected because of centrifuge sensitivity to vibrations. The ASCE Hazard Tool was utilized to obtain a rough estimate of the various criteria based on Risk Category IV and ASCE/SEI 7-22 (ASCE 2025): wind, ice, rain, tsunami, seismic, snow, flood, tornado. This tool gives a comparable estimate of construction loads for the various sites considered throughout the United States.

Tornado event frequency was selected because of its influence on design to meet safety requirements. Constructing the Facility in areas having a tornado design wind speed greater than 160 mph (probability of $10^{-5}$ $yr^{-1}$) was cost prohibitive to meet design standards and safety requirements. Again, the ASCE Hazard Tool was utilized to obtain a rough estimate of both tornado wind levels and general wind loading based on 3-second gust wind speeds at 33 ft above ground level.

Hurricane frequency was selected because of its influence on design to meet safety requirements and potential impact on maintaining operations during an event. Constructing the Facility in areas potentially affected by hurricanes with wind speeds no greater than 96 mi/hr was considered necessary to meet design standards, safety requirements, and operational requirements. Maps of the U.S. potentially affected by Category 1 through 5 hurricanes (Saffir-Simpson index) based on data from 1950 through 2024 were evaluated to identify regions with a high likelihood of impact (wind or flood damage).

Severe winter weather was selected because of potential impacts on construction loads and maintaining operations. Ice, snow and rain loads can have an impact on construction loads for the Facility and impact road closures which could impact on worker safety during commutes and the ability to maintain operations if workers or materials were not able to reach the Facility. The ASCE Hazard Tool was utilized to obtain a rough estimate of ice, snow and rain from a construction loading standpoint.

Discussions with local government officials and economic development organizations identified sites with favorable socioeconomic for consideration within the acceptable geographic regions.

Six reasonable alternative sites identified for the enrichment facility.

- Richland, Benton County, WA
- Hollywood, Jackson County, AL
- Piketon, Pike County, OH
- Wilmington, New Hanover County, NC
- Idaho Falls, Bonneville County, ID
- Oak Ridge, Roane County, TN

**Table 2-2: Seismological and Climatological Comparison of Potential Sites**

| Site | Earthquake ($PGA_M$) [1] | Wind (Vmph)[2] | Ice Thickness (in) | Snow ($lb/ft^2$) [3] | Rain (inch/hr)[4] | Flood | Tsunami | Tornado (mph)[5] |
|---|---|---|---|---|---|---|---|---|
| Richland, Benton County, WA | 0.24 | 111 | 0.92 | 30 | No data | Minimal | N/A | N/A |
| Hollywood, Jackson County, AL | 0.22 | 117 | 0.96 | 38 | 4.37 | [9] | N/A | 132 |
| Piketon, Pike County, OH | 0.11 | 119 | 1.50 | 41 | 3.53 | [6] | N/A | 110 |
| Wilmington, New Hanover County, NC | 0.11 | 156[7] | 0.60 | 40 | 5.63 | [9] | N/A | 118 |
| Idaho Falls, Bonneville County, ID | 0.15 | 116 | 0.25 | 85 | 1.51 | Minimal | N/A | N/A |
| Oak Ridge, Roane County, TN | 0.31 | 117 | 1.35 | 32 | 4.29 | [8, 10] | N/A | 124 |

(1) $PGA_M$ - mapped peak ground acceleration
(2) Mean Recurring Interval (MRI) - a statistical measure of how often a certain wind speed or load is expected to be exceeded. Wind value is a 3-second gust wind speed at 33 ft AGL.
(3) Snow Ground Load, ($p_g$)
(4) 60-minute precipitation intensity
(5) 3,000 MRI
(6) Area determined to be outside the 0.2% annual chance flood.
(7) Hurricane prone region
(8) Area of 0.2% annual chance flood
(9) The FEMA Flood Insurance Study provides questionable results, namely, the area surrounding the particular location used as the reference point was designed as a flood zone; however, the exact coordinates show no impact. The site is actually at the same elevation as the surrounding area, so it is questionable how the specific site is also not a flood zone.
(10) While this site is designated as "Area of 0.2% annual chance of flood", it is surrounded by the area designated as "Base Flood Elevation determined" - meaning the 1% annual chance of flood (100-year flood).

### 2.1.5 Alternative Technologies

Several enrichment processes have been demonstrated historically or in the laboratory, but only two, the gaseous diffusion process and the centrifuge process, have operated on a commercial scale. Gaseous centrifuge is the only enrichment process currently used in LEU Enrichment facilities, and therefore was chosen for use in the OE Facility.

In both gaseous diffusion and centrifuge processes, $UF_6$ gas is used as the feed material. Molecules of $UF_6$ with U-235 atoms are about one percent lighter than the rest, and this difference in mass is the basis of both processes. Current uranium enrichment primarily relies on gas centrifuge technology, while proposed advancements focus on laser-based methods, which promise greater efficiency and proliferation resistance.

#### 2.1.5.1 Current Uranium Enrichment Technologies

##### 2.1.5.1.1 Gas Centrifuge

Uranium hexafluoride ($UF_6$) gas is spun at high speeds in a centrifuge, separating lighter U-235 from heavier U-238 isotopes due to their slight mass difference.

Advantages: Highly efficient, lower energy consumption than older methods like gaseous diffusion.

Use: Widely adopted in countries like the U.S., Russia, and European nations.

##### 2.1.5.1.2 Gaseous Diffusion

$UF_6$ gas was forced through semi-permeable membranes; lighter U-235 passed through slightly faster.

Disadvantage: Extremely energy-intensive and now largely phased out.

Use: Widely used but now obsolete.

#### 2.1.5.2 Proposed and Emerging Technologies

##### 2.1.5.2.1 Laser Isotope Separation (LIS)

Uses finely tuned lasers to selectively excite and separate U-235 atoms based on their unique atomic or molecular properties.

Types:

AVLIS (Atomic Vapor Laser Isotope Separation)

MLIS (Molecular Laser Isotope Separation)

SILEX (Separation of Isotopes by Laser Excitation)

SILEX, developed by Silex Systems (Australia) and licensed to Global Laser Enrichment (GLE), is undergoing commercial demonstration in the U.S

Advantages:

Potentially more energy-efficient and compact than centrifuges.

Higher enrichment precision and scalability.

2.1.5.2.2 Plasma Separation and Electromagnetic Methods

Use electromagnetic fields or plasma to separate isotopes.

Challenges: High energy costs and technical complexity limit viability for large-scale use.

### 2.1.6 Radionuclides And Other Hazardous Materials

All alternatives to the proposed action for enrichment of uranium use $UF_6$ for feed material to produce enriched uranium products and depleted uranium tails. Other hazardous materials used or byproducts for operation of the alternatives have been identified for the proposed action.

### 2.1.7 Facility Support Systems

All alternatives to the proposed action for enrichment of uranium require a reliable electrical power supply and a water supply for cooling process equipment.

## 2.2 ALTERNATIVES CONSIDERED BUT ELIMINATED

The six reasonable sites were downselected in two rounds. Based on an initial screening, the North Carolina site was excluded due to the possibility of hurricanes. The Ohio and Alabama sites were excluded due to the possibility of high tornado/wind risk. The site in Washington state was eliminated primarily due to lack of government support.

The six sites were reduced to a final two, Bonneville County, ID and Roane County, TN, and a direct comparison of 17 criteria were considered to compare these two sites (see Table 2-3).

In Table 2-3, the 17 criteria represent relevant environmental and socio-economic factors that would contribute to the project delivery and operational success of the Facility. Weight was assessed based on the importance of the category for meeting this objective.

The Oak Ridge area offers several differentiating advantages including strategic location for economic performance, local government and public support, a highly skilled nuclear workforce, and a growing synergistic commercial nuclear sector in the immediate area. Based on its review, OE has identified the Roane County, Tennessee site, as the proposed site for the Facility. The site has sufficient acreage to support the Facility. Water and sewage facilities are supplied by the local municipality. Estimated costs for electric power, labor, and materials are among the lowest considered. In addition, Roane County and the State of Tennessee have shown strong support for the Facility.

**Table 2-3: Site Selection Criteria Comparison of Final Potential Sites**

| Category | Weight | Bonneville, ID | | | Roane, TN | | |
|---|---|---|---|---|---|---|---|
| | | Score | Contribution | Description | Score | Contribution | Description |
| Topography | 100 | 2 | 2 | Favorable | 1 | 1 | Less Favorable |
| Ecology | 95 | 2 | 1.9 | Favorable | 1 | 0.95 | Less Favorable |
| Size | 100 | 3 | 3 | Significantly Favorable | 1 | 1 | Less Favorable |
| Surrounding Area | 100 | 3 | 3 | Significantly Favorable | 2 | 2 | Favorable |
| Floodplain | 70 | 4 | 2.8 | Excellent | 4 | 2.8 | Excellent |

| Category | Weight | Bonneville, ID | | | Roane, TN | | |
|---|---|---|---|---|---|---|---|
| | | Score | Contribution | Description | Score | Contribution | Description |
| Contamination in Area | 40 | 4 | 1.6 | Excellent | 1 | 0.4 | Less Favorable |
| Land Transfer | 100 | 4 | 4 | Excellent | 3 | 3 | Significantly Favorable |
| Distance to Nearest Resident | 70 | 3 | 2.1 | Significantly Favorable | 2 | 1.4 | Favorable |
| Regional Nuclear Investment | 100 | 1 | 1 | Less Favorable | 4 | 4 | Excellent |
| Trained Workforce | 65 | 1 | 0.65 | Less Favorable | 4 | 2.6 | Excellent |
| Public Support | 100 | 2 | 2 | Favorable | 4 | 4 | Excellent |
| State and Local Support | 100 | 3 | 3 | Significantly Favorable | 4 | 4 | Excellent |
| Overall Economics | 100 | 1 | 1 | Less Favorable | 4 | 4 | Excellent |
| Geography | 100 | 3 | 3 | Significantly Favorable | 4 | 4 | Excellent |
| Transportation | 35 | 1 | 0.35 | Less Favorable | 4 | 1.4 | Excellent |
| Waste Disposal Options | 15 | 1 | 0.15 | Less Favorable | 4 | 0.6 | Excellent |
| Power Availability | 60 | 0 | 0 | Not Favorable | 4 | 2.4 | Excellent |
| **Cumulative Score** | | **31.55** | | | **39.55** | | |

Notes:
Weight: Captures contribution of criteria to the overall scoring in percentage [0%-100%]
Score: 0-4 ranking with 0 being Not Favorable and 4 being Excellent
Contribution: Weighted scoring for each criteria (Weight x Score) [0-4]
Cumulative Score: Sum of the Contribution for all criteria [0-54]

### 2.2.1 Conclusions

Of the two sites considered in Roane County, TN: SSP-2 was selected for the Facility. SSP-2 resides on the Oak Ridge Reservation and therefore is currently owned by the Department of Energy. Portions of SSP−2 have streams and wetlands and some threatened or endangered species habitat. Portions of these areas will be impacted. A segment of the property, the White Wing Scrapyard, has some surface contamination and will remain DOE responsibility based on CERLA Regulations until it is remediated and suitable for transfer to OE. The remaining portion of the property still is of sufficient size to support the Facility. Review of seismic and meteorological conditions for this specific site shows that it is acceptable.

Power requirements can be met since the existing TVA 161 kV lines cross the northern perimeter of the property. Both state and local governments are highly supportive of the Facility. Because ORNL, Y-12, East Tennessee Technology Park, TVA and the University of Tennessee being in the area, there is broad regional support for the project and an ample supply of highly trained personnel to support Facility operations. The existing 161-kilovolt (kV) electrical transmission line on the site that is required to power the Facility will be relocated by TVA. TVA has jurisdiction over

transmission lines; therefore, the transmission line for the Facility is not considered part of the proposed action. However, construction and operation of this transmission line are considered in the cumulative effects.

Based on the comparison of the two sites, the Oak Ridge SSP-2 site was selected for the Facility. The largest contribution factors were as follows:

- The Oak Ridge SSP-2 site is strategically located in the southeastern United States greatly improving the economics of the investment
- The Oak Ridge area has a strong and growing commercial nuclear industry that will provide important synergy for Facility operations related to the commercial supply chain
- Oak Ridge has a well-trained multi-generational nuclear workforce experienced with nuclear operations and specifically with enrichment technology.
- State and local support for nuclear investment is very high and includes financial incentives that greatly increase the probability that the Facility will be a financial success

Power to the site is readily available with the TVA transmission lines already being on the property

## 2.3 CUMULATIVE EFFECTS

Cumulative effects are those cumulative impacts that result from the incremental impact of an action added to other past, present, and reasonably foreseeable future actions. In conducting this analysis, OE considered past, current, and potential future facilities and activities that could have some potential for cumulative impacts when combined with the proposed construction and operation of the Facility.

OE is aware of several other private development plans that would exist within 10 mi of the Facility, namely the Clinch River nuclear SMR, TRISO-X Fuel Fabrication Facility and the Hermes Demonstration Reactor Project. Additionally, TVA will perform a power line relocation within the site boundary that will be subject to a separate Environmental Assessment. OE is not aware of any other Federal or State development plans within the 10 mi radius of the Facility. Thus, the local cumulative effects are associated with the construction and operation of the Facility and the existing offsite development on surrounding properties.

Details of the cumulative effects are described in Chapter 4 and summarized in Chapter 8.

## 2.4 COMPARISON OF THE PREDICTED ENVIRONMENTAL IMPACT

Not building the Facility could have the following consequences:

- A uranium supply deficit for which other sources of supply must compensate.
- Expansion of other facilities resulting in a higher concentration of production in one location.
- Diminished long-term security and surety of supply for U.S. commercial nuclear power generating stations.
- Decreased competition potentially resulting in higher fuel costs for U.S. commercial nuclear generating stations.
- Diminish the objective of long-term security of supply.

**Table 2-4 Impact Comparison of Proposed Action and Alternative Scenarios**

| Environmental Category | Proposed Action Impacts [1] | | Alternative Scenarios Impacts | |
|---|---|---|---|---|
| | Unavoidable Adverse Environmental Impacts | Short-term and Long-term Impacts | Eagle Rock Enrichment Facility [2] | No-Action Alternative [3] |
| Land Use | SMALL | SMALL | SMALL | NO IMPACTS |
| Transportation | SMALL | SMALL | MODERATE | NO IMPACTS |
| Geology & Soils | SMALL | SMALL | SMALL | NO IMPACTS |
| Water Resources | SMALL | SMALL | SMALL | NO IMPACTS |
| Ecology | SMALL | SMALL | SMALL | NO IMPACTS |
| Air Quality | SMALL | SMALL | SMALL | NO IMPACTS |
| Noise | SMALL | SMALL | SMALL | NO IMPACTS |
| Historical & Cultural Resources | SMALL | SMALL | SMALL | NO IMPACTS |
| Visual/ Scenic Resources | SMALL | SMALL | SMALL | NO IMPACTS |
| Socioeconomics | POSITIVE | POSITIVE | SMALL | NEGATIVE |
| Environmental Justice | NO IMPACTS | NO IMPACTS | SMALL | NO IMPACTS |
| Public & Occupational Health | SMALL | SMALL | SMALL | NO IMPACTS |
| Waste Management | SMALL | SMALL | SMALL | NO IMPACTS |

Notes:

[1] Summary of impacts for the Proposed Action in Oak Ridge, TN described in ER Chapter 8, Table 8-1.

[2] Source: (AES 2012)

[3] As stated in Section 2.1.1, the No-Action Alternative is for the Facility to not be built, therefore keeping the environment as is, without having the Positive socioeconomic impact as described in Section 4.10.

# Chapter 3: Affected Environment

## TABLE OF CONTENTS


**Page**

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT 3-1

3.1 LAND USE ....3-1

3.1.1 DESCRIPTION OF THE PROPOSED PROPERTY ....3-1

3.1.2 REGIONAL SETTING ....3-2

3.1.3 MAJOR POPULATION CENTERS AND INFRASTRUCTURE ....3-4

3.1.4 SPECIAL LAND USES ....3-6

3.1.5 AGRICULTURAL RESOURCES AND FACILITIES ....3-7

3.1.6 LAND USE PLANS ....3-9

3.1.7 ZONING ....3-10

3.2 TRANSPORTATION ....3-12

3.2.1 Transportation Access ....3-12

3.2.2 Land Use Transportation Restrictions ....3-13

3.2.3 Transportation Routes ....3-13

3.3 GEOLOGY AND SOILS ....3-13

3.3.1 Seismic Hazard Assessment ....3-15

3.3.2 Regional Non-Seismic Geologic Hazards ....3-17

3.3.3 Geology at the Site ....3-18

3.3.4 Mineral Resources ....3-38

3.3.5 Non-Fuel Mineral Production ....3-38

3.3.6 Coal, Oil, and Gas ....3-39

3.3.7 Geotechnical Evaluation ....3-39

3.3.8 Environmental Investigations at the Site and vicinity ....3-44

3.4 Water Resources ....3-44

3.4.2 Surface Water Hydrology ....3-52

3.5 ECOLOGICAL RESOURCES ....3-64

3.5.1 BIOTIC COMMUNITIES ....3-67

3.5.2 Terrestrial Resources ....3-68

3.5.3 Aquatic Resources ....3-72

3.5.4 Rare, Threatened, and Endangered Species ....3-80

3.6 METEOROLOGY, CLIMATOLOGY, AND AIR QUALITY....3-90
3.6.1 METEOROLOGY AND CLIMATOLOGY....3-95
3.6.2 BASELINE AIR QUALITY....3-142
3.7 NOISE....3-151
3.7.1 EXTENT OF NOISE ANALYSIS....3-152
3.7.2 COMMUNITY DISTRIBUTION....3-152
3.7.3 CURRENT SOURCES AND LEVELS OF NOISE....3-153
3.7.4 TOPOGRAPHY AND LAND USE....3-157
3.7.5 METEOROLOGICAL CONDITIONS....3-158
3.7.6 SOUND LEVEL STANDARDS....3-158
3.8 HISTORIC AND CULTURAL RESOURCES....3-160
3.8.1 Defining The Area Of Potential Effects....3-160
3.8.2 EXISTING CONDITIONS....3-161
3.8.3 SURVEY METHODS....3-164
3.8.4 SURVEY FINDINGS....3-165
3.8.5 REGULATORY COORDINATION....3-167
3.9 VISUAL AND SCENIC RESOURCES....3-167
3.9.1 VIEWSHED BOUNDARIES....3-167
3.9.2 LANDSCAPE CHARACTERISTICS....3-168
3.9.3 LOCATION OF CONSTRUCTED FEATURES....3-169
3.9.4 SITE PHOTOGRAPHS....3-169
3.9.5 RESIDENTS AND VISITORS POTENTIALLY AFFECTED BY VISUAL IMPACTS.. 3-177
3.9.6 VISIBILITY FROM ACCESS ROADS....3-177
3.9.7 HIGH-QUALITY VIEW AREAS....3-177
3.9.8 APPLICABLE REGULATORY INFORMATION....3-178
3.9.9 COORDINATION WITH LOCAL PLANNERS....3-178
3.9.10 AESTHETIC AND SCENIC QUALITY RATING....3-178
3.10 SOCIOECONOMIC ENVIRONMENT....3-183
3.10.1 POPULATION CHARACTERISTICS....3-184
3.10.2 ECONOMIC CHARACTERISTICS....3-189
3.10.3 COMMUNITY CHARACTERISTICS....3-196
3.11 PUBLIC AND OCCUPATIONAL HEALTH....3-207

3.11.1 MAJOR SOURCES AND LEVELS OF BACKGROUND RADIATION.....3-207
3.11.2 CURRENT PROPOSED SITE RADIATION SOURCES.....3-212
3.11.3 MAJOR SOURCES AND LEVELS OF CHEMICAL EXPOSURE .....3-214
3.11.4 Chemical Exposure Limits .....3-215
3.11.5 HISTORICAL EXPOSURE TO RADIOACTIVE MATERIALS .....3-217
3.11.6 SUMMARY OF HEALTH EFFECTS.....3-218
3.11.7 Occupational injury .....3-219
3.12 WASTE MANAGEMENT .....3-219
3.12.1 GASEOUS WASTESTREAMS .....3-219
3.12.2 WASTEWATERS.....3-219
3.12.3 SOLID WASTES.....3-219

## LIST OF TABLES

Table 3-1: Regional Land Use ..... 3-3
Table 3-2: Prime Farmland in the Region ..... 3-8
Table 3-3: Average Annual Daily Traffic Counts (2020 – 2024) ..... 3-12
Table 3-4: OE Facility Boring Summary ..... 3-20
Table 3-5 White Wing Scrap Yard Well Summary ..... 3-50
Table 3-6 Side by Side comparison of USACE and TDEN Jurisdictional Wetlands in Affected area ..... 3-64
Table 3-7: Bats Identified from 2024 Survey and Listing Status ..... 3-85
Table 3-8: Federally Listed Species and Habitats within Site vicinity (USFWS 2025) ..... 3-88
Table 3-9 Consolidated Meteorology Variations Based on Diurnal Data Supporting the Facility 3-93
Table 3-10 Climate Normals (1991-2020) and Extremes (1948-2021) for Oak Ridge National Laboratory, Oak Ridge, Tennessee with 2021 ORNL Comparisons ..... 3-99
Table 3-11 Relative Humidity Summary for ORNL Tower “C” in % (1998-2013) ..... 3-101
Table 3-12 ORNL Tower "D" (1000 Area) 15-meter Relative Humidity (%) for 2015-2021 . 3-102
Table 3-13 ORNL Meteorological Towers Monthly Wind Averages ..... 3-124
Table 3-14 Average Monthly and Annual Mixing Depth in meters for ORNL Tower “C/D” for 2003-2012, 2013 to 2022 individually, and for the last 20 years ..... 3-127
Table 3-15 Average Annual Mixing Depth by hour of day in meters for ORNL Tower “C/D” for 1998-2012, 2013 to 2022 individually, and for the last 25 years ..... 3-128
Table 3-16 Tower D, 2014, 15 m AGL Frequency ..... 3-131
Table 3-17 Tower D, 2014, 60 m AGL Frequency ..... 3-131
Table 3-18 Tower D, 2015, 15 m AGL Frequency ..... 3-132
Table 3-19 Tower D, 2015, 60 m AGL Frequency ..... 3-132
Table 3-20 Tower D, 2016, 15 m AGL Frequency ..... 3-133
Table 3-21 Tower D, 2016, 60 m AGL Frequency ..... 3-133
Table 3-22 Tower D, 2017, 15 m AGL Frequency ..... 3-134
Table 3-23 Tower D, 2017, 60 m AGL Frequency ..... 3-134
Table 3-24 Tower D, 2018, 15 m AGL Frequency ..... 3-135
Table 3-25 Tower D, 2018, 60 m AGL Frequency ..... 3-135
Table 3-26 Tower D, 2019, 15 m AGL Frequency ..... 3-136
Table 3-27 Tower D, 2019, 60 m AGL Frequency ..... 3-136
Table 3-28 Tower D, 2020, 15 m AGL Frequency ..... 3-137
Table 3-29 Tower D, 2020, 60 m AGL Frequency ..... 3-137
Table 3-30 Tower D, 2021, 15 m AGL Frequency ..... 3-138
Table 3-31 Tower D, 2021, 60 m AGL Frequency ..... 3-138
Table 3-32 Tower D Annual Stability Class as Percentage ..... 3-139
Table 3-33 EPA Ambient Air Quality Standards for Criteria Pollutants (black text) TDEC Ambient Air Quality Standards for Criteria Pollutants (blue text) ..... 3-144
Table 3-34 Facility Criteria Air Pollutant Emissions in the Roane County and the Eight-County Region Surrounding the Oak Ridge Enrichment Facility Site (Based on 2022 Emissions) ... 3-149
Table 3-35 TRISO-X Ambient Noise Monitoring Results ..... 3-154
Table 3-36 Hermes Measured Ambient Noise Levels ..... 3-155
Table 3-37 U.S. Department of Housing Urban Development Land Use Compatibility Guidelines ..... 3-159
Table 3-38 Previously Recorded Archaeological Sites within 1 Mi of the Survey Area (CRA 2025) ..... 3-162
Table 3-39 – Scenic Quality Inventory Evaluation and Scoring for the Facility Site ..... 3-181
Table 3-40: Population in the Region of Influence (2000-2020) ..... 3-184

Table 3-41: Population Projection for the Region of Influence Through 2070 ..... 3-185
Table 3-42: Minority Populations in the Region of Influence in 2020 ..... 3-186
Table 3-43: Population Density for the Region of Influence in 2020 & 2070 ..... 3-188
Table 3-44: Labor Force and Employment Characteristics in the Region of Influence ..... 3-190
Table 3-45: Employment by Industry in the Region of Influence in 2023 ..... 3-191
Table 3-46: Largest Employers in the Region of Influence in 2023 ..... 3-192
Table 3-47: Income Data for Counties within the Region of Influence in 2023 ..... 3-193
Table 3-48: Property Tax Structure in Tennessee ..... 3-195
Table 3-49: Property Tax Rates (2013-2023) (in $ per $100 Assessed Value) ..... 3-195
Table 3-50: Housing Characteristics within the Region of Influence in 2023 ..... 3-197
Table 3-51: Value of Owner-Occupied Homes in the Region of Influence in 2023 ..... 3-198
Table 3-52: Education Facilities in the Region of Influence (2021-22 & 2023-24) ..... 3-200
Table 3-53: Enrollment by Level of School in Region of Influence in 2023 ..... 3-201
Table 3-54: Educational Attainment for the 25 or Older Population in 2023 ..... 3-203
Table 3-55: Licensed Health Care Facilities in the Region of Influence ..... 3-205
Table 3-56: Radiological Analyses of the Facility Site Soil ..... 3-209
Table 3-57: Summary of Background Radiation Exposure (mrem/yr) in Vicinity of the Facility ... 3-211
Table 3-58: Public and Occupational Radiation Exposure Limits ..... 3-213
Table 3-59 Health Effects of Soluble Uranium ..... 3-215
Table 3-60 Guideline for the Uranium exposure limits ..... 3-216
Table 3-61 Hydrogen Fluoride (HF) Regulations and Guidelines ..... 3-217
Table 3-62 GB2 Worker Accident with Lost Time (Orano 2023) ..... 3-219

## LIST OF FIGURES

Figure 3-1: Aerial View of the Facility Site Region ..... 3-1
Figure 3-2: The Site with the Facility General Layout ..... 3-2
Figure 3-3: Regional Land Uses Surrounding the Facility ..... 3-4
Figure 3-4: Major Population Centers near the Facility ..... 3-5
Figure 3-5: Population Centers within 5 Miles of the Facility ..... 3-6
Figure 3-6: Other Land Features Near the Site ..... 3-7
Figure 3-7: Prime Farmland in the Region ..... 3-9
Figure 3-8: City of Oak Ridge Zoning Map ..... 3-11
Figure 3-9: Geologic Map in the Vicinity of the Facility Site ( (DOE 2020a) ..... 3-16
Figure 3-10: 2018 Long-term National Seismic Hazard Map (USGS 2019) ..... 3-17
Figure 3-11: Boring Locations on OE Facility Layout ..... 3-19
Figure 3-12: Geologic Map of the Facility Site ..... 3-24
Figure 3-13: Regional Geologic Cross-Section (Hatcher 1992) ..... 3-25
Figure 3-14: Regional Geologic Map (Lemiszki, Peter J. 1994) ..... 3-26
Figure 3-15: Stratigraphic Column of the Kingston thrust sheet (Hatcher 1992) ..... 3-28
Figure 3-16: Geophysical Profile through boring A-04 (Kiewit 2025a) ..... 3-32
Figure 3-17: Geophysical Profile through boring B-07 (Kiewit 2025a) ..... 3-33
Figure 3-18: Interpreted Depth to Top of Rock (feet) (Kiewit 2025a) ..... 3-34
Figure 3-19: Interpreted Elevation of Top of Rock (feet AMSL) (Kiewit 2025a) ..... 3-35
Figure 3-20: NRCS Soil Map (CEC 2025) ..... 3-38
Figure 3-21 Topography within 2mi of Facility ..... 3-40
Figure 3-22: Groundwater Wells in the Vicinity of the Facility from TRISO-X ER Figure 3.4.1-2 (NRC 2022) ..... 3-46
Figure 3-23: Generalized Groundwater Flow in the Vicinity of the Facility (DOE 2025) ..... 3-48
Figure 3-24: Generalized Potentiometric Surface Beneath the White Wing Scrap Yard (DOE 2024b) ..... 3-49
Figure 3-25: Streams and Topography in the Vicinity of the site (NRC 2022) ..... 3-53
Figure 3-26: East Fork Poplar Creek Floodplain Map (NRC 2022) ..... 3-56
Figure 3-27: East Fork Poplar Creek Flood Elevations (NRC 2022) ..... 3-57
Figure 3-28 Facility Floodplain Hazard Map (FEMA 2007) ..... 3-58
Figure 3-29: USACE Jurisdiction Waters Delineation of Affected Area ..... 3-63
Figure 3-30 TDEC Jurisdictional Waters Determination of Affected Area (TDEC 2025) ..... 3-63
Figure 3-31: Topographic Map for the Site ..... 3-65
Figure 3-32: SSP-2 Borders ..... 3-66
Figure 3-33: Oak Ridge Reservation Area Natural Areas and SSP-2 and SPP-2A Sites ..... 3-69
Figure 3-34: Locations of Bear Creek and East Fork Poplar Creek on and Around the Site .. 3-73
Figure 3-35: Aquatic Resources on the Site ..... 3-74
Figure 3-36: Important Ecological Areas Within the Vicinity of HCS and the Site (NRC 2022).. 3-77
Figure 3-37: Aerial Photograph of the Site Circa 2022 ..... 3-83
Figure 3-38: Locations of Bat Acoustic Monitors Within and Adjacent to SSP-2 ..... 3-86
Figure 3-39 Location of the Facility and Oak Ridge National Laboratory Nearby Meteorological Monitoring Towers ..... 3-91
Figure 3-40 Location of the Facility and Nearby Airport ASOS Meteorological Monitoring Towers ..... 3-92
Figure 3-41 Monthly Temperature ..... 3-96
Figure 3-42 Monthly Relative Humidity (%) ..... 3-97
Figure 3-43 Monthly Precipitation (inches) ..... 3-98
Figure 3-44 Monthly Snowfall (inches) ..... 3-98

Figure 3-45 Monthly Wind Averages (mph) ..... 3-104
Figure 3-46 Tower A (10/15 m) 10-yr Wind Rose Data ..... 3-105
Figure 3-47 Tower A (30 m) 10-yr Wind Rose Data ..... 3-105
Figure 3-48 Tower B (15 m) 10-yr Wind Rose Data ..... 3-106
Figure 3-49 Tower B (30 m) 10-yr Wind Rose Data ..... 3-107
Figure 3-50 Tower C (10 m) 10-yr Wind Rose Data ..... 3-108
Figure 3-51 Tower C (30 m) 10-yr Wind Rose Data ..... 3-108
Figure 3-52 Tower C (100 m) 10-yr Wind Rose Data ..... 3-109
Figure 3-53 Tower D (15 m) 5-yr Wind Rose Data ..... 3-109
Figure 3-54 Tower D (35 m) 5-yr Wind Rose Data ..... 3-110
Figure 3-55 Tower D (60 m) 5-yr Wind Rose Data ..... 3-110
Figure 3-56 Tower F (10 m) 3.2-yr Wind Rose Data ..... 3-111
Figure 3-57 Tower K (10 m) 10-yr Wind Rose Data ..... 3-111
Figure 3-58 Tower K (60 m) 10-yr Wind Rose Data ..... 3-112
Figure 3-59 Tower L (10/15 m) 10-yr Wind Rose Data ..... 3-112
Figure 3-60 Tower L (30 m) 10-yr Wind Rose Data ..... 3-113
Figure 3-61 Tower M (10 m) 10-yr Wind Rose Data ..... 3-113
Figure 3-62 Tower W (10 m) 10-yr Wind Rose Data ..... 3-114
Figure 3-63 Tower W (30 m) 10-yr Wind Rose Data ..... 3-115
Figure 3-64 Tower W (60 m) 10-yr Wind Rose Data ..... 3-115
Figure 3-65 Tower S (25 m) 5-yr Wind Rose Data ..... 3-116
Figure 3-66 Tower Y (15 m) 10-yr Wind Rose Data ..... 3-116
Figure 3-67 Tower Y (33 m) 10-yr Wind Rose Data ..... 3-117
Figure 3-68 Oak Ridge Met (OQT), 10-yr Wind Rose Data ..... 3-117
Figure 3-69 Rockwood (KRKW), 6-yr Wind Rose Data ..... 3-118
Figure 3-70 Knoxville Municipal (KTYS), 10-yr Wind Rose Data ..... 3-118
Figure 3-71 Knoxville Downtown (KDKX), 10-yr Wind Rose Data ..... 3-119
Figure 3-72 Madisonville (Monroe County)(KMNV), 8-yr Wind Rose Data ..... 3-119
Figure 3-73 Jacksboro (Colonel Tommy G Stiner)(KJAU), 9-yr Wind Rose Data ..... 3-120
Figure 3-74 Oneida Scott (KSCX), 5-yr Wind Rose Data ..... 3-120
Figure 3-75 Athens (McMinn County)(KMMI), 10-yr Wind Rose Data ..... 3-121
Figure 3-76 Crossville Memorial (KCSV), 10-yr Wind Rose Data ..... 3-121
Figure 3-77 Dayton (Mark Anton) (2A0), 7-yr Wind Rose Data ..... 3-122
Figure 3-78 Sevierville (Gatlin-Pigeon Forge)(KGKT), 10-yr Wind Rose Data ..... 3-122
Figure 3-79 Cleveland (KRZR), 10-yr Wind Rose Data ..... 3-123
Figure 3-80 Morristown Moore-Murrell (KMOR), 10-yr Wind Rose Data ..... 3-123
Figure 3-81: Valley and mountain ranges surrounding Oak Ridge and the Oak Ridge Reservation (ORNL 2023) ..... 3-126
Figure 3-82 County Map of Interest ..... 3-140
Figure 3-83 Facility Boundary and ORETTC Location (DOE 2025) ..... 3-156
Figure 3-84 Previous Archaeological Surveys and Recorded Archaeological Sites within 1 mi of the Survey Area (CRA 2025) ..... 3-163
Figure 3-85*:* Survey Area on the Site ..... 3-164
Figure 3-86*:* Results from the Cultural Survey on the Site ..... 3-165
Figure 3-87: Details of the Site Findings on the Site ..... 3-166
Figure 3-88: Facility Site Vicinity Map ..... 3-168
Figure 3-89: Aerial View of SSP-2 with Image Locations ..... 3-169
Figure 3-90: Images A-I of the Site and SSP-2 ..... 3-170
Figure 3-91 – Population Centers within the Region of Influence ..... 3-183
Figure 3-92 – Minority Percentage by within 5 Miles of the Facility Site ..... 3-187

Figure 3-93 – Population Density by CBG within the Region of Influence..... 3-189
Figure 3-94 – Percent of Low-Income Population within 5 Miles of the Facility Site..... 3-194
Figure 3-95 - Community Facilities within 5 Miles of the Facility Site..... 3-202

# 3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

## 3.1 LAND USE

This section describes the land use of the Facility site and within a 5-mile radius of the Site. Figure 3-1 shows the Site in relation to regional lands. Major transportation corridors are identified in Section 3.2.

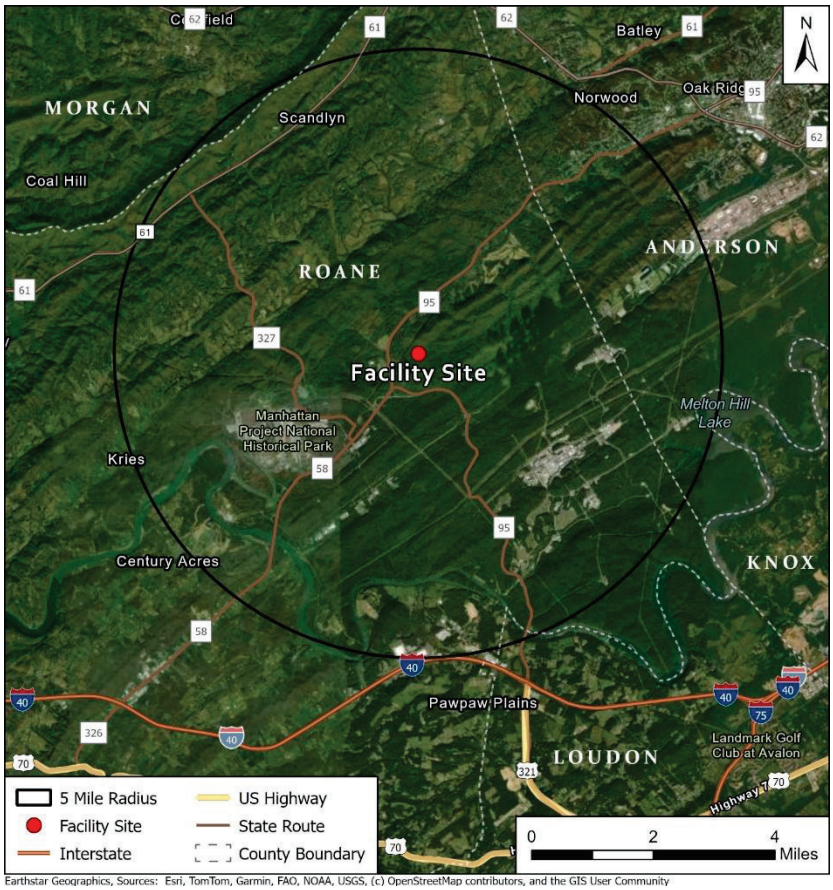



**Figure 3-1: Aerial View of the Facility Site Region**

### 3.1.1 DESCRIPTION OF THE PROPOSED PROPERTY

The Facility is in Oak Ridge, Tennessee within Roane County. The Site is a portion of the Self-Sufficiency Parcel 2 (SSP-2) and is a part of the Oak Ridge Reservation (ORR) that is owned by the U.S. Department of Energy (DOE). Figure 1-5 shows the portions of SSP-2 that will be transferred to OE prior to beginning construction efforts. The Site is currently undeveloped land. The Site is east of the Oak Ridge Turnpike and north of White Wing Road.

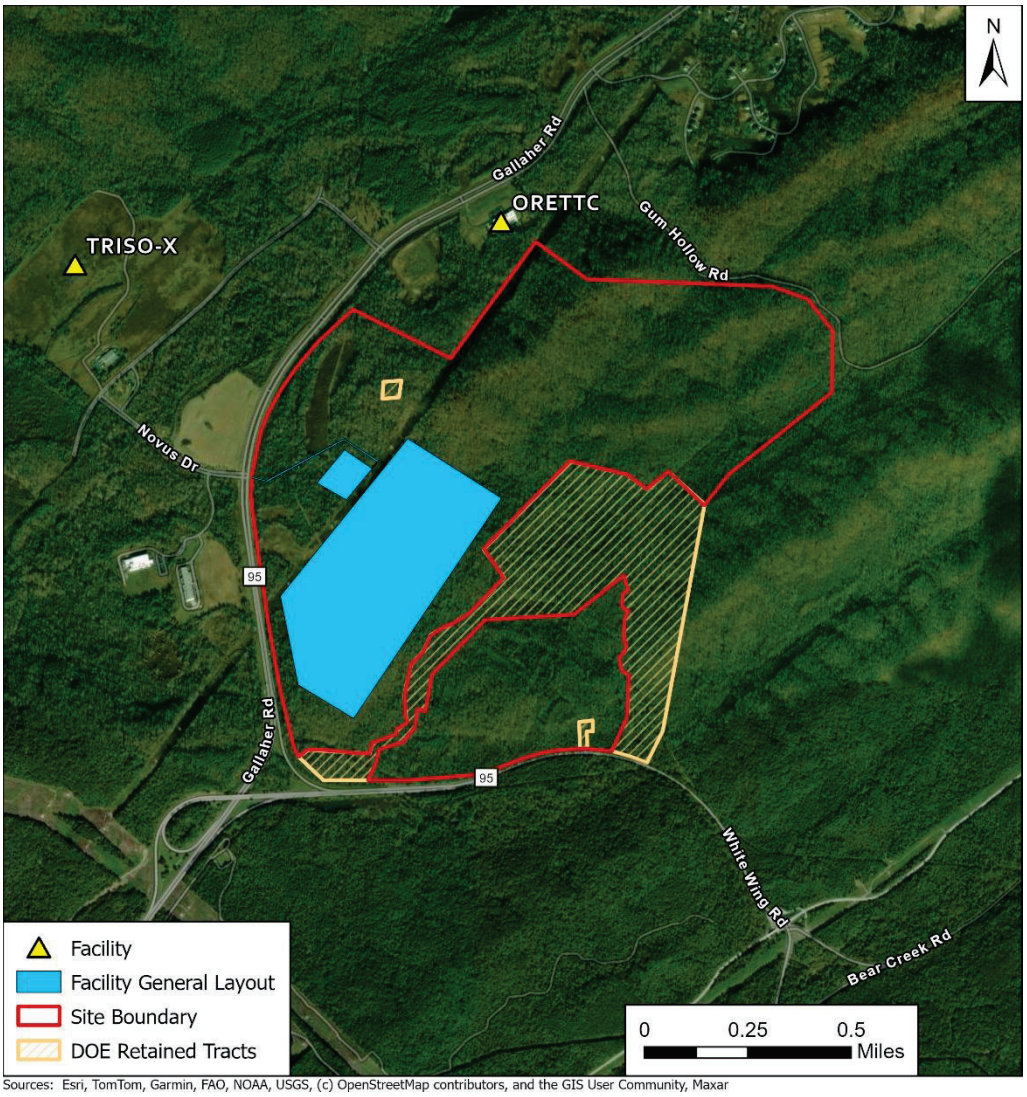



**Figure 3-2: The Site with the Facility General Layout**

### 3.1.2 REGIONAL SETTING

The region in which the Facility is located is defined as the area within 5 mi radius of the center point of the site. Most of the region is located in Roane County, Tennessee with small parts of the region including Anderson County, Loudon County, and Morgan County.

Major land uses are depicted in Figure 3-3 and in Table 3-1. The dominant land uses in the region are forest lands (37,242 ac., 64 percent), developed lands (9,767 ac., 17 percent), agriculture (7,347 ac., 13 percent), and waters or wetlands (2,674 ac., 5 percent).

**Table 3-1: Regional Land Use**

| NLCD Land Cover Class | Area (ac) | Area (%) |
|---|---|---|
| Deciduous Forest | 30,827 | 52.97 |
| Hay/ Pasture | 7,347 | 12.62 |
| Mixed Forest | 5,041 | 8.66 |
| Developed, Open Space | 3,899 | 6.70 |
| Developed, Low Intensity | 3,187 | 5.48 |
| Developed, Medium Intensity | 1,769 | 3.04 |
| Woody Wetlands | 1,621 | 2.78 |
| Evergreen Forest | 1,373 | 2.36 |
| Open Water | 1,013 | 1.74 |
| Developed, High Intensity | 913 | 1.57 |
| Shrub/ Scrub | 635 | 1.09 |
| Herbaceous | 465 | 0.80 |
| Barren Land | 66 | 0.11 |
| Emergent Herbaceous Wetlands | 40 | 0.07 |
| **Total** | **58,196** | **100.00** |

Source: **(USGS 2024)**

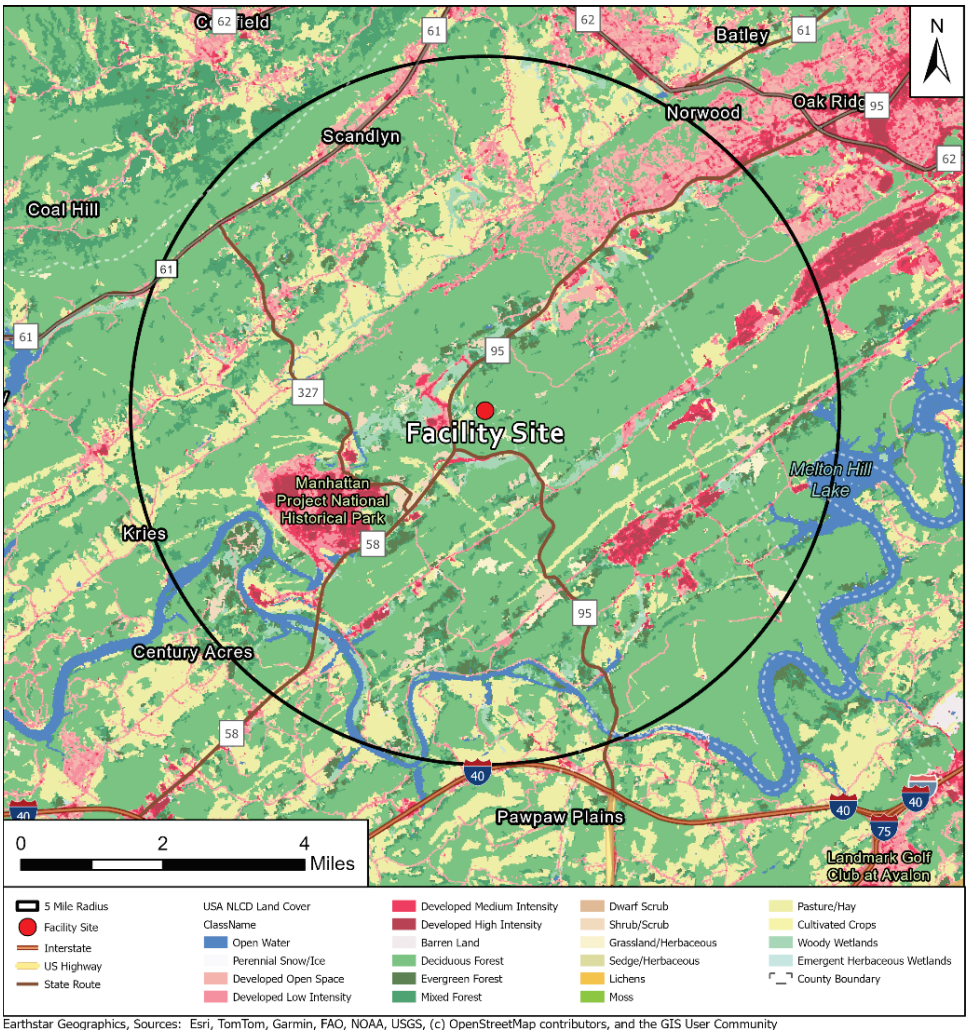



**Figure 3-3: Regional Land Uses Surrounding the Facility**

### 3.1.3 MAJOR POPULATION CENTERS AND INFRASTRUCTURE

The population centers located near the Facility are shown in Figure 3-4. The major population center in the region is the City of Oak Ridge, Tennessee with a population of 31,402 (USCB 2020a). Population centers within 5 miles of the Facility are shown in Figure 3-5. Section 3.10 provides an in-depth description of the demographic, economic, and community characteristics of the region of influence.

Existing infrastructure located near the Facility are also shown on Figure 3-5. Available utilities in the City of Oak Ridge include electric service, potable water, gas, sewer, garbage collection, telephone, cable, and internet service (City of Oak Ridge 2025a).

The major transportation corridors within the region are described in Section 3.2. Transportation infrastructure near the site includes Tennessee State Route 95 (Oak Ridge Turnpike), Interstate 75, Interstate 40, several Tennessee State highways, and local roads.

CSX Transportation Class I Railroad provides freight rail service in Anderson County. A CSX Operating Agreement extends service into Roane County, along State Route 61, with a mainline extension to the East Tennessee Technology Park, adjacent to State Route 327.

McGhee Tyson Airport is the primary airport in the region. It is located south-southwest of Knoxville, Tennessee. McGhee Tyson serves both public and military operations. The closest private airport is the Oliver Springs Airport (Figure 3-4).

The Clinch River flows in the region of the Facility, downstream of Melton Hill Dam. The Clinch River is a component of the navigable river channels on the Cumberland and Tennessee Rivers and is a part of the U.S. Inland Waterway System (USACE 2024).

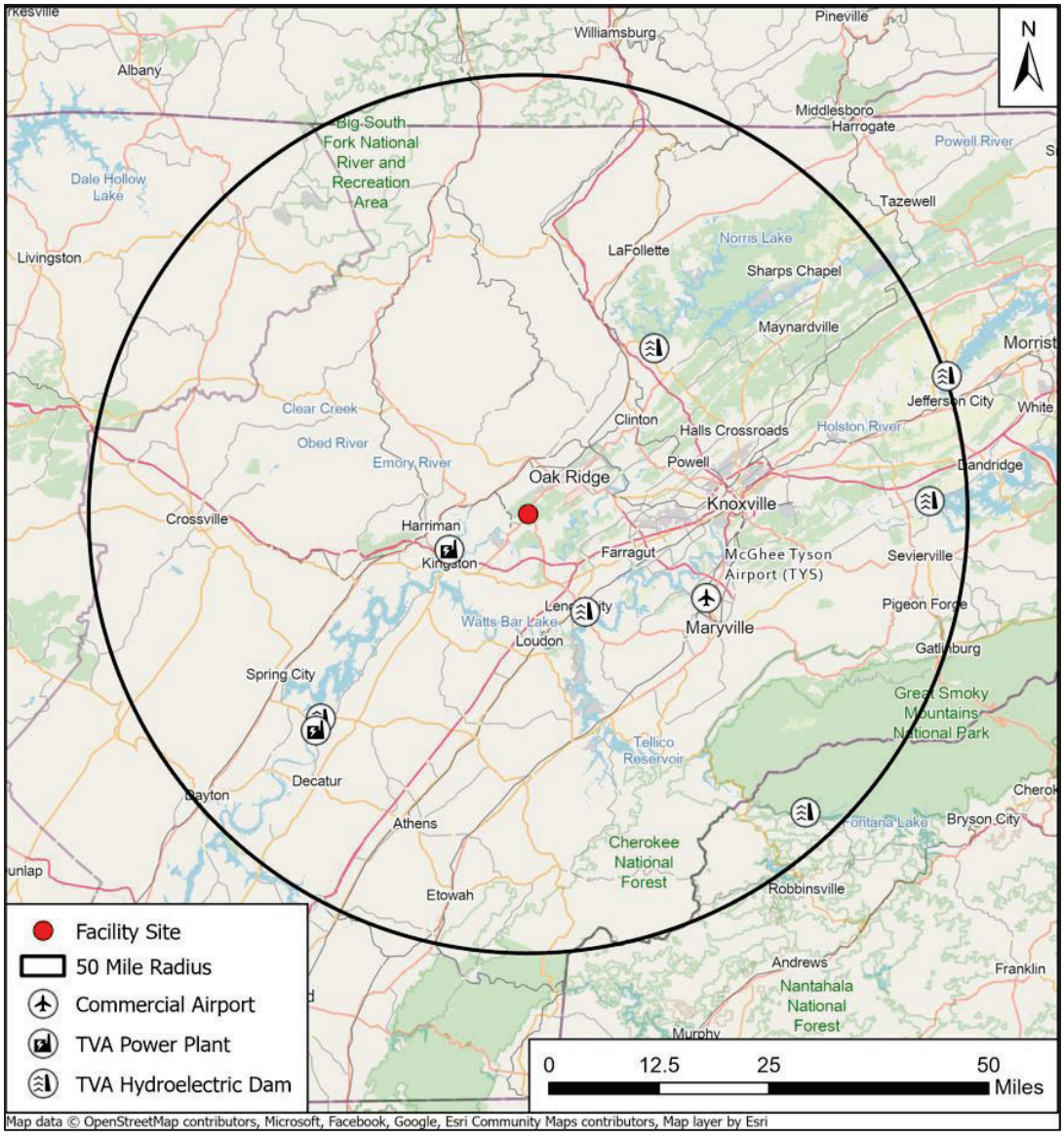



**Figure 3-4: Major Population Centers near the Facility**

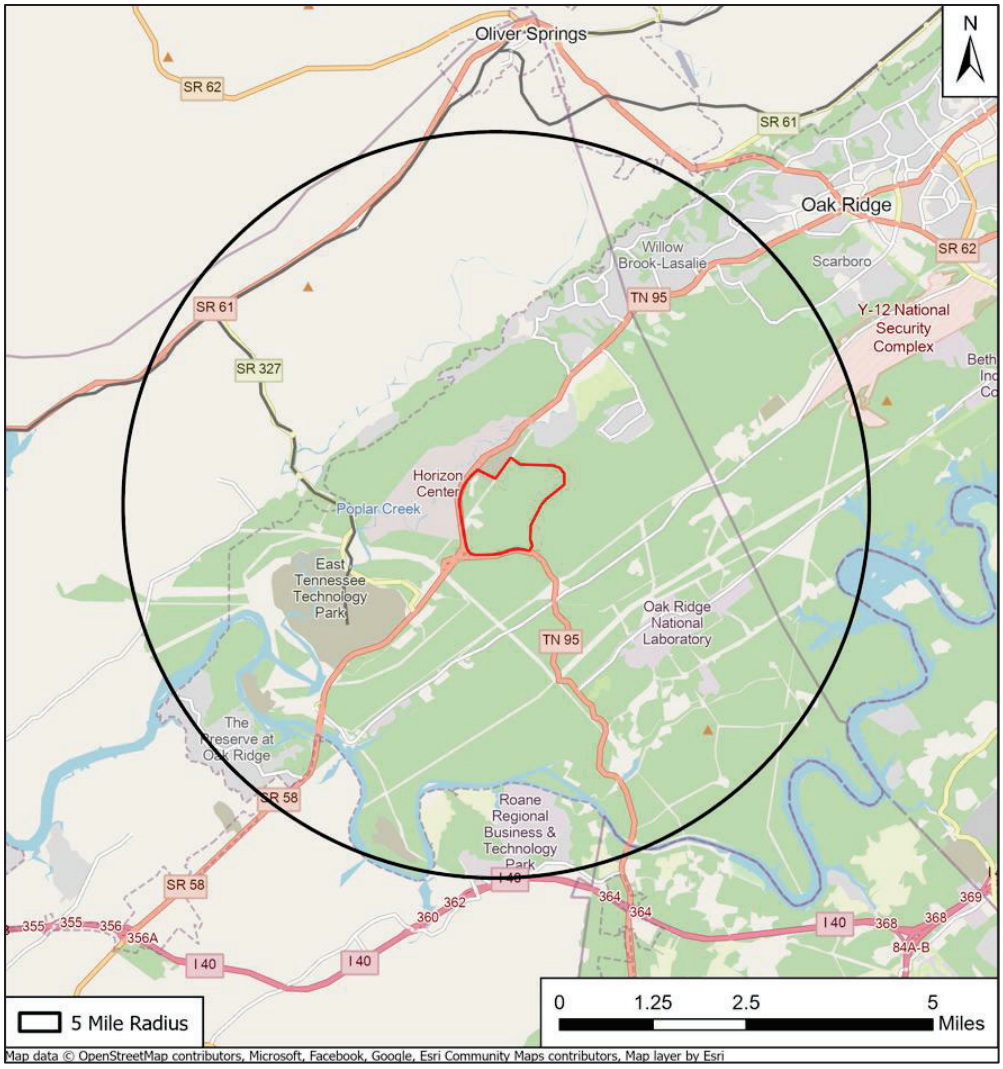



**Figure 3-5: Population Centers within 5 Miles of the Facility**

### 3.1.4 SPECIAL LAND USES

#### 3.1.4.1 DOE Oak Ridge Reservation

The ORR is situated in or near the City of Oak Ridge. The ORR covers roughly 37,000 acres of land in Roane County and Anderson County. The DOE operates three sites on the reservation: the East Tennessee Technology Park (ETTP), on the site of the former K-25 site; the Oak Ridge National Laboratory (ORNL); and the Y-12 National Security Complex (DOE 2020b). These sites are government-owned but contractor-operated under DOE guidance. Private companies manage the day-to-day operation of the sites according to Federal laws, DOE orders, and State laws and regulations.

Government sponsored activities in Oak Ridge began during the Manhattan Project and have continued to the current day. Both past and present activities involve hazardous chemicals and radioactive materials. The Manhattan Project National Historical Park protects many structures associated with the Manhattan Project including the ones on the ORR as shown in Figure 3-6.

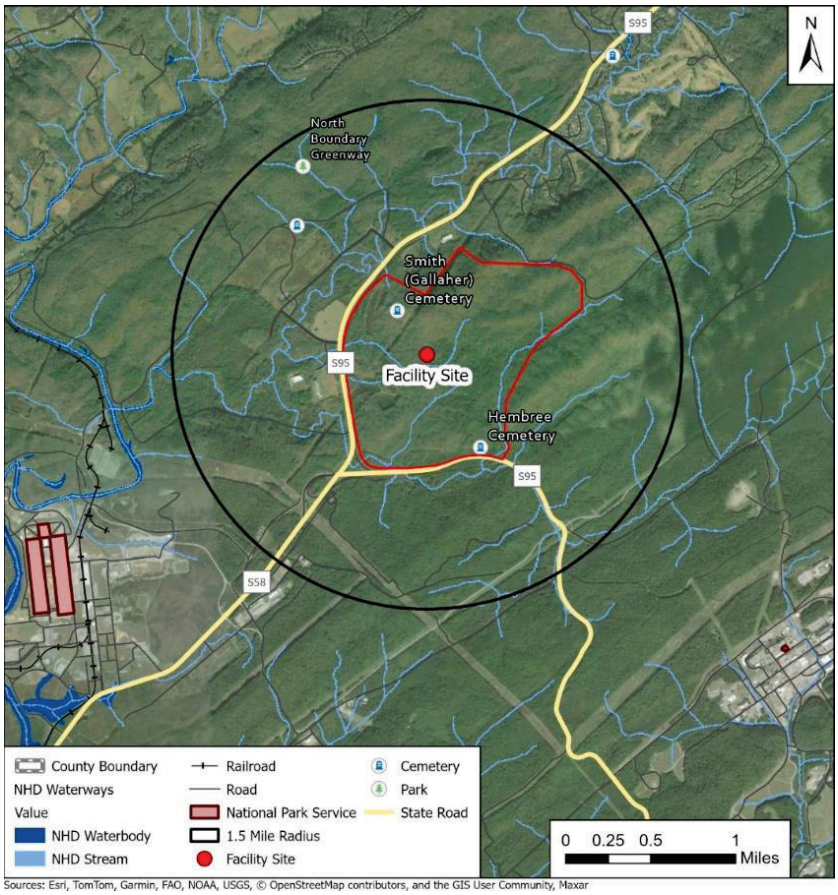



**Figure 3-6: Other Land Features Near the Site**

### 3.1.4.2 Other Land Uses

Other land uses in the vicinity of the Facility include the following facilities:

- U.S. DOE natural areas
- Campbell Bend Barrens and Crowder Cemetery State Natural Areas
- North Boundary Greenways (Figure 3-6)
- Gallaher (Smith) Cemetery (Figure 3-6)
- Hembree Cemetery (Figure 3-6)

## 3.1.5 AGRICULTURAL RESOURCES AND FACILITIES

According to the U.S. Department of Agriculture (USDA), there are approximately 69,500 farms in Tennessee covering approximately 10,800,000 ac., producing a variety of crops and livestock (USDA 2024). Tennessee also produces a variety of forest products (USDA 2009a).

### 3.1.5.1 Farming

A breakdown of prime farmland data for the Facility site is provided in Table 3-2 and Figure 3-7. The USDA Natural Resource Conservation Service (NRCS) soil survey data are not available for Federal land including the ORR to which the Site belongs.

In Roane County, there are 617 farms, comprising over 47,000 ac. with an average size of 77 ac. Land in farms consists of cropland (32 percent), pastureland (27 percent), woodland (35 percent), and other (5 percent) (USDA 2017). Only 37 ac. of Roane County farmland is irrigated (USDA 2017). The major crops include forage (hay/haylage), 10,493 ac., corn for grain, 128 ac., vegetables harvested, 80 ac., sweet corn 31 ac., and berries, 20 ac. The majority of the livestock inventory consists of cattle and layers (i.e., egg-producing poultry). Other livestock includes broilers and other meat-type chickens, goats, hogs, pigs, horses, ponies, pullets, sheep, lambs, and turkeys.

**Table 3-2: Prime Farmland in the Region**

| NLCD Land Cover Class | Area (ac) | Area (%) |
|---|---|---|
| All areas are prime farmland | 7225 | 12.4 |
| Not prime farmland | 50,803 | 83.3 |
| Prime farmland if drained | 21 | 0.0035 |
| Prime farmland if protected from flooding or not frequently flooded during the growing season | 174 | 0.25 |
| **Total** | **58,196** | **100.00** |

Source: **(USGS 2024)**

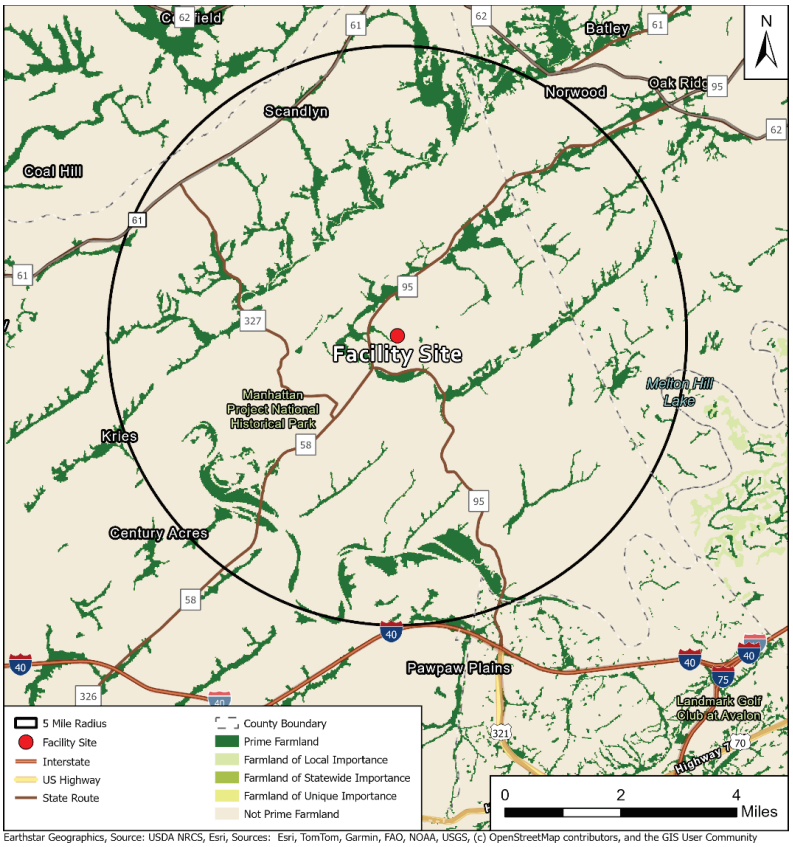



**Figure 3-7: Prime Farmland in the Region**

### 3.1.5.2 Forestry

According to the Directory of Tennessee's Forest Industries, which is published by the Tennessee Division of Forestry of the Department of Agriculture, in cooperation with the TVA and the USDA Forest Service, wood consuming industries in or near the Region include two secondary mills located in Roane County. Secondary mills process primary materials, such as hardwood lumber or paper, into other products, including furniture from hardwood lumber (TDF 2012).

## 3.1.6 LAND USE PLANS

The DOE does not plan to develop the Site prior to the transfer of ownership to OE. Once the parcel has been transferred, there will be no further developments on the site outside of any that OE plans to conduct. It will remain a private parcel under ownership of OE.

### 3.1.7 ZONING

The City of Oak Ridge has zoned the Site for Federal and Institutional Research (FIR). FIR is defined by the City of Oak Ridge Zoning Ordinance, Article IX, Section 9.06 (City of Oak Ridge 2025b). FIR zoned lands are:

> "*established for the United States Government Oak Ridge Reservation and its operation within its boundaries. Whenever land is transferred from the Oak Ridge Reservation to the City of Oak Ridge or to a private company for the purposes not directly related to the mission of the DOE, the City of Oak Ridge Planning Commission shall study and make recommendations to the city council concerning the appropriate zoning district designation*."

It is expected that once the land has been transferred from the ORR to OE that the Site will be rezoned into the appropriate zoning district in accordance with the above ordinance. The City of Oak Ridge's zoning map is shown in Figure 3-8 (City of Oak Ridge 2025c).

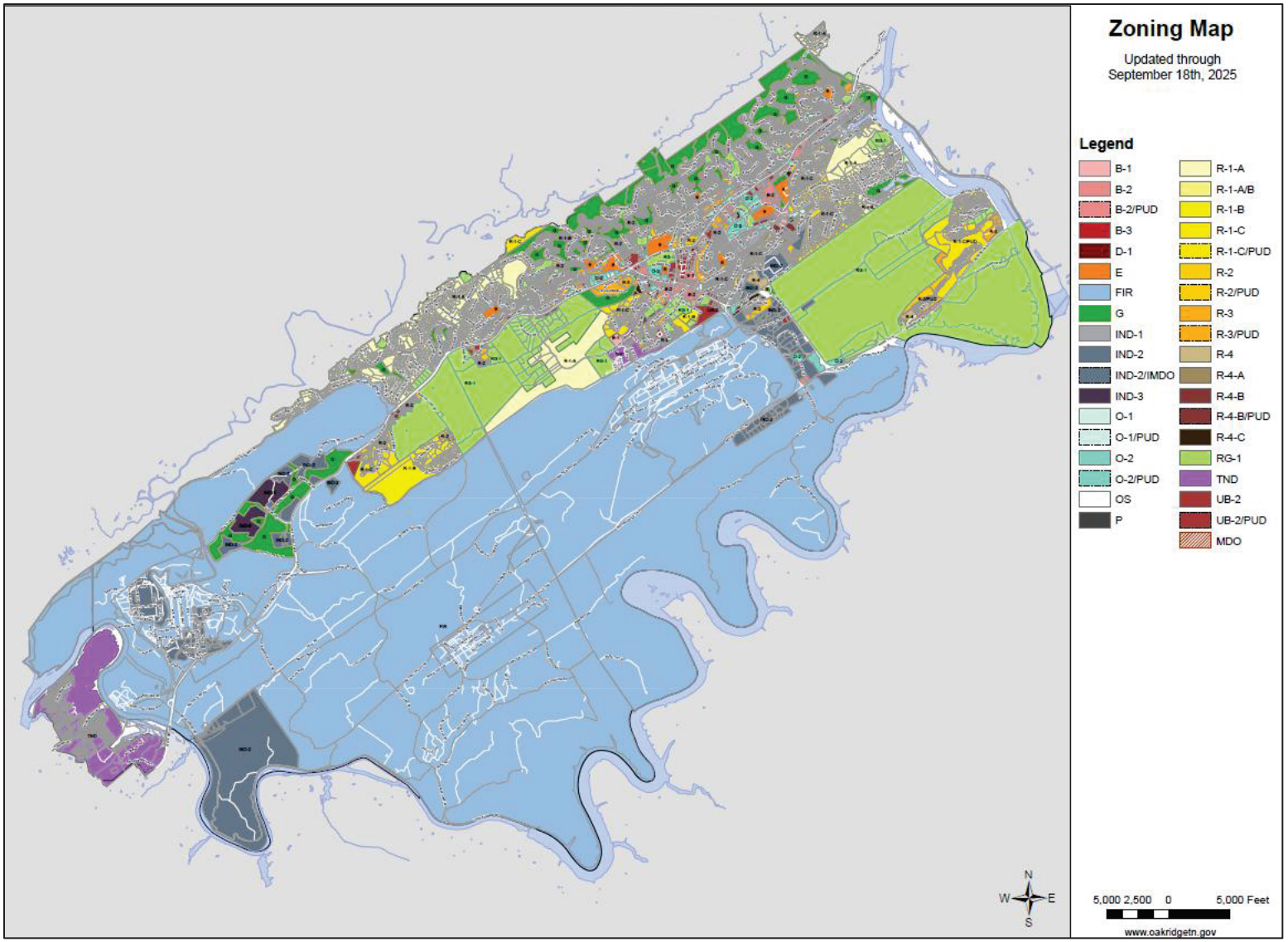



**Figure 3-8: City of Oak Ridge Zoning Map**

## 3.2 TRANSPORTATION

### 3.2.1 TRANSPORTATION ACCESS

The Site is in eastern Tennessee (TN), Roane County, in the city limits of Oak Ridge, about 2.9 mi northwest of the ORNL. As shown in Figure 3-4, the site is located in East Tennessee west of Knoxville. The Facility is east of Tennessee State Route 95 (SR-95), which is a multi-lane State highway. West of the Facility at an interchange, SR-95 turns south toward Lenior City and connects to Interstate 40 (I-40), continuing south the route turns into Highway 321 which connects to Interstate 75 (I-75). From the SR-95 interchange, continuing southwest, it connects to State Route 58 (SR-58). SR-58 is a north-south state highway that serves as a major route for many communities in Roane, Meigs, and Hamilton counties. SR-58 joins I-40 for part of its route in Roane County, from Kingston (exit 352) east to Oak Ridge (exit 356) west of Oak Ridge. East of the Facility SR-95 turns into Highway 61 and connects to I-75 after passing through the cities of Oak Ridge and Clinton, Tennessee. I-40 and I-75 interchange in two locations: in Knoxville, Tennessee, for I-75 northbound into Kentucky, and north of Lenoir City for I-75 southbound toward Chattanooga, approximately 8 mi southeast of the Facility.

The current traffic volume for the nearby road systems is shown in Table 3-3, which depicts the current traffic volume for the major roads in the vicinity of the Site.

**Table 3-3: Average Annual Daily Traffic Counts (2020 – 2024)**

| Location | TNDOT Identifier | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|
| SR-95 Oak Ridge (White Wing Rd) | 73000058 | 7,453 | 6,052 | 6,382 | 7,359 | 7,140 |
| SR-95 Oak Ridge | 73000059 | 13,635 | 10,798 | 10,766 | 13,074 | 13,624 |
| SR-58 Oak Ridge | 73000060 | 14,944 | 11,148 | 13,109 | 13,322 | 15,271 |
| SR-58 E of Kingston (Gallaher Rd) | 73000061 | 12,924 | 14,152 | 10,812 | 11,262 | 12,353 |
| I-40 EB Off Ramp to SR-58 (Gallaher Rd) | 7300017R | 3663 | 4011 | 5135 | 5315 | 5288 |
| I-40 EB Loop on Ramp from SR-58 (Gallaher Rd) | 7300018R | 795 | 863 | 986 | 1154 | 1240 |
| I-40 EB On Ramp from SR-58 (Gallaher Rd) | 7300019R | 568 | 657 | 672 | 763 | 777 |
| I-40 WB Off Ramp to SR-58 (Gallaher Rd) | 7300020R | 854 | 993 | 1036 | 1287 | 1848 |
| I-40 WB Loop Off Ramp to SR-58 (Gallaher Rd) | 7300021R | 490 | 488 | 444 | 543 | 532 |
| I-40 WB On Ramp from SR-58 (Gallaher Rd) | 7300022R | 4539 | 4909 | 4964 | 5596 | 5818 |
| SR-95 N of I-40 near Roane | 53000001 | 5599 | 6025 | 5886 | 9194 | 8358 |
| I-40 EB Off Ramp to SR-95 | 53000001R | 3100 | 4434 | 4479 | 5001 | 5103 |
| I-40 EB On Ramp from SR-95 | 53000002R | 2285 | 2831 | 3223 | 3581 | 3607 |
| I-40 WB Off Ramp to SR-95 | 53000003R | 2145 | 3000 | 3312 | 3995 | 3884 |
| I-40 WB On Ramp from SR-95 | 53000004R | 3007 | 4320 | 3897 | 4199 | 4406 |

Source: (TDOT 2025)

With respect to other transport services, the closest public airport to Oak Ridge and the Facility site is Knoxville's McGhee Tyson airport located approximately 22.7 mi southeast of the site. McGhee Tyson Airport is used by commercial, military, and private planes with approximately 120,000 to 125,000 aircraft operations each year (FAA 2025a). Oliver Springs Airport is a small private airport located 6.1mi to the northeast of the site. Oliver Springs Airport is privately owned and is used by private planes which averages about 9,000 aircraft operations each year (FAA 2025b).

CSX Transportation (CSXT) provides industrial rail services to the Oak Ridge area via a line that follows State Route 61 (SR 61) north of Oak Ridge to/from the town of Oliver Springs (CSXT 2025). Energy Solutions operates a railway system (ESI 2018) servicing its rail transload yard located on South Perimeter Road near SR-58 from the CSTX rail line. The Energy Solutions line runs along Blair Road (State Route 327) and SR-61 until it connects with the main CSTX line. The Energy Solutions transload facility is approximately 3.1 mi. south of the Facility site.

The Clinch River lies south of the Facility site, approximately 3.3 mi. away at its closest point, on the other side of the East Tennessee Technology Park (ETTP). Portions of the Clinch River are used for maritime transportation.

### 3.2.2 LAND USE TRANSPORTATION RESTRICTIONS

There are no restrictions on the types of materials that may be transported along the Site's transportation corridor (Figure 3-2).

### 3.2.3 TRANSPORTATION ROUTES

The Site is undeveloped land and is currently accessible at three points: twice via Old County Road from SR-95 and once via Salvage Yard Road from SR-95. There is minimal industrial activity via these routes associated with the remediation occurring at White Wing Scrap Yard.

## 3.3 GEOLOGY AND SOILS

This section provides information on the general geologic and soils conditions of the Site located in Roane County Tennessee. Given the proximity of the of the Oak Ridge Enhanced Technology Training Center (ORETTC) (approximately 0.85 mi) and the Clinch River Nuclear (CRN) Small Modular Reactor (SMR) site (approximately 4.5 mi) to the Facility, information and data as compiled in the ORETTC Environmental Assessment (DOE-EA-2144-Final) (DOE 2020a) and the CRN SMR Early Site Permit (ESP) Revision 2 (TVA 2019) are used as surrogate for the Facility. Both references include the citation for public viewing are incorporated by reference, the Geology and Soil surrounding the Site are the same as that in DOE-EA-2144-Final (DOE 2020a) and the CRN SMR ESP Revision 2 (TVA 2019). Specifically, the following section, table and figure numbers from the CRN SMR ESP Revision 2 (TVA 2019) are directly applicable:

Section Number(s): 2.5.1.1.1, 2.5.1.1.1.1, 2.5.1.1.1.1.1, 2.5.1.1.1.1.2, 2.5.1.1.1.1.3, 2.5.1.1.1.1.4, 2.5.1.1.1.1.5, 2.5.1.1.1.1.6, 2.5.1.1.1.2, 2.5.1.1.1.3, 2.5.1.1.1.3.1, 2.5.1.1.1.3.2, 2.5.1.1.2, 2.5.1.1.3, 2.5.1.1.3.1, 2.5.1.1.3.2, 2.5.1.1.3.3, 2.5.1.1.3.4, 2.5.1.1.3.5, 2.5.1.1.3.5.1, 2.5.1.1.3.5.2, 2.5.1.1.3.6, 2.5.1.1.4, 2.5.1.1.4.1, 2.5.1.1.4.1.1, 2.5.1.1.4.1.2, 2.5.1.1.4.3, 2.5.1.1.4.1.4, 2.5.1.1.4.1.4.1, 2.5.1.1.4.1.4.2, 2.5.1.1.4.1.4.3,

2.5.1.1.4.1.5, 2.5.1.1.4.1.6, 2.5.1.1.4.2, 2.5.1.1.4.3, 2.5.1.1.4.3.1, 2.5.1.1.4.3.2, 2.5.1.1.5, 2.5.1.1.5.1, 2.5.1.1.5.2

Table Number(s): 2.5.1-1 (modified to delete CRBR column)

Figure Number(s): 2.5.1-1, 2.5.1-2, 2.5.1-18 (instead of 2.5.1-3), 2.5.1-19, 2.5.1-27, 2.5.1-11, 2.5.1-4, 2.5.1-6, 2.5.1-5, 2.5.1-7, 2.5.1-8, 2.5.1-9, 2.5.1-10, 2.5.1-12, 2.5.1-13, 2.5.1-14, 2.5.1-35 (modified to identify the Facility), 2.5.1-28, 2.5.1-16, 2.5.1-15, 2.5.1-17, 2.5.1-18, 2.5.1-20, 2.5.1-21 (sheet 1 & 2), 2.5.1-82, 2.5.1-22

The following section, and figure numbers from DOE-EA-2144-Final (DOE 2020a) are directly applicable:

Section Number(s): 3.7.1

Figure Number(s): 3-12, 3-13, 3-14

The Geological and Soil discussion, for the Site, has been “Incorporated By Reference” (IBR) (NRC 2025a), for the most part, and the details are in the corresponding references, discussed above, and not included herein. Regional Geology and Physiography (within the 200-Mile Regional Radius), Regional Processes, Regional Geologic History and Tectonic Evolution, Regional Stratigraphy, and Regional Tectonic Setting discussions are all under the IBR approach since these discussions deal with the wider regional area of 25 to 200 miles centered on the Site area; and the Facility, ORETTC and Clinch River Nuclear sites all lay withing 4.5 miles of each other and are situated at approximately the same elevation and are located above any potential floodplains.

A discussion of natural drainage patterns, surface geology, notable geological features, local stratigraphy, soil chemical characteristics, local tectonics discussion and seismic hazards representative of onsite conditions are included. Summaries of the mineral resource potential and seismology of the area are also provided. In addition, the results of field investigations to determine site-specific conditions are presented. The geologic overview presented below is a brief synopsis based on published scientific literature that is cited in subsequent sections of this report.

As noted in NUREG-1520 Revision 2 (NRC 2015):

> “*For natural phenomena, deterministically defined events such as the probable maximum flood (PMF) or safe-shutdown earthquake (SSE), which are used as reactor design bases, can also be applied to 10 CFR Part 70 facilities as “highly unlikely” events*.”

It is further stated in NUREG-1520 that

> **“***new facilities and new processes at existing facilities must also address the requirements of 10 CFR 70.64, ‘Requirements for New Facilities or New Processes at Existing Facilities,’ which includes the baseline design criterion for natural phenomena hazards (10 CFR 70.64(a)(2)). This baseline design criterion requires that ‘the design must provide for adequate protection against natural phenomena with consideration of the most severe documented historical events for the site’*.**”**

NUREG−1520 also cites DOE-STD-1020 (DOE 2016a) for seismic analysis for fuel cycle and enrichment facilities. This methodology assumes the unmitigated radiological/chemical release

from a facility and its corresponding hazard categorization to establish the seismic considerations, which for the Facility would be a Hazard Category 3 (HC-3) facility. ANSI/ANS-2.26-2004 (ANSI/ANS 2021) defines the criteria for selecting the seismic design category (SDC) for nuclear facility structures, systems, and components (SSCs) (this would be IROFS for this facility) to achieve earthquake safety and for a Hazard Category 3 facility it would require, at a minimum, a Seismic Design Category 3 level (SDC-3).

ANSI/ANS-2.26-2004 further states that:

> **"***the assignment of an SDC to an SSC is based on the consequences of the unmitigated failure of the SSC. Unmitigated consequence analysis is a procedure that has been used by the DOE for the purpose of incorporating safety in design and operation of its nuclear facilities. The concept is also used in 10 CFR 70, the U.S. Nuclear Regulatory Commission (NRC) regulation that applies to fuel cycle facilities, and the associated Standard Review Plan (NUREG–1520).***"**

With the regulatory criteria defined, it is simply a conveyance of Part 50 siting criteria to Part 70 facilities since Part 70 does not have siting criteria established.

Thus, the information IBR demonstrates compliance with the requirements of 10 CFR 100.23(c), which while established for nuclear power plants, can also be extended to Part 70 facilities. Information on the geological and seismological characteristics of the Facility site region (200–mi radius) and site vicinity (25–mi radius) are addressed in the IBR sections identified previously. Site area (5-mi radius), and site location (0.6–mi radius) is presented in the following sections. The geological and seismological information was developed in accordance with NRC guidance documents Regulatory Guide (RG) 1.206 and RG 1.208. As already discussed, much of the site region, site vicinity, and site area data obtained from the CRN SMR ESP Revision 2 (TVA 2019), bounds the Facility (i.e., the Facility and CRN sites are only approximately 4.5 miles apart). Only the site location data would vary between the two sites.

### 3.3.1 SEISMIC HAZARD ASSESSMENT

The Site is located in the Valley and Ridge Physiographic Province, 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.

The geology of the study area is complex as a result of extensive thrust faults and folds. As shown in Figure 3-9, the ORETTC is underlain by bedrock of the Chickamauga Group, which is primarily a limestone with layers of siltstone. Northeast to the Site are rocks of the Rockwood Formation (southwest of the ORETTC site) Clastic bedrock of the older Rome Formation has been placed over the calcareous rocks of the Chickamauga Group and the younger clastic rocks of the Rockwood Formation by the White Oak Mountain thrust fault, which trends generally southwest to northeast in the vicinity of SR 58.

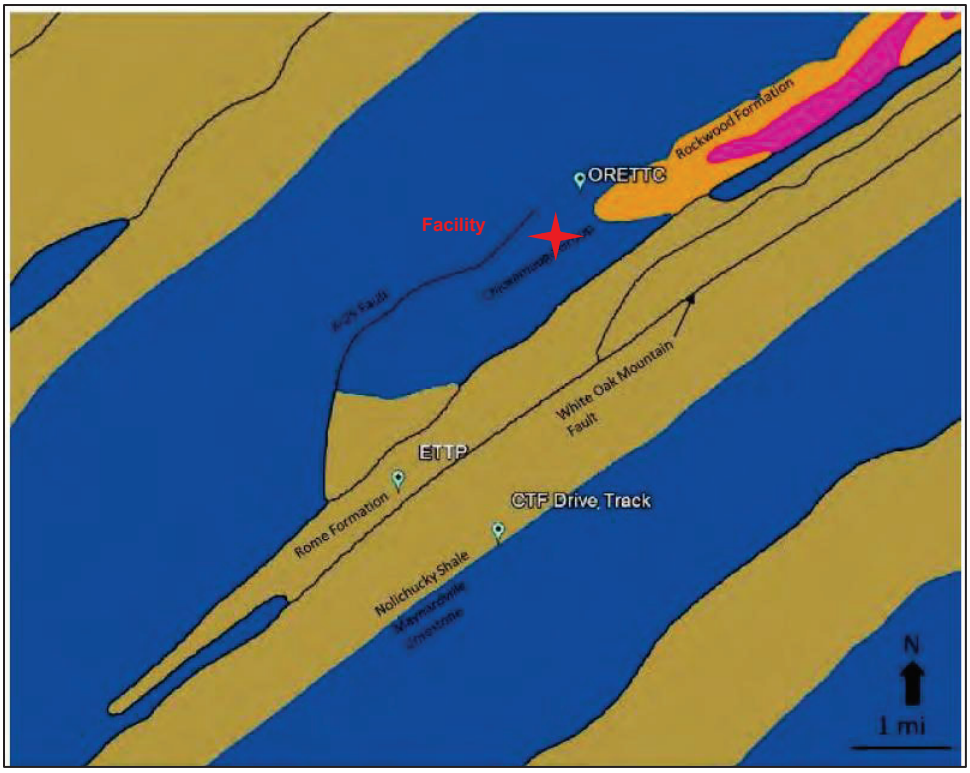



**Figure 3-9: Geologic Map in the Vicinity of the Facility Site ( (DOE 2020a)**

Although major thrust faults are numerous in the vicinity of the study area, 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 1973, 139 earthquakes have been recorded within 62 miles of the Site with the highest magnitude of 4.7 occurring on November 30, 1973, 0.62 miles northeast of Alcoa, Tennessee, which is 24.6 miles southeast from the Facility. The U.S. Geological Survey (USGS) Earthquake Hazards Program's 2018 Long-term Model for the Conterminous United States shows earthquake ground motions for various probability levels across the United States, Figure 3-10 (USGS 2019).

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 seismic map for 2018 indicates that the study area is located in an area with a moderate seismic hazard class rating: 0.34 g peak horizontal ground acceleration with a 2 percent probability of exceedance in 50 years; and 0.10 g peak horizontal ground acceleration with a 10 percent probability of exceedance in 50 years (USGS 2025b).

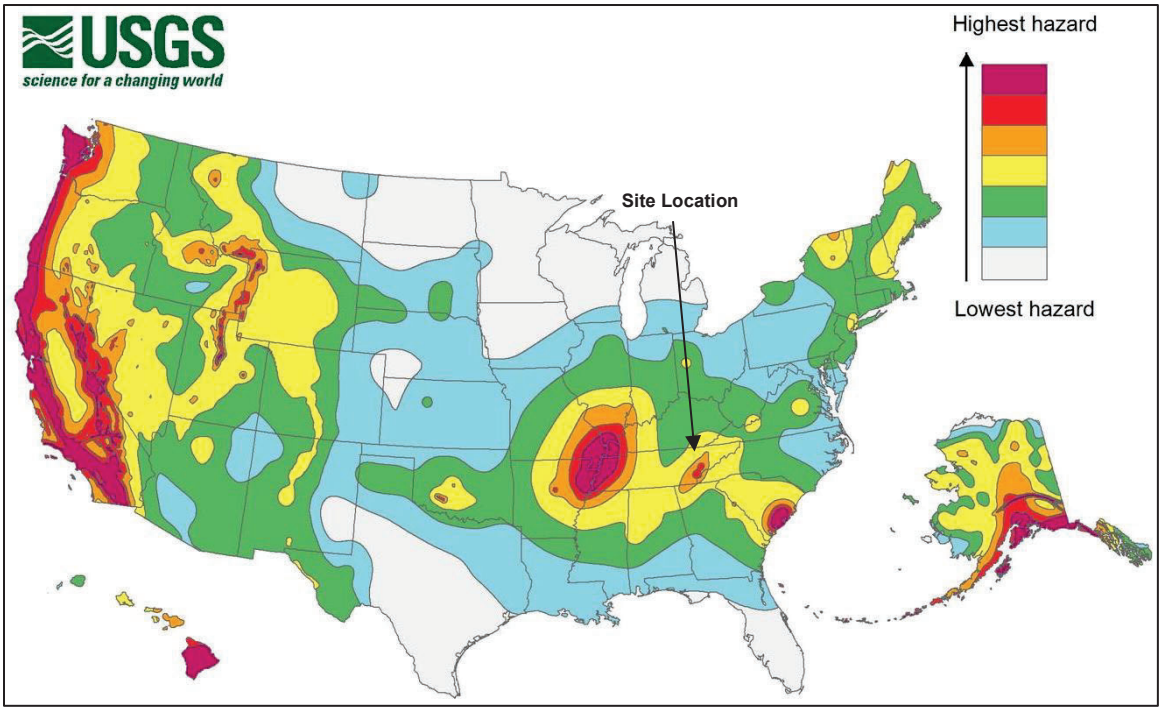



**Figure 3-10: 2018 Long-term National Seismic Hazard Map (USGS 2019)**

An earthquake generating 0.3 g would produce very strong perceived shaking. Damage would be slight in specially designed structures. An earthquake generating 0.10 g would be perceived by all, with minimal damage to well-built ordinary structures.

Pre-construction topographic maps and historical investigations indicate that karst conditions, such as enclosed drainage basins and sinkholes, are present in both the Knox Group and Chickamauga Group formations in the vicinity of the project area. Because the study area is underlain by Chickamauga Group rocks, the possibility exists for karst conditions to be encountered. Small cavities have been reported in the drilling logs for several of the bedrock wells located near the ETTP (East Tennessee Technology Park). These cavities have ranged in width from 0.3 to 6.5 ft and have generally been mud-filled. During recent surveys, karst outcrops and a small unplugged sinkhole were identified near the southeast corner of the planned parking area for the ERTF (Emergency Response Training Facility).

### 3.3.2 REGIONAL NON-SEISMIC GEOLOGIC HAZARDS

#### 3.3.2.1 Karst Hazards

Carbonate rock dissolution and karst formation is the dominant non-seismic geologic hazard in the Facility site region. This geomorphic process has resulted in extensive cave development in the gently folded and flat lying Mississippian to Pennsylvanian carbonate stratigraphic units in the Cumberland Plateau. This hazard or potential hazard within the Cumberland Plateau occurs from Kentucky southwest into Tennessee and Alabama (Figure 3-13). The folded and faulted Paleozoic limestones and dolomites in the Valley and Ridge Province contain fractures and, in some locations, fracture cleavage, which provides conduits for fluid flow and enhanced carbonate dissolution. Cave development and geometry tend to show structural control of karst. The karst

hazard in the Valley and Ridge Province extends from Virginia southwest into Tennessee, Georgia, and Alabama (Figure 3-13).

#### 3.3.2.2 Landslide Hazards

The United States Geological Survey has identified zones of varying landslide susceptibility within the conterminous United States. Since the cessation of deformation that occurred during the late Paleozoic and Mesozoic, erosion has produced steep slopes including the development of canyons throughout the site region. Persistent rainfall followed by more intense precipitation has resulted in damaging debris slides and avalanches. Landslides occur predominantly on weathered rock or colluvial soils on steep slopes. Many of these landslides have occurred on soils derived from weathered Pennsylvanian and Permian sedimentary rocks. Shales, particularly red beds and shale-limestone sequences, weather rapidly into clayey soils when exposed at the earth's surface. Common forms of mass wasting in the site region consist of rockslides originating from detached rock slabs and translational landslides involving soils containing elevated groundwater under a hydrostatic head. Numerous slow-moving debris slides occur in the Valley and Ridge and Blue Ridge provinces. These slides form in colluvial soils containing rock fragments on slopes underlain by sandstones and metamorphic rocks. The Interior Low Plateaus and the Cumberland Plateau are underlain by relatively flat-lying Devonian and Mississippian shales, sandstones and limestones. The shale becomes susceptible to landsliding when weathered into clayey soils.

### 3.3.3 Geology at the Site

The following subsection presents a summary of geology at the Facility site. The information presented is based on a review of the Facility reports and documents, ORNL reports, review of published and unpublished geologic literature, and the results of geotechnical and geologic field investigations conducted at the Facility Site. Additional hydrologic and hydrogeologic information is presented in Section 3.4.

#### 3.3.3.1 Surface Geology

The understanding of geologic conditions for the Facility is based upon subsurface investigation activities that included drilling of geotechnical borings to support facility design (Kiewit 2025a). A total of 22 geotechnical borings were advanced in the overburden soil using hollow stem augers with split-barrel sampling to refusal (bedrock) to characterize the unconsolidated overburden directly below the Facility site (Figure 3-11). The borings were augured to refusal while performing Standard Penetration Testing. The soil descriptions on the boring logs in the appendices are based on the field descriptions by the field professionals. Laboratory Atterberg Limits (Soil Plasticity) tests were performed on 25 split-spoon samples and 10 undisturbed samples from 12 borings from Site A and 18 split-spoon samples and 3 undisturbed samples from 10 borings from Site B. Upon auger refusal, the borings were extended below the auger refusal depths using rock coring techniques. Rock descriptions on the boring logs are based on field descriptions by the field professional and review by a senior geotechnical professional. Rock Quality Designation (RQD) was determined in accordance with ASTM D6032 (ASTM 2017). Boring information for Site A and Site B borings is summarized in Table 3-4.

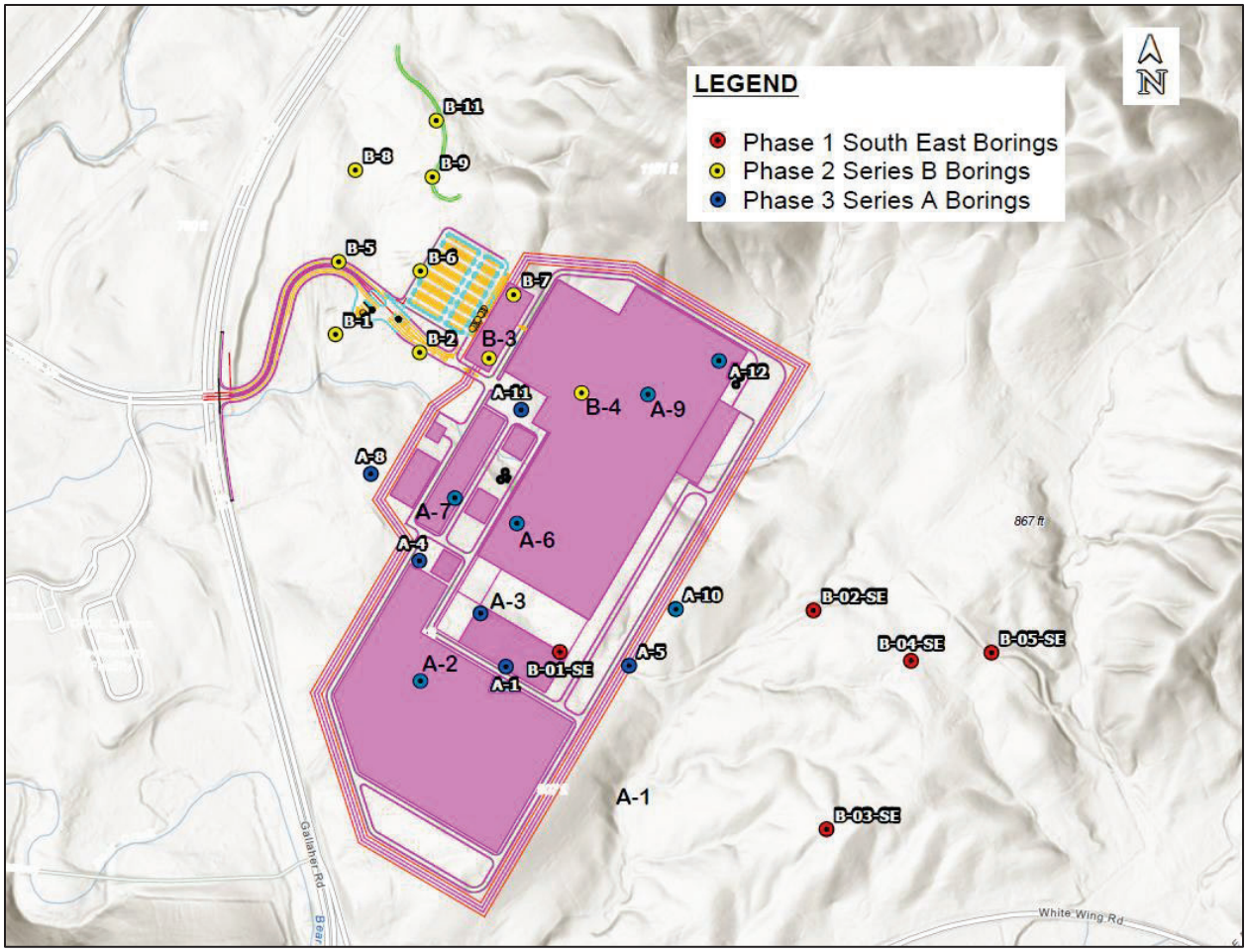



**Figure 3-11: Boring Locations on OE Facility Layout**

**Table 3-4: OE Facility Boring Summary**

| Boring ID | Ground Elevation (feet asml) | Overburden Thickness (feet) | Elevation of Overburden/ Bedrock Interface (feet asml) | Total Depth (feet) | Elevation of Bottom of Boring (feet asml) | Soil-Filled Cavity (feet bgs) | Voids (feet bgs) | Notes |
|---|---|---|---|---|---|---|---|---|
| A-01 | 811 | 30.7 | 780.3 | 63.7 | 747.3 | 33.7-34.0 | 43.0-47.7<br>53.3-56.6 | |
| A-02 | 814 | 32.2 | 781.8 | 32.2 | 781.8 | -- | | Overburden boring only |
| A-02A | 793 | 14.8 | 778.2 | 46.0 | 747.0 | 16.8-17.1<br>17.9-19.7<br>20.8-20.9<br>21.8-21.9<br>23.3-23.8<br>24.2-24.3<br>26.0-26.4<br>27.1-27.5<br>27.9-28.8<br>29.9-30.2 | 45.3-45.7 | Boring A-02 redrilled to obtain additional bedrock information |
| A-03 | 813 | 34.4 | 778.6 | 34.4 | 778.6 | -- | -- | Overburden boring only |
| A-03A | 810 | 33.0 | 777 | 65.0 | 745.0 | 36.5-36.7<br>38.7-39.1<br>41-42.1<br>46-47.1<br>47.5-47.8<br>57.7-58.2<br>59.2-59.4<br>59.6-61.2 | 39.5-39.9<br>42.6-45.0<br>48.4-49.0<br>49.4-50.6<br>51.8-53.4<br>54.3-57.4 | Boring A-03 redrilled to obtain additional bedrock information |
| A-04 | 801 | 11.9 | 789.1 | 43.9 | 757.1 | 11.9-12.1<br>13.7-14.6<br>15.0-15.1<br>15.5-17.4<br>18.0-20.6<br>21.9-22.2<br>33.8-33.9<br>37.9-38.0 | 22.4-28.6 | |
| A-05 | 805 | 17.1 | 787.9 | 49.7 | 755.3 | 17.1-17.3<br>18.0-19.2 | -- | Interpreted to be Rome Formation |
| A-06 | 803 | 33.1 | 769.9 | 65.3 | 737.7 | 33.5-41.0<br>41.3-43.1<br>49.1-49.6 | -- | |

| Boring ID | Ground Elevation (feet asml) | Overburden Thickness (feet) | Elevation of Overburden/ Bedrock Interface (feet asml) | Total Depth (feet) | Elevation of Bottom of Boring (feet asml) | Soil-Filled Cavity (feet bgs) | Voids (feet bgs) | Notes |
|---|---|---|---|---|---|---|---|---|
| A-07 | 830 | 26.4 | 803.6 | 56.3 | 773.7 | 30.2-36.3<br>36.8-37.1<br>37.8-38.1<br>39.5-39.7<br>40.2-40.3 | -- | |
| A-08 | 813 | 15.9 | 797.1 | 46.9 | 766.1 | 20.7-21.1<br>23.0-23.2 | 16.8-19.3<br>20.3-20.7<br>21.7-22<br>23.4-23.6<br>39.8-40.1 | |
| A-09 | 860 | 53.9 | 806.1 | 84.9 | 775.1 | -- | -- | |
| A-10 | 826 | 37.0 | 789 | 89.9 | 736.1 | -- | -- | Partially weathered rock (Rome Formation) encountered from 37.0-59.1 feet bgs, competent bedrock from 59.1-89.9 ft bgs |
| A-11 | 832 | 23.6 | 808.4 | 54.9 | 777.1 | 25.3-25.8<br>26.4-27.5<br>30.1-30.8<br>31.6-32.0<br>32.2-32.5<br>45.1-45.4<br>46.0-46.5 | -- | |
| A-12 | 868 | 43.9 | 824.1 | 74.8 | 793.2 | 44.5-44.9<br>45.1-45.5<br>59.8-60.7<br>68.7-69.8 | 45.8-53.1<br>54.8-58.7<br>64.8-68.7 | |
| A-12A | 870 | 32.0 | 838 | -- | -- | -- | -- | Geotechnical boring to collect undisturbed overburdened samples. Bedrock not encountered. |
| B-01 | 772 | 7.0 | 765 | 15.5 | 756.5 | 8.5-9.5 | -- | |
| B-02 | 772 | 10.5 | 761.5 | 36.5 | 735.5 | | -- | |
| B-03 | 804 | 23.5 | 780.5 | 29.5 | 774.5 | 27.3-29.5 | -- | |
| B-03A | 804 | 29.0 | 775 | 55.0 | 749.0 | 54.0-55.0 | -- | Boring B-03 redrilled to obtain additional bedrock information |
| B-04 | 814 | 32.0 | 782 | 65.5 | 748.5 | 34.8-35.33 | -- | |

| Boring ID | Ground Elevation (feet asml) | Overburden Thickness (feet) | Elevation of Overburden/ Bedrock Interface (feet asml) | Total Depth (feet) | Elevation of Bottom of Boring (feet asml) | Soil-Filled Cavity (feet bgs) | Voids (feet bgs) | Notes |
|---|---|---|---|---|---|---|---|---|
| B-05 | 800 | 27.5 | 772.5 | 61.0 | 739.0 | | -- | |
| B-06 | 810 | 11.5 | 798.5 | 41.5 | 768.5 | 11.5-11.9<br>12.5-13.1 | -- | |
| B-07 | 830 | 30.5 | 799.5 | 60.5 | 769.5 | 30.5-32.4 | -- | |
| B-08 | 816 | 29.5 | 786.5 | 61.5 | 754.5 | | -- | |
| B-09 | 826 | 11.5 | 814.5 | 41.5 | 784.5 | 20.0-20.5<br>23.8-24.3 | | |
| B-10 | -- | -- | -- | -- | -- | -- | -- | Boring not completed |
| B-11 | 831 | 16.0 | 815 | 46.0 | 785.0 | -- | -- | |

Notes:
amsl – above mean sea level
bgs – below ground surface

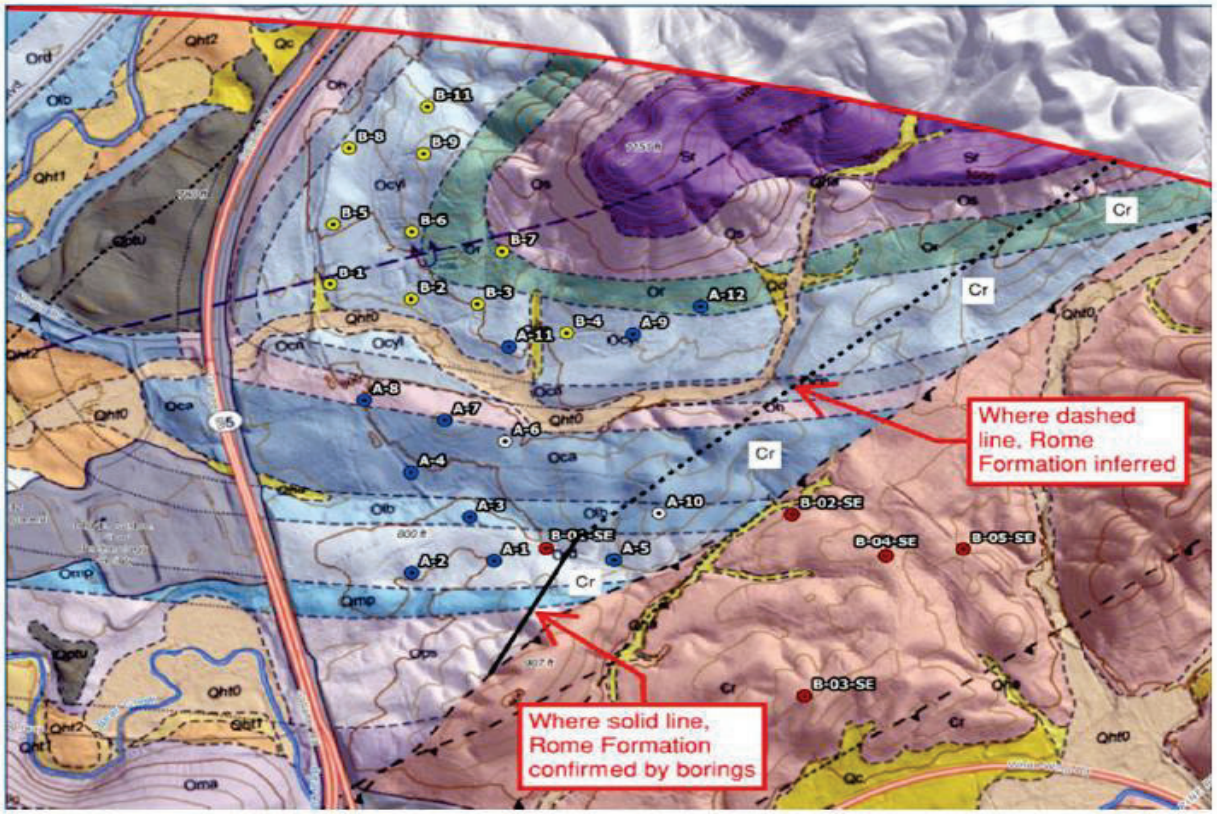
Borings depths ranged from 15.5 feet to 89.9 feet below ground surface. The thickness of the unconsolidated overburden ranged from approximately 7 to 54 feet across the site. Bedrock coring was completed from approximately 8 to 54 feet into bedrock. Groundwater was not encountered in any of the borings completed at the Facility site.

The Facility site is primarily underlain by the middle to upper Ordovician Chickamauga Supergroup, except for in areas along the northeastern and southern margins. To the south, the area is underlain by the Rome Formation (Kiewit 2025a) (Hatcher 1992) (Lemiszki, Peter J. 1992). The area outside of the northeastern margin of the Facility site also is underlain by the Reedsville Formation and Sequatchie Formation (Upper Ordovician) and Lower Silurian Rockwood Formation (Figure 3-12).

Regional geologic mapping, including reconnaissance mapping of the project site confirmed that the Facility site is underlain by the Chickamauga Supergroup except for the eastern margin which is underlain by the Rome Formation (Kiewit 2025a). The Rome Formation was encountered in Borings A-5 and A-10 but was not encountered in A-01 indicating the contact between the Chickamauga Group and the Rome Formation is located approximately 500 feet further northwest than shown on previous interpretations. Note that the contact between the Chickamauga Group and the Rome Formation represents the Whiteoak Mountain thrust fault. As noted in Section 3.3.1, major thrust faults such as the Whiteoak Mountain thrust fault are numerous in the vicinity of the study area. These faults are associated with mountain building episodes that ended more than 200 million years ago and these faults are no longer active, but stress stored up at depth in these rocks is periodically released as minor earthquakes.

The revised location of the fault line is shown in Figure 3-12 by both a solid and dashed line. The solid line is where the fault location is confirmed by the borings. The dashed line is inferred and is based on the distance of the northwest offset of the mapped fault location as indicated by borings B-01 and A-5 (Kiewit 2025b).

As noted in the ORETTC environmental assessment, topographic maps and historical investigations indicate that karst conditions, such as enclosed drainage basins and sinkholes, are present in both the Knox Group and Chickamauga Group formations in the vicinity of the project area (DOE 2020a). Because the Facility site is underlain by Chickamauga Group rocks, the possibility exists for karst conditions to be encountered. Small cavities have been reported in the drilling logs for several of the bedrock borings completed at the Facility (Table 3-4). Both soil-filled and voids were noted on the boring logs. The soil-filled cavities have ranged in thickness up to 7.5 ft, with most of these cavities less than 2 feet in thickness. Voids in the bedrock were noted in numerous borings as well, with these voids ranging in thickness up to approximately 7.3 feet (boring A-12). No surface development of karst features are evident based on site topography.




| Formation | | |
|---|---|---|
| Holocene | Qht0 | Holocene river traces |
| Lower Silurian | Sr | Rockwood Fm: sandstone, siltstone and shale |
| Ordovician Chickamauga Supergroup | Os | Sequatchie Fm: limestone and shale |
| | Or | Reedsville shale: shale and siltstone with limestone Interbeds |
| | Ocyl | Catheys and Leipers Fm: limestone with shale interbeds |
| | Ocn | Cannon Ls: limestone |
| | Oh | Hermitage Fm: limestone |
| | Oca | Carter Ls: limestone with shale interbeds. May form sinkholes |
| | Olb | Lebanon Ls: limestone |
| | Ord | Ridley Ls: limestone with chert |
| | Omp | Pierce and Murfreesboro Ls: limestone with shale interbeds |
| | Ops | Pond Spring Fm: limestone with dolomite, shale and sandstone interbeds |
| Cambrian | Cr | Rome Fm: sandstone, shale and siltstone with interbeds of dolomite |

**Figure 3-12: Geologic Map of the Facility Site**

### 3.3.3.2 Notable Geological Features Within and Adjacent to the Facility

The Facility site is located on the western boundary of the Valley and Ridge Physiographic Province characterized by a series of parallel, narrow, elongated ridges and valleys that follow a northeast-to-southwest trend. The valley and ridge province contain several west directed thrust faults that formed when the Blue Ridge sheet to the east pushed the Valley and Ridge sedimentary succession in front of it (Hatcher 1992) (Lemiszki, Peter J. 1992) (Lemiszki, Peter J. 1994). The geologic structure in the immediate area of the Facility site is dominated by the Whiteoak Mountain fault and the East Fork Ridge syncline in the footwall of the Whiteoak Mountain thrust (Figure 3-13 and Figure 3-14).

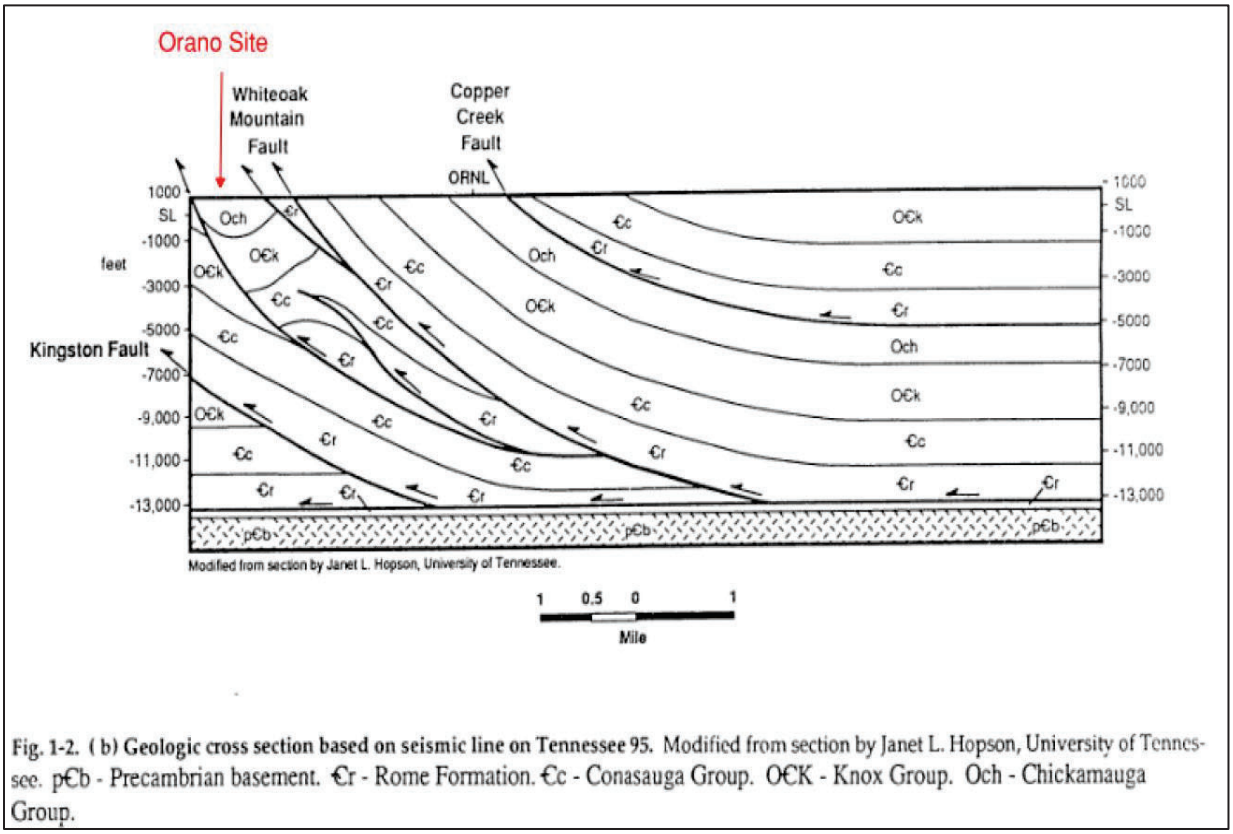



Fig. 1-2. ( b) Geologic cross section based on seismic line on Tennessee 95. Modified from section by Janet L. Hopson, University of Tennessee. p€b - Precambrian basement. €r - Rome Formation. €c - Conasauga Group. O€K - Knox Group. Och - Chickamauga Group.

**Figure 3-13: Regional Geologic Cross-Section (Hatcher 1992)**

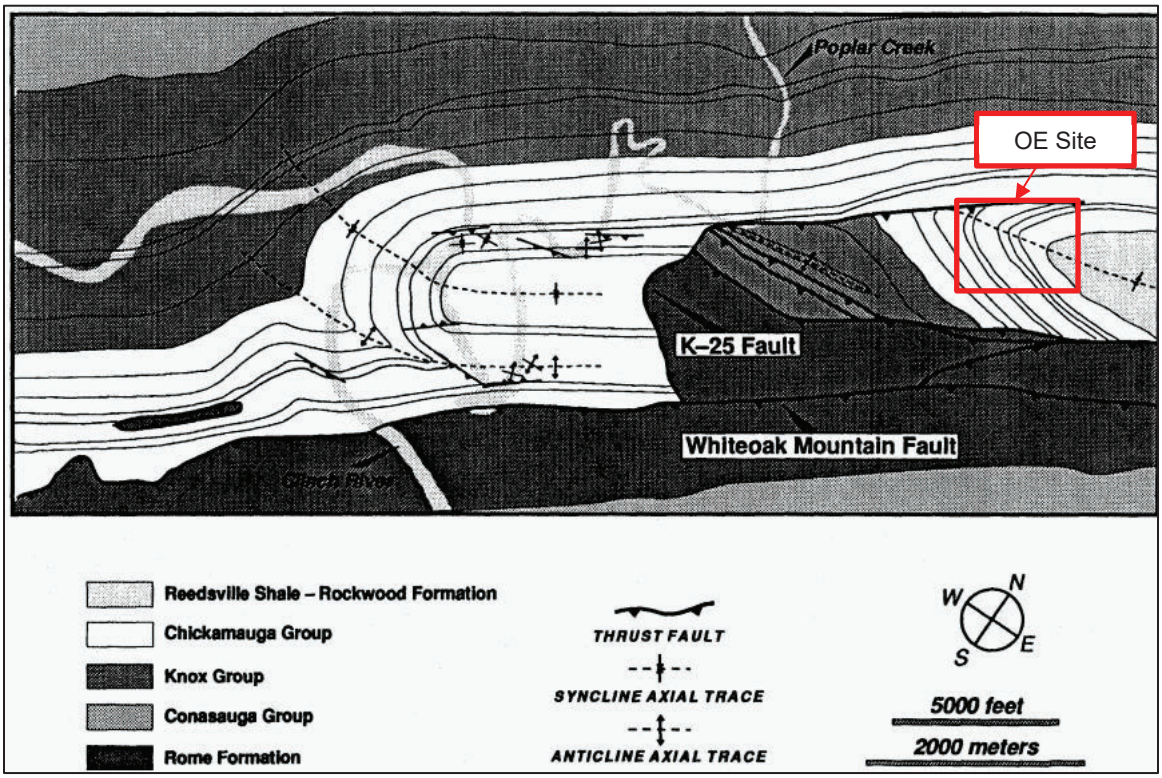



**Figure 3-14: Regional Geologic Map (Lemiszki, Peter J. 1994)**

The site is underlain by rocks of the Chickamauga Group with the Rome Formation to the south, separated by the Whiteoak Mountain fault that strikes northeast and dips southeast (Lemiszki, Peter J. 1994). As noted in Section 3.3.1, major thrust faults such as the Whiteoak Mountain thrust fault are numerous in the vicinity of the study area, these faults are associated with mountain building episodes that ended more than 200 million years ago and these faults are no longer active. The emplacement of the Whiteoak Mountain thrust sheet is interpreted as responsible for the East Ridge syncline. The East Fork Ridge syncline is a prominent topographic feature that involves the folding of Knox Group and younger rock units adjacent to the Whiteoak Mountain fault. The syncline has an upright northwest limb and a southeast limb that is overturned to the northwest. In general, the fold axis (long axis of the fold) is oriented northeast-southwest, parallel to the strike of the Whiteoak Mountain fault. The southwestern end of the East Fork Ridge syncline is offset by an array of faults. This zone of faulting is bounded to the southwest and north by a fault referred to as the K-25 fault. In map view, the fault projects off the mapped trace of the Whiteoak Mountain fault striking to the northwest and then changes strike toward the northeast, where displacement decreases to zero at the tip line. Little can be inferred about the subsurface geometry of the K-25 fault, but down-plunge projections suggest that it dips beneath the East Fork Ridge syncline. The geometry of the southwestern hinge of the East Fork Ridge syncline has been modified by displacement along the K-25 fault, causing a clockwise rotation of the fold hold hinge towards the northwest. In addition, fault displacement has offset the syncline fold hinge in the Chickamauga carbonates and transported it towards the northwest. The Chickamauga carbonates west of the K-25 fault are folded into an anticline and syncline pair. Although the folds are open and not overturned, the orientation of the map-scale folds is similar to the larger East

Fork Ridge syncline. The folds trend and plunge very gently to the northeast' under the K-25 plant area.

#### 3.3.3.3 Local Stratigraphy (0.6-mi radius)

Strata identified during the Facility Site subsurface investigation are shown in Figure 3-15 as they occur beneath the Facility Site.

Residual soils are the dominant surficial sediment types, whereas alluvial soils are located surficially within drainage swales. Underlying a mantle of residual soil and weathered bedrock, stratigraphy at the Facility Site comprises rocks of the Lower Cambrian Rome Formation and Middle to Upper Ordovician age rocks of the Chickamauga Group, the Reedsville Shale, and the Sequatchie and Rockwood Formations. The Whiteoak Mountain thrust fault, located adjacent (south) of the Facility site, has displaced the Rome Formation over the Ordovician Chickamauga Group (Hatcher 1992) (Lemiszki, Peter J. 1992) (Lemiszki, Peter J. 1994).

Stratigraphy of the Valley and Ridge Province is characterized by Hatcher et al. in conjunction with the ORR (Figure 3-15) (Hatcher 1992). This stratigraphy formed as part of the early Paleozoic drift (ocean-opening) succession. The carbonate bank developed, then uplift and erosion of the carbonate bank occurred in early Middle Ordovician time (post- Knox unconformity). The carbonate bank was reestablished during the Middle Ordovician, then destroyed again during development of a clastic wedge in the Middle and Late Ordovician. The clastic wedge persisted into the Late Ordovician and Silurian. This was followed by erosion and formation of another unconformity, then by deposition of the Upper Devonian-Early Carboniferous clastic wedge. The Rome Formation and the Conasauga, Knox, and Chickamauga Groups and associated formations comprise the majority of the underlying bedrock of the Valley and Ridge Province and are characterized below.

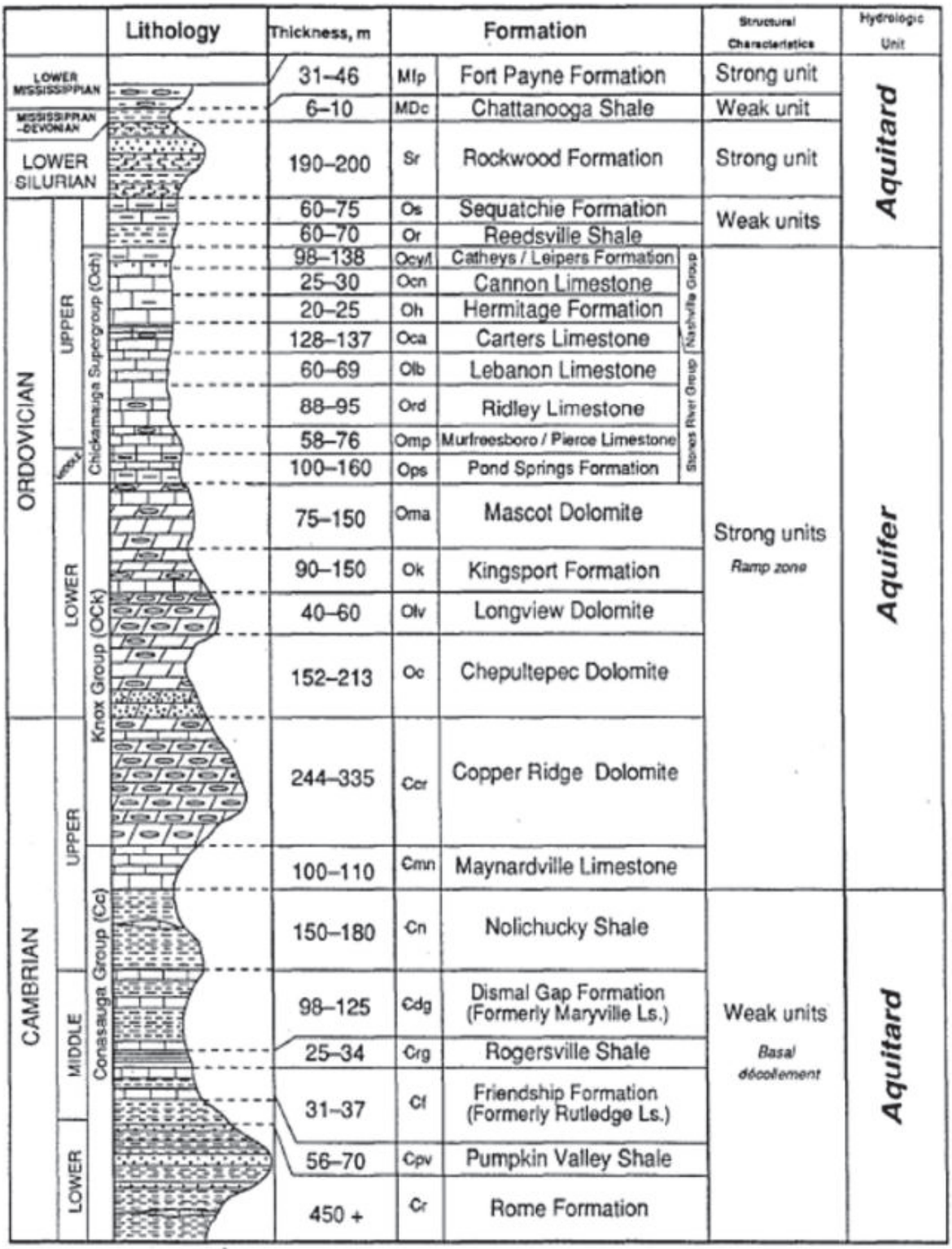



**Figure 3-15: Stratigraphic Column of the Kingston thrust sheet (Hatcher 1992)**

#### 3.3.3.3.1 Rome Formation

The Rome Formation (Cr) is the oldest rock unit exposed at the Facility Site (Hatcher 1992) (Lemiszki, Peter J. 1992). From a distance, Rome topography is recognized by narrow, steep ridges broken by closely spaced wind and water gaps that give it a cockscomb appearance. The lower stratigraphic contact is not exposed in eastern Tennessee because it commonly is cut off by the basal decollement. The upper contact with the Pumpkin Valley Shale is located at the last thick sandstone bed below a consistent section of shale, thin sandstone, and siltstone of the Pumpkin Valley Formation. A thicker sequence of the Rome Formation is present within the Whiteoak Mountain thrust sheet than within the Copper Creek thrust sheet. The lower Rome Formation consists of maroon, green and yellow-brown micaceous shale, with thin to medium beds of light-gray argillaceous limestone and dolomite. The upper Rome Formation consists of maroon sandstone, siltstone, and shale. Greenish-gray, yellowish-gray, light brown, and olive-green sandstones are interbedded with maroon sandstones. The upper Rome siltstones are tan, gray, and greenish-gray. The siltstones are thin bedded and contain similar sedimentary structures as the sandstones. Shales in the upper Rome are olive-green, light brown, green-gray, and maroon, and thin bedded. Dolomites in the Rome are light to dark gray and massively bedded. Interbedded with the massive dolomites are better defined thick bedded dolomitic sandstones.

#### 3.3.3.3.2 Chickamauga Group

The Middle and Upper Ordovician Chickamauga Group in the vicinity of the Facility site represents deposition on the regionally extensive disconformity at the top of the Knox Group (Hatcher 1992) (Lemiszki, Peter J. 1992). The Chickamauga Group underlies East Fork Valley (Oak Ridge Valley) in the Kingston thrust sheet and Bethel Valley in the Whiteoak Mountain thrust sheet. The Chickamauga Supergroup in the Kingston thrust sheet of East Fork Valley (Oak Ridge Valley) consists almost entirely of limestone-dominated lithologies that include the Pond Spring Formation, Murfreesboro/Pierce Limestone, Cannon Limestone, Hermitage Formation, Carters Limestone, Lebanon Limestone, and Ridley Limestone. Thickness of these formations varies between 20 ft and 453 ft. Formations that overly the Chickamauga Supergroup include the Reedsville Shale, Rockwood Formation, and Sequatchie Formation.

Formations likely to be present as consolidated bedrock and/or associated residuum soils beneath the Facility are described below (Hatcher 1992) (Lemiszki, Peter J. 1992):

- Pond Springs Formation consists of fine grained, light gray, thick bedded, micritic limestone. The rest of the formation consists of greenish-gray, grayish-red, micritic limestone and mudstone. The limestone can range from thin to thick bedded and the mudstone is commonly mottled. Thin chert beds occur throughout the formation.
- Murfreesboro/Pierce (Om) Limestone is typically micritic, fine-grained crystalline, thin bedded (with rare thick to massive beds), minor argillaceous limestone. The middle part is similar but is typically black and includes bryozoans, chert, and ropy pods. The upper portion exhibits thick to massive bedding and is ropy, gray-black, with nodular chert and silicified fossils.
- Ridley (Ord) Limestone is typically dark gray, thick to massively bedded, with a fucoidal texture (tan-brown, irregularly shaped, fine to coarse-grained dolomitic patches) and micritic character. The middle part is shale-rich, yellowish-red, mud cracked, and

calcareous. The upper part is thick-bedded, coarse-grained crystalline limestone, gray-black, and fossiliferous, with rare chert.

- Lebanon (Olb) Limestone is typically light- to dark-gray, thin to medium-bedded, even regular; with irregular, cobbly beds, micritic to coarse-grained limestone lenses, thin laminae of calcareous mud, and brachiopods, bryozoans, gastropods, and cephalopods present. Minor thick to massive beds may be present. Fucoidal texture is common, and rare chert may be encountered.
- Carters Limestone is medium to dark gray, thin to thick bedded, bioturbated, fossiliferous micrite in the lower portion. The upper part is argillaceous to fine grained, medium-gray, greenish-gray, and yellowish-gray, thin bedded limestone.
- Hermitage Formation is olive-gray and light-gray, nodular, argillaceous micrite, poorly bedded and very fossiliferous.
- Canon Limestone consists of medium to dark gray, fossiliferous, medium bedded limestone.
- Catheys and Leipers Formation is a yellowish gray to medium gray, fossiliferous micrite and occasional coarse-grained limestone. Shale partings and float blocks of greenish-gray calcareous siltstone are common.

#### 3.3.3.3.3 Reedsville Shale

The Upper Ordovician Reedsville Shale overlies the Chickamauga Group at the Facility site (Hatcher 1992) (Lemiszki, Peter J. 1992). The Reedsville Shale consists primarily of thin bedded, often calcareous, orange-brown and gray-green shales and siltstones. The shales also contain black manganese stains. Near the lower contact with the Catheys Formation, thin, fossiliferous, limestone lenses are interbedded with the shale. Brachiopods, gastropods, crinoid stems, and bryozoans in the limestones and a few bryozoans and brachiopods in the shales.

#### 3.3.3.3.4 Sequatchie Formation

The Late Ordovician Sequatchie Formation developed in locally emergent tidal flat or deltaic depositional conditions (Hatcher 1992) (Lemiszki, Peter J. 1992). The Sequatchie Formation is composed of thin-to medium-bedded, gray to maroon-gray, argillaceous limestone, calcareous, maroon shales (sometimes silty), and minor amounts of fine-grained limestone. The contact with the underlying Reedsville Shale is gradational, make the contact difficult to identify. The formation is approximately 6-75 meters thick.

#### 3.3.3.3.5 Rockwood Formation

The Rockwood Formation is late Silurian and was deposited within a shoreface and shallow marine shelf environment (Hatcher 1992) (Lemiszki, Peter J. 1992). The lower part of the Rockwood Formation contains shale and siltstone, but exposures containing medium to thick bedded, and sometimes massive sandstones are widespread. The middle and upper parts of the Rockwood contain alternating thin to medium beds of brown, tan, olive and gray shale and siltstone, and occasionally thick beds of sandstone. In addition, the upper half of the formation contains a few thin hematite beds that are usually oolitic and very fossiliferous.

#### 3.3.3.4 Residuum

Drilling logs from the geotechnical investigation within the Facility area indicate that the topsoil thickness ranges from 2 to 6 inches in the A-series borings (Kiewit 2025a). Topsoil was not encounter in the B-series borings because those locations were previously disturbed. Classification of the surface soil based on USDA-NRCS information is further discussed in Section 3.3.3.5.2.

A relatively moderate to thick overburden residuum is present across the Facility site (Kiewit 2025a). The thickness of the unconsolidated overburden ranged from approximately 7 feet in boring B-01 to 54 feet in boring A-09 (Figure 3-11). In general, the thickness of the unconsolidated overburden is greatest near the northeastern portion of the proposed construction area (borings A-09 and A-12) correlating to the highest elevation at the Site. Conversely, the unconsolidated overburden thins to less than 16 feet near the Oak Ridge Turnpike (borings A-04, A-08 and B-01). However, in areas of intermediate elevation, there is more variability in the elevation of the top of rock versus surface elevation. This variability is due to the differential weathering of the Chickamauga Supergroup formations resulting in an undulating top of rock that does not necessarily mirror the ground surface topography. It is important to note that the maximum elevation of the overburden/bedrock interface is approximately 824 feet above mean sea level (AMSL) in boring A-12. This suggests that during placement of the Facility slab foundation, most of the area will not encounter bedrock during construction. However, bedrock is anticipated to be encountered during contouring the slope on the northeast portion of the site.

Seismic Refraction Tomography (SRT) was conducted over selected areas to support the geotechnical exploration program in identify depths to bedrock (Kiewit 2025a). The SRT method measures travel times of seismic compression waves (P-waves) generated from an active energy source. The velocities at which the seismic waves propagate along the array can be determined from the slope of arrival times. Waves in soil (low-density) will travel slower than waves in competent bedrock (high-density). Where increases in elastic material properties occur, the seismic waves are refracted much like light in a prism. Depths to higher velocity strata such as rock can be determined from the location of a slope change in the first arrival vs. distance plots. The SRT data was correlated to geotechnical borings near the SRT profile locations to determine depth to the contact of the residuum overburden and partially weathered rock/competent bedrock. The SRT data was used to construct profiles across the site for numerous transects. On these profiles, the residuum overburden appears to have seismic P-wave velocities generally less than 6,500 feet per second (ft/s) (dark blue to green). The PWR and competent bedrock appear to exhibit seismic P-wave velocities generally greater than about 6,500 ft/s (yellow, orange to red, and red to purple). The approximate locations of the relatively adjacent geotechnical borings are overlain on the SRT geophysical models for reference and comparison. Profiles are shown Figure 3-16 and Figure 3-17.

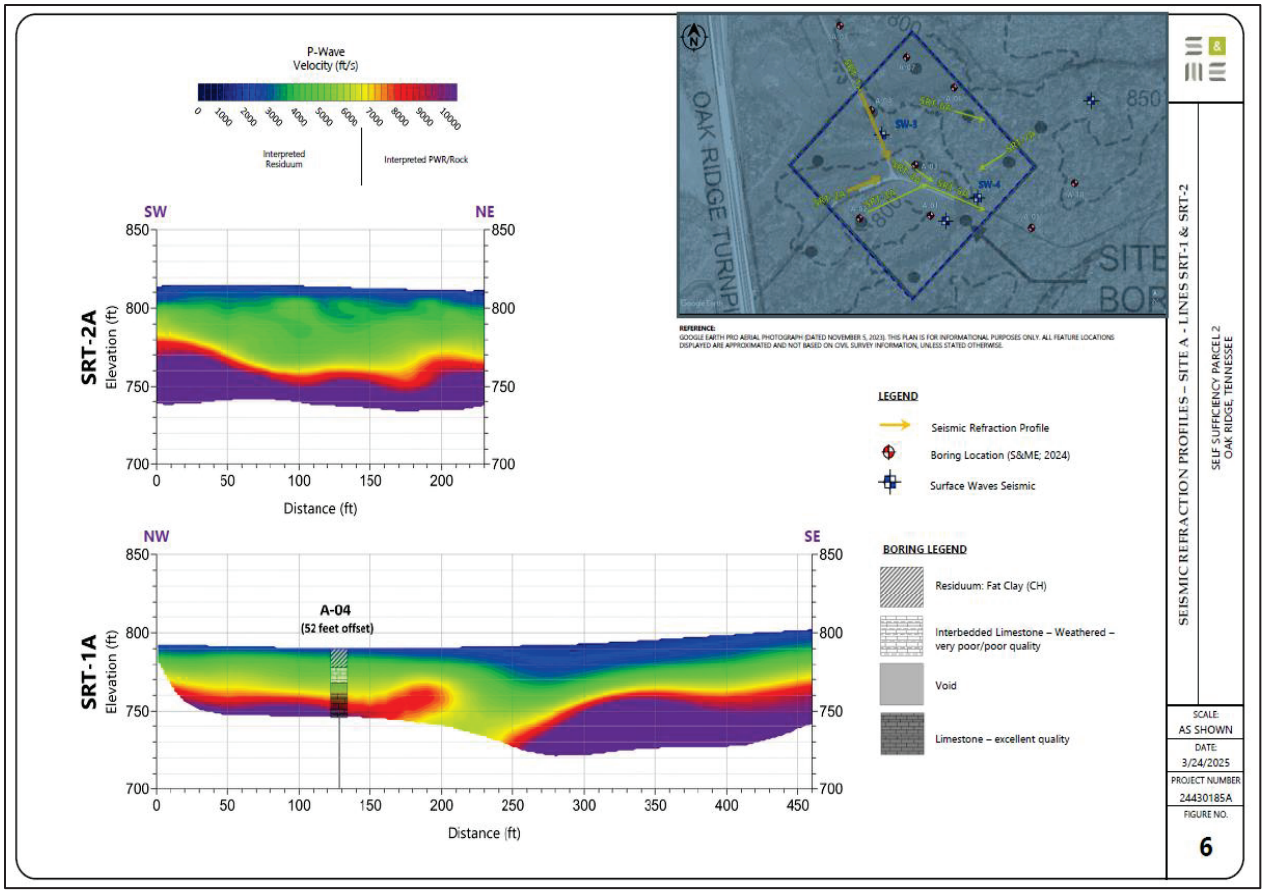



**Figure 3-16: Geophysical Profile through boring A-04 (Kiewit 2025a)**

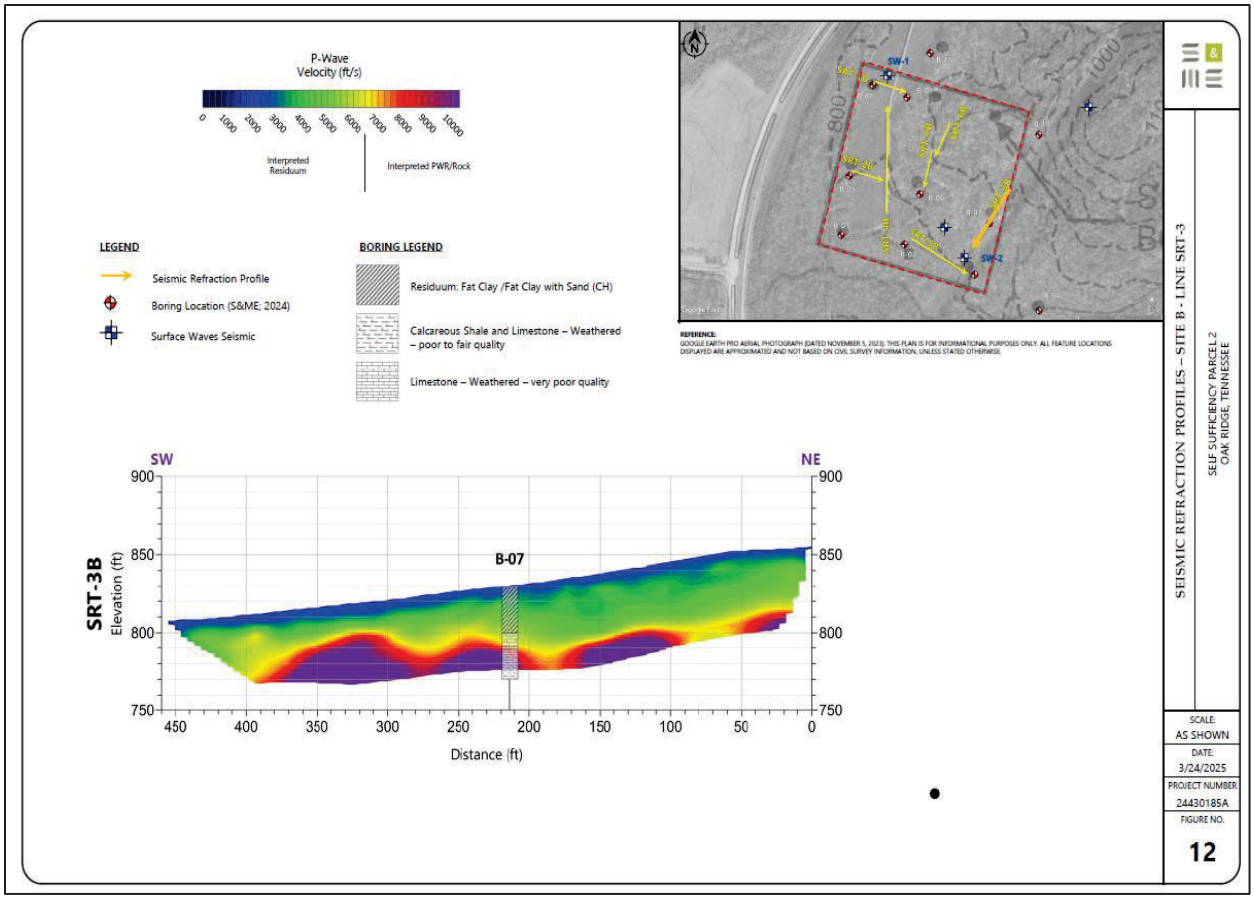



**Figure 3-17: Geophysical Profile through boring B-07 (Kiewit 2025a)**

In addition to the profiles presented in Figure 3-16 and Figure 3-17, elevations/depths of the interpreted top of bedrock were extracted from the SRT data sets along with auger refusals from the boring logs, to develop contoured elevation/depth plots (Figure 3-18 and Figure 3-19).

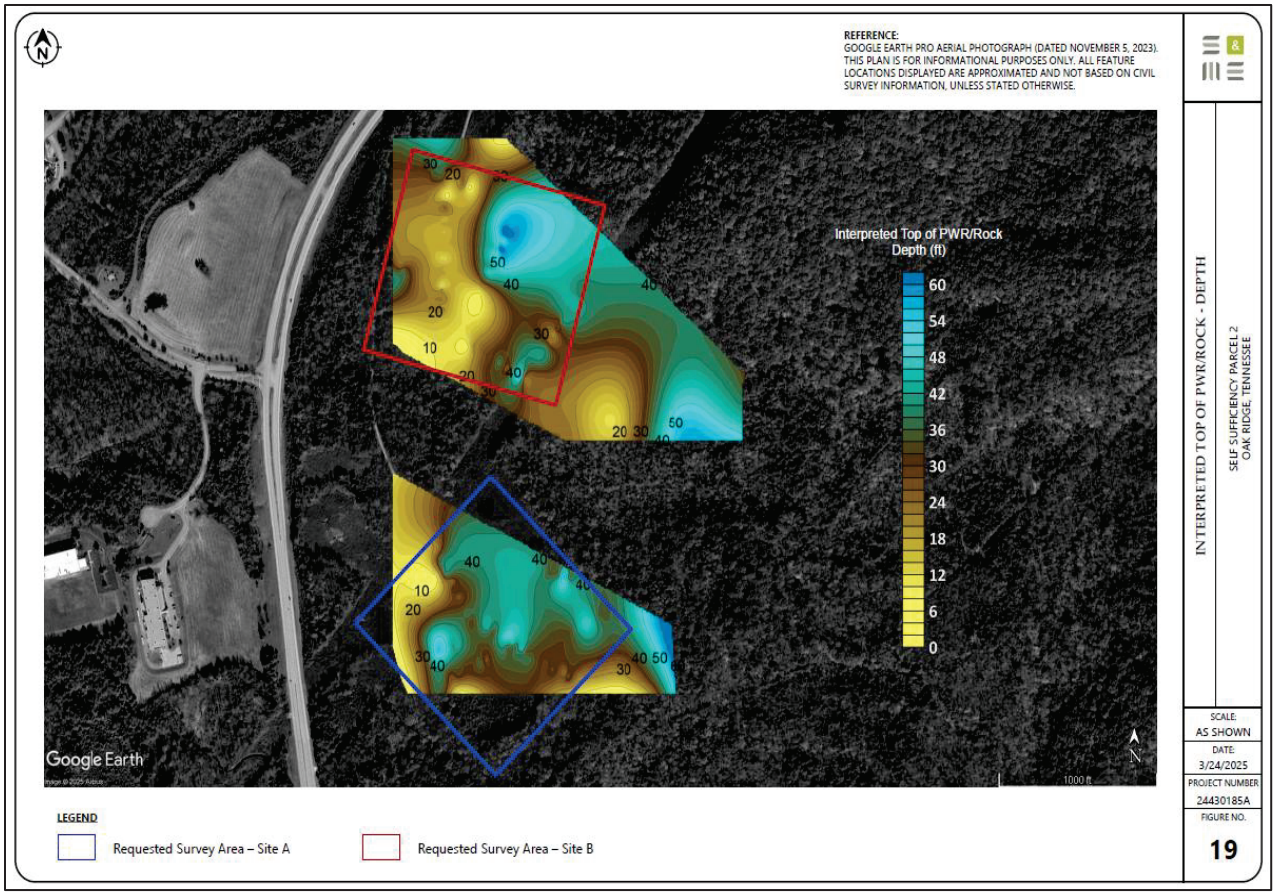



**Figure 3-18: Interpreted Depth to Top of Rock (feet) (Kiewit 2025a)**

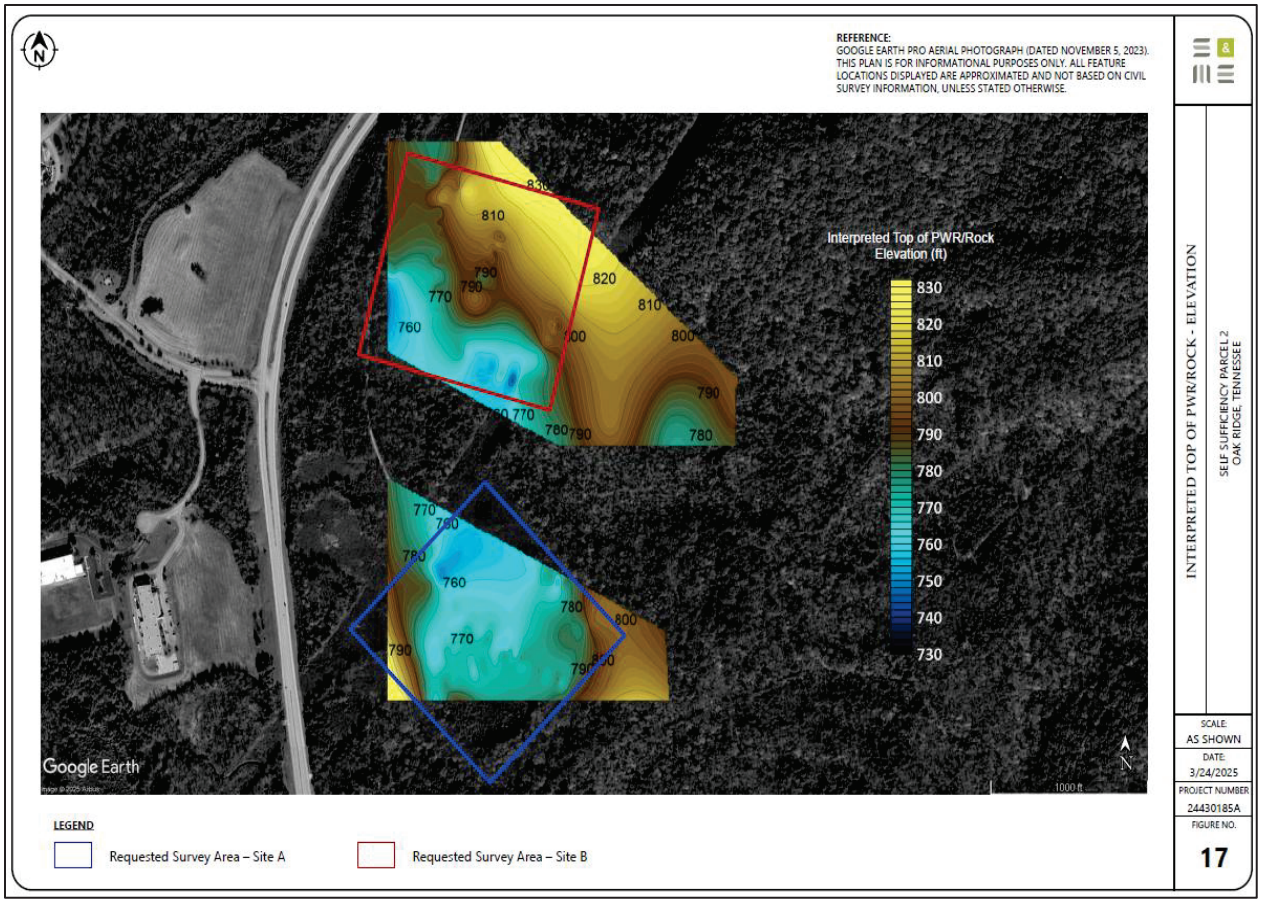



**Figure 3-19: Interpreted Elevation of Top of Rock (feet AMSL) (Kiewit 2025a)**

The geotechnical borings indicate the unconsolidated overburden is predominantly fat clay with lesser amounts of lean clay, sandy-silt, and elastic-silt. A thin layer of chert was encountered in Boring A-06 at a depth of 14.5-15 feet below ground surface. The overburden consistency is predominantly "stiff" fat clay that transitions soft to firm near the overburden/rock interface. The potential for liquefaction is dependent on soil type and saturation. Unsaturated clay, such as present at the Facility, typically has a negative potential for liquefaction. Liquefaction is more likely in loose, sandy soils that are saturated and have high water pressure due to water in the soil pore space that occurs in areas prone to earthquakes.

### 3.3.3.5 SOILS

#### 3.3.3.5.1 Soils in the Vicinity of the Facility site

The Natural Resources Conservation Service (NRCS) soil survey database identified 34 soil map units digitally within the 1.9-mi radius of the Facility (USDA n.d.) (USDA 2025). The following soil types comprise greater than 8 percent of the soils mapped within a 1.9-mi radius of the Facility assessment area:

- Fullerton-Pailo complex, typically a gravelly silt loam, 20 to 35 percent slopes with approximately 23.5 percent of the area.
- Armuchee silt loam, 5 to 60 percent slopes with approximately 4.6 percent of the area.

- Townley silt loam, 2 to 45 percent slopes with approximately 12.15 percent of the area.
- Dewey silt loam, 2 to 40 percent slopes, with approximately 10.5 percent of the area.

Of these four soil types, only the Armuchee silt loam and the Townley silt loam are present in the immediate vicinity of the Facility assessment area (USDA n.d.) (USDA 2025).

#### 3.3.3.5.2 Soils Mapped on the Facility Site

The NRCS soil survey database depicts nine soil types within the Facility (USDA n.d.) (USDA 2025). The soil types are as follows:

- Ridge/Upland Soils:
  - Armuchee silt loam (AmC, AmD, AmE)
  - Apison-Sunlight complex (ApC, ApD, ApF)
  - Colbert-Lyerly-Rock outcrop (CbD)
  - Collegedale silt loam (CoB, CoC, CoD)
  - Townley silt loam (TeC, TeD)
- Terrace/Floodplain Soils:
  - Capshaw silt loam (CaB)
  - Etowah silt loam (EtB, EtC)
  - Hamblen silt loam (Ha)
  - Waynesboro silt loam (WaC, WaD)

In general, soils at the site are well to moderately well drained and non-hydric, except for the Capshaw silt loam, Colbert-Lyerly-Rock outcrop, and Hamblen silt loam which are well drained and predominately non-hydric having hydric components less than six percent (CEC 2025).

The following soil descriptions are taken from the Soil Survey of Roane County, Tennessee (USDA 2009) supplemented with online information (USDA n.d.) (USDA 2025).

The Armuchee silt loam consists of moderately deep well drained soil found on rolling to steep uplands with 5 to 35 percent slopes. These soils were formed in residuum of acid shale and contain 10 to 60 percent shale fragments. The Armuchee soils have medium runoff potential on gentle slopes to high runoff potential on steep slopes. Permeability is very slow to impermeable.

The Apison-Sunlight complex is an undifferentiated complex comprised of Apison and Sunlight soils. Apison soils are deep and formed in residuum of interbedded shale, siltstone, and fine-grained sandstone or in a layer of colluvium and the residuum on the crests, side slopes, foot slopes, and back slopes of uplands. Sunlight series soils are shallow and formed in residuum weathered from interbedded shaly siltstone, siltstone and sandstone on side slopes and narrow ridgetops. The Apison-Sunlight soil types are well drained with permeability listed as slow to impermeable. The Apison-Sunlight complex has medium to high runoff potential depending on slope. The slopes range from 5 to 60 percent in the assessment area.

Colbert-Lyerly-Rock outcrop complex is an undifferentiated complex comprised of the Colbert and Lyerly soils formed on upland hillslopes. The complex consists of Colbert and similar soils (25 to

50 percent) and Lyerly soils (30 to 36 percent) with 20 to 25 percent rock outcrop. Colbert soils form on argillaceous limestone or shaly limestone while Lyerly soils formed from limestone. These soils are moderately deep to deep and moderately well drained with very high runoff. Permeability is listed as very slow to impermeable. Slopes range from 5 to 20 percent.

Collegedale silt loam consists of very deep, well drained soils with moderately slow permeability and slow to high runoff. These soils were formed in material weathered from limestone or limestone interbedded with shale on upland ridges. Slopes range from 2 to 20 percent in the Facility area.

The Townley silt loam consists of moderately deep, well drained, impermeable soils on upland ridgetops and side slopes. These soils formed in clayey residuum weathered from shale or interbedded sandstone and shale. Slopes range from 5 to 20% with very high runoff.

The Capshaw silt loam consists of deep and very deep, moderately well drained soil on stream terraces, in depressions and on upland flats. The soil formed in a thin layer of loess or old alluvium and in the underlying clayey residuum. The Capshaw silt loam is listed as impermeable. Slopes range from 2 to 5 percent with low to medium runoff.

The Etowah series is a silt loam consisting of very deep, well drained, moderately permeable soils on high stream terraces, alluvial fans and foot slopes with low to medium runoff. These soils were formed in alluvium or colluvium that is commonly underlain by limestone residuum. The slopes range from 0 to 35 percent.

Hamblen silt loam consists of very deep soils on flood plains with slopes ranging from 0 to 3 percent. These soils formed in loamy alluvium from watersheds dominated by limestone, sandstone and shale. Hamblen silt loam soils are moderately well drained, have moderate permeability, and have negligible runoff.

Waynesboro silt loam consists of very deep, well drained, moderately permeable soils that formed in old alluvium or unconsolidated material of sandstone, shale, and limestone origin. Slopes range from 6 to 25 percent.

The distribution of the various soil types is shown on Figure 3-20.

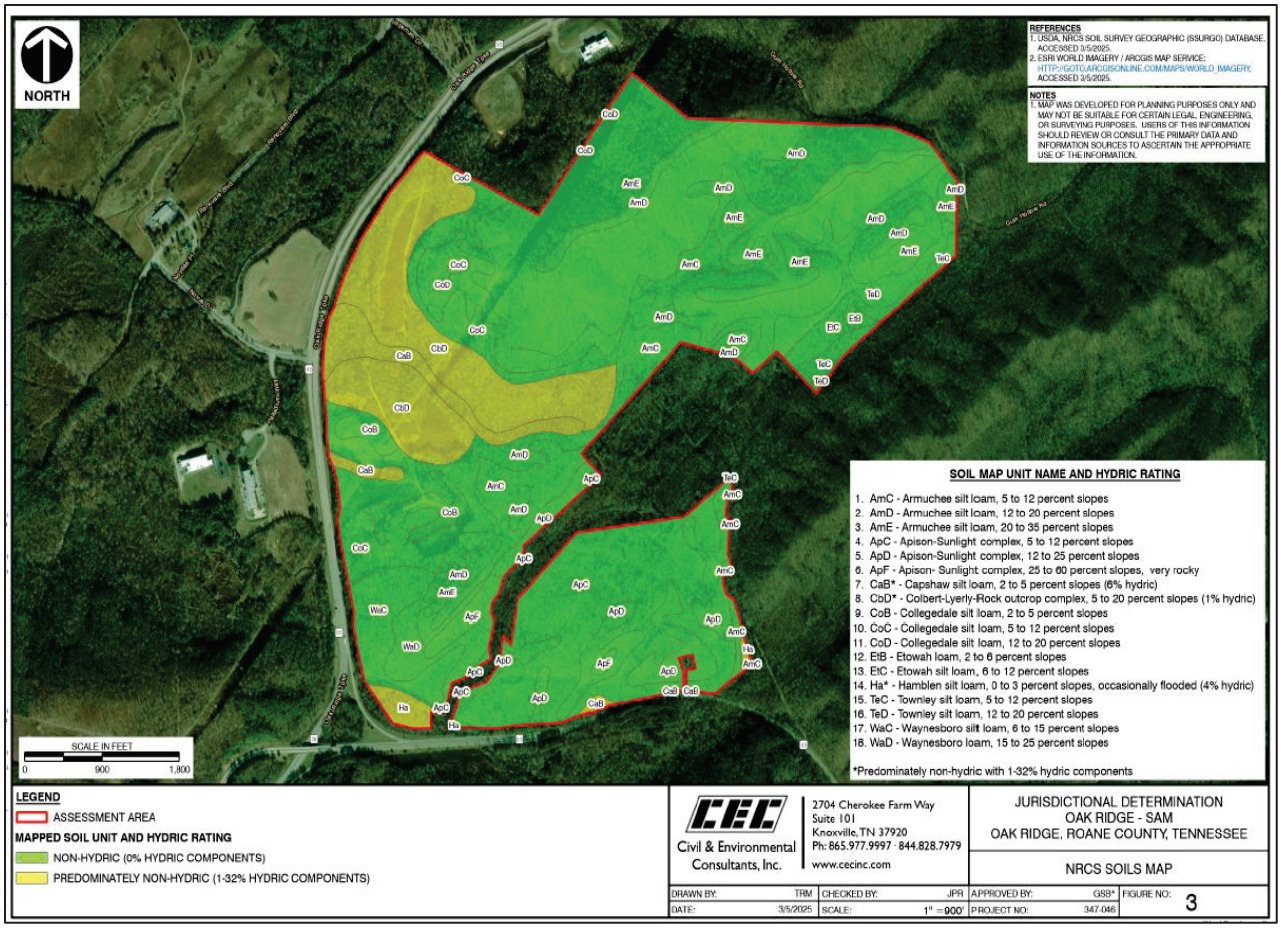



**Figure 3-20: NRCS Soil Map (CEC 2025)**

### 3.3.4 MINERAL RESOURCES

According to the Tennessee Geological Survey (TGS), which is part of the Tennessee Department of Environment and Conservation (TDEC), the State has a history of mining more varieties of mineral resources than any other State east of the Mississippi River, except North Carolina, dating back to the late 18th century. Tennessee's non-fuel mineral production includes Portland cement, sand and gravel, stone, zinc, and ball clay. Non-fuel mineral products valued at more than $1.5 billion were produced in 2018, creating more than 48,600 jobs and direct and indirect economic impacts of $3.8 billion. Tennessee also has coal, oil, natural gas, oil shale, and radioactive minerals deposits. Only coal, oil, and natural gas are currently being recovered, with a total production value in 2018 of $44.8 million (TDEC 2020).

### 3.3.5 NON-FUEL MINERAL PRODUCTION

The Site is capable of producing crushed stone, however, there are no producers within the Roane County (USGS 2014).

### 3.3.6 COAL, OIL, AND GAS

Current coal production includes bituminous coal from 22 counties in the Cumberland Plateau and Cumberland Mountains regions, which includes a slight portion of western Roane County (TDEC 2020). There is currently no coal, oil, or gas production in the Horizon Center Site (HCS) site Region (EIA 2025).

### 3.3.7 GEOTECHNICAL EVALUATION

The following sections summarize site geotechnical conditions including slope stability, foundation recommendations, and potential geological hazards (e.g., liquefaction) (Kiewit 2025a). The information is based on fieldwork completed at the site and includes the following:

- Twenty-seven (27) exploratory borings with Standard Penetration Tests (Figure 3-11). Ten (10) boring locations had offset holes for additional sampling collection
- Twenty-two (22) thin-walled (Shelby) tube samples
- Geophysical surveys including fourteen (14) Seismic Refraction Tomography (SRT) profiles and four (4) Surface Wave Surveys. Surface Wave Surveys were a combination of the active Multi-Channel Analysis of Surface Waves and passive Microtremeor Array Measurements methods.

#### 3.3.7.1 Site Topography

Topographically, the East Fork Ridge oriented northeast to southwest rises from approximately 770 feet AMSL along the western portion of the proposed building foundation to approximately 870 feet AMSL at the northeastern portion of the building foundation. The topographic elevation rises to over 1,100 feet AMSL immediately northeast of the Facility as shown in Figure 3-21.

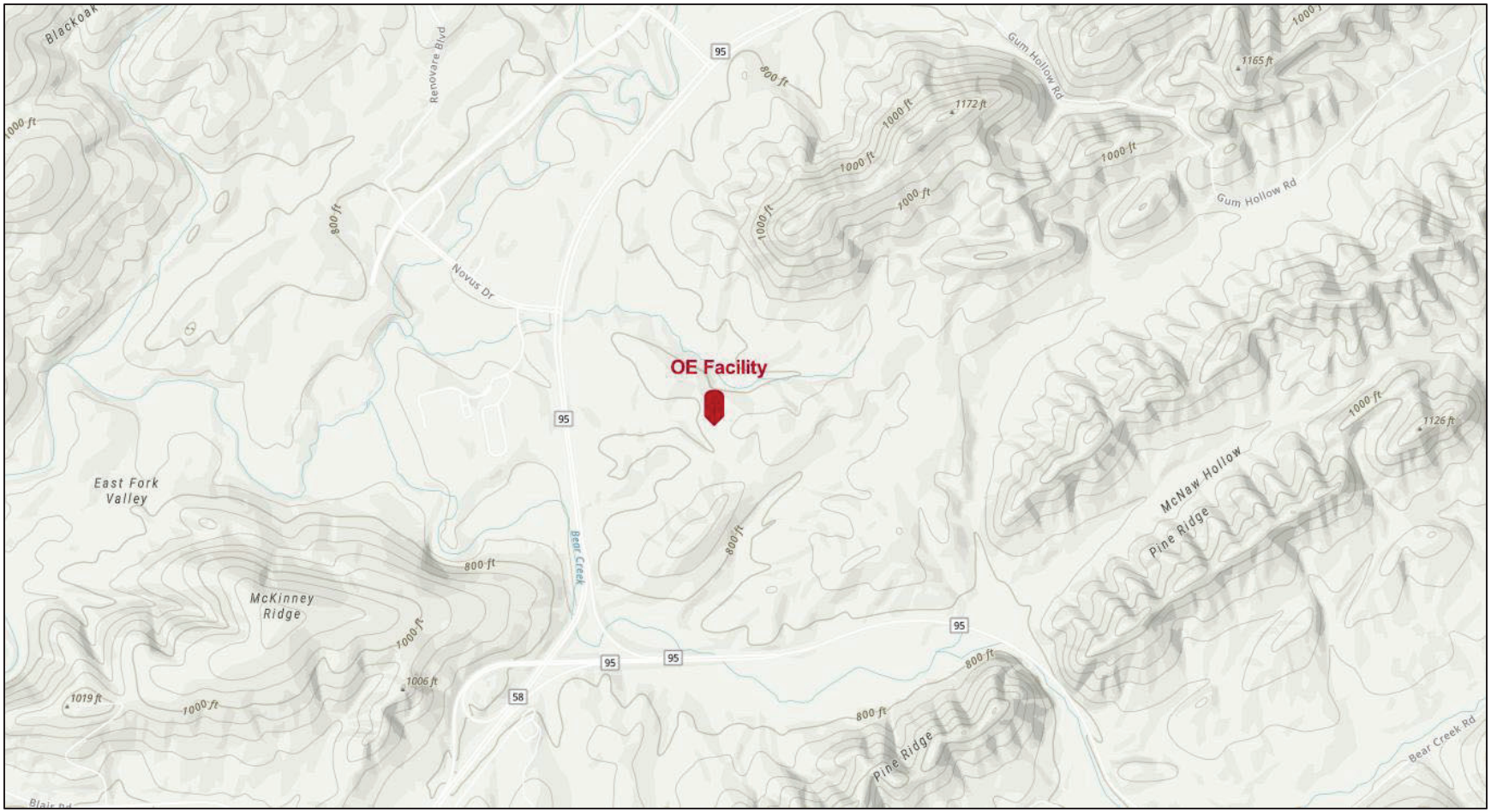



**Figure 3-21 Topography within 2mi of Facility**

### 3.3.7.2 Slope Stability

#### 3.3.7.2.1 Earth Slope Stability Analysis

Slope stability analyses were completed during the geotechnical investigation for approximately 50 feet tall, 3H:1V fill slope proposed on the south side of the project where the existing valley will be filled (Kiewit 2025a). Based on the established correlation between friction angle and soil plasticity index, the friction angle for the onsite clay is estimated to range between 25 and 30 degrees. To maintain a conservative approach in the slope stability analysis, the lower bound values of the friction angle were adopted. Groundwater was assumed at the soil and bedrock interface. Based on these analyses, the proposed embankment outslope of 3H:1V has a calculated factor of safety greater than 1.5. No other slope stability concerns were identified based on existing site conditions and proposed site grading.

The following recommendations were made based on the geotechnical analyses:

- Embankment slopes constructed of compacted soil should be 3H:1V.
- Diversion berms or swales should be installed at the top of slopes to divert runoff water away from the slope faces. Loading conditions (vehicular, staged equipment, structures, etc.) should be kept at least 10 feet from the top of fill slopes. Temporary slope stability requirements will need to be established for project specific construction equipment to prevent fill slope instability during material placement and compaction.
- Fill slope construction should include subgrade evaluation and improvements under the observation of a representative of the Geotechnical Engineer. Unsuitable soils and unstable subgrade may require over-excavation and replacement.
- Drainage should be installed in all fill slopes where springs are encountered to intercept and direct water through the embankment without loss of embankment material. This could include hard piping through the embankment to discharge through a headwall or construction of a durable rock drainage blanket to prevent build-up of hydrostatic pressure within the embankment that could impact the stability of the embankment.
- Where fill is placed on existing slopes steeper than 5H:1V, the existing slope will be benched with minimum 8 feet wide benches as the fill is placed to key the fill into the existing slope.

#### 3.3.7.2.2 Rock Cut Slope Stability Analysis

Based on the initial geotechnical analyses, rock cut slopes in limestone should be sloped to 0.25H:1V with a 15 feet wide intermediate bench every 40 feet vertically (Kiewit 2025a). Permanent rock cut slopes in the Reedsville Shale and Rome Formation shale should be sloped at 1H:1V with a 15 feet wide intermediate bench every 30 feet vertically. Use a 10-feet wide overburden bench at the top of all rock cuts. These slope configurations may change once a supplemental geotechnical exploration is performed that includes rock core borings in the planned cuts.

### 3.3.7.3 Fill Placement and Compaction

#### 3.3.7.3.1 Structural Soil Fill

Structural soil fill defined as all fill that will be subjected to structural loads such as those imposed by foundations, storage pads and roadways (Kiewit 2025a). These materials shall

- be free of organic and inorganic trash and debris
- frost or frozen material
- not contain particles greater than three (3) inches in any dimension.

Clay fill shall also have a dry unit weight greater than 90 pounds per cubic foot. Soil fill will be placed in horizontal layers not exceeding 8 inches loose lift thickness. Each lift will be compacted to at least 98 percent of the standard Proctor maximum dry density (ASTM 2021). Moisture control is dictated by the individual Proctor curves but was assumed to be plus or minus 3 percent of the standard Proctor optimum moisture content.

Where supporting slabs on grade, sidewalks, pavement and shallow foundations, the structural clay fill within five feet of the finished grade elevation will have a Plasticity Index less than or equal to 35 (PI<35), as determined by ASTM D4318 or be lime-treated to reduce the soil plasticity and swell potential. This requirement may be waived if additional testing during the supplemental geotechnical exploration determines the swell pressure of the compacted fat clay is less than the applied load of the slab on grade, sidewalk, pavement or shallow foundation. The native clay overburden soils generally have a PI greater than 35, but less than 50 which makes it suitable for reuse as structural fill if placed greater than five feet below finished grade.

#### 3.3.7.3.2 Structural Granular Fill

Structural granular fill is defined as all non-degradable granular fill that will be subjected to structural loads such as those imposed by foundations and roadways (Kiewit 2025a). These materials will be free of organic and inorganic trash and debris, frost or frozen material, and will not contain particles greater than three (3) inches in any dimension and less than ten (10) percent fines passing the #200 sieve. This material includes processed non-degradable (durable) limestone shot-rock and non-degradable limestone imported from a quarry. It does not include the degradable (non-durable) shales from the Reedsville Shale or the Rome Formation.

- Place clean non-degradable structural granular fill in loose lifts no thicker than 12-inches.
- Place in a manner that prevents nesting and results in voids being filled with smaller rock fragments to form a dense and compact mass.
- Rock materials shall not be dumped into its final position but shall be spread by blading and dozing in a manner that will minimize voids, pockets, and bridging.
- Each layer shall be leveled over the entire lift area and compacted with a CAT 815 or 825 or similar compactor with an operating weight of at least 45,000 pounds. The rubber-tired construction equipment should vary their haul path across the fill to promote compaction.
- Water may be needed to reduce dust during the compaction process.
- Tennessee DOT-approved materials, such as Type A aggregate and Grading D, may be used as structural granular fill to ensure compliance with local specifications.

#### 3.3.7.3.3 General Soil Fill

Defined as fill placed over relatively large open areas to raise the overall grade and will not support structures or pavement (Kiewit 2025a). These materials will be free of organic and inorganic trash and debris, and frost or frozen material. The material will not contain particle sizes greater than three (3) inches. Fine-grained native soils not suitable for use as structural fill may be utilized as general fill. These soils may require additional moisture control during placement and compaction.

- Place soil fill in horizontal layers not exceeding eight inches loose lift thickness.
- Compact each lift to at least 98 percent of the standard Proctor maximum dry density (ASTM 2021).
- Moisture control is dictated by the individual Proctor curves but for now assume plus or minus 3 percent of the standard Proctor optimum moisture content.

#### 3.3.7.3.4 General Granular Fill

Defined as fill placed over relatively large open areas to raise the overall grade and will not support structures or pavement (Kiewit 2025a). These materials shall be free of organic and inorganic trash and debris, frost or frozen material, and shall not contain particles greater than eight (8) inches in any dimension and less than twenty (20) percent soil fines passing the #200 sieve. This material includes processed and unprocessed non-degradable (durable) limestone shot-rock and nondegradable limestone imported from the quarry. It does not include the degradable (non-durable) shales from the Reedsville Shale or the Rome Formation

- Place clean non-degradable shot-rock fill in loose lifts no thicker than 24-inches.
- Place in a manner that prevents nesting and results in voids being filled with smaller rock fragments to form a dense and compact mass.
- Rock materials will not be dumped into its final position but will be spread by blading and dozing in a manner that will minimize voids, pockets, and bridging.
- Each layer will be leveled over the entire lift area and compacted with a CAT 815/ 825 or similar compactor with an operating weight of at least 45,000 pounds. The rubber-tired construction equipment should vary their haul path across the fill to promote compaction.

#### 3.3.7.3.5 General Shale Fill

Defined as fill placed over relatively large open areas to raise the overall grade and will not support structures or pavement (Kiewit 2025a). These materials will be free of organic and inorganic trash and debris, frost or frozen material, and will not contain particles greater than eight (8) inches in any dimension. The General Shall Fill is comprised of the degradable (non-durable) shales from the Reedsville Shale and/ or the Rome Formation. The shale will be mechanically broken down by successive wetting, blading, and discing until it reaches the consistency of soil. Each layer will be leveled over the entire lift area and compacted with a CAT 815 or similar compactor with an operating weight of at least 45,000 pounds.

### 3.3.8 ENVIRONMENTAL INVESTIGATIONS AT THE SITE AND VICINITY

The SSP-2 parcel and vicinity were investigated as part of the East Fork Ridge/White Wing investigations during an Environmental Baseline Survey Report completed in 2013. The study identified no evidence of past activities involving hazardous substances at the Site and recommended no further investigation at the site. Prior to the Environmental Baseline Study, a recommendation of no further investigation of soils was also determined during footprint reduction studies in 1997 (DOE 2013).

Remediation is under way for a neighboring property (White Wing Scrap Yard), but the Site (SSP-2A and SSP-2B) have been determined clean by the DOE and EPA based on the clean parcel transfer classification (DOE 2025).

## 3.4 WATER RESOURCES

The applicant indicates the regional water resource characterization for the TRISO-X Fuel Facility associated with the HCS in Roane County, TN is applicable to the OE Facility (NRC 2022). The regional ground water hydrogeology, ground water use, and groundwater quality described in section 3.4.1 of the TRISO-X Environmental Report which is incorporated by reference.

### 3.4.1 Groundwater Wells Within the Vicinity of Facility

Given the proximity of the proposed TRISO-X fuel fabrication facility to the Facility (approximately 1.0 mi between the two sites directly across Highway 95), information and data as compiled in the TRISO-X updated ER (NRC 2022) is used as a surrogate for Facility. The search area included the 3-mi radius from the TRISO-X Fuel Fabrication Facility (TRISO-X FFF) boundary (Figure 3-22).

Data sources used by TRISO-X include:

- Tennessee Department of Environment & Conservation,
- Oak Ridge Environmental Information System, and
- National Water Quality Monitoring Council's portal service for public access to Federal agencies (including United States Geologic Survey [USGS]) databases.

A supplementary search for the Facility site using the same 3-mi radius from the approximate center of the Site resulted in a total of 26 groundwater wells identified in the TDEC Database (NRC 2022):

- 18 were residential
- 1 was for irrigation
- 1 was for a heat pump
- 1 was noted as unknown
- 5 wells do not exist or have incorrect location data

These wells are located in Roane County. None of these wells, as listed in the TDEC database, are recorded as industrial or commercial water supply use.

While the search data does not include municipal wells, as those are considered confidential under Tennessee Code Annotated § 10-7-504 (a)(21)(A) and Tennessee Compilation Rules and Regulations 0400-01-01-.01(4)(c), it was confirmed by Annabelle Dempsey of TDEC via email communication that no public water supply wells exist within the area of the HCS. A single public supply wellhead protection area is partially included within the 3-mi. radius; however, that area was classified as inactive.

The closest residential wells to the Facility site based on the TDEC database are a cluster of residential wells approximately 1.2 mi east of the Facility; however, these wells are shown to be located on DOE property and the reported survey locations are likely in error (Figure 3-22). In addition, two residential wells included in the TDEC database were reportedly installed at coordinates within 0.08-mi. southwest of the HCS. Field reconnaissance to confirm the location of this well demonstrated that no wellhead, water service connections, power service, or any evidence of a former well casing were present. It was concluded that the recorded coordinates for this well were erroneous and no wells were present at this location. Therefore, the closest well to the Facility site is a residential well at 1.9 mi. northwest. This well is developed within the Poplar Creek Valley, which is separated from the Site by Blackoak Ridge.

The well search of the Oak Ridge Environmental Information System (OREIS) and USGS databases (identified 952 groundwater monitoring and observation wells within the search radius. These wells are associated with the adjacent DOE facilities, Y-12 National Security Complex and East Tennessee Technology Park (ETTP, former K25 Plant), as well as parts of the general area defined as the ORR (NRC 2022). Well locations included:

- 484 at ETTP
- 249 on the ORR
- 215 at Y-23
- 4 listed as offsite locations

Of these DOE facility-related wells, eight are also associated with the USGS Tennessee Water Science Center. Six of the eight USGS well co-serve as ETTP (former K-25) monitoring wells and two are also used as ORR monitoring wells.

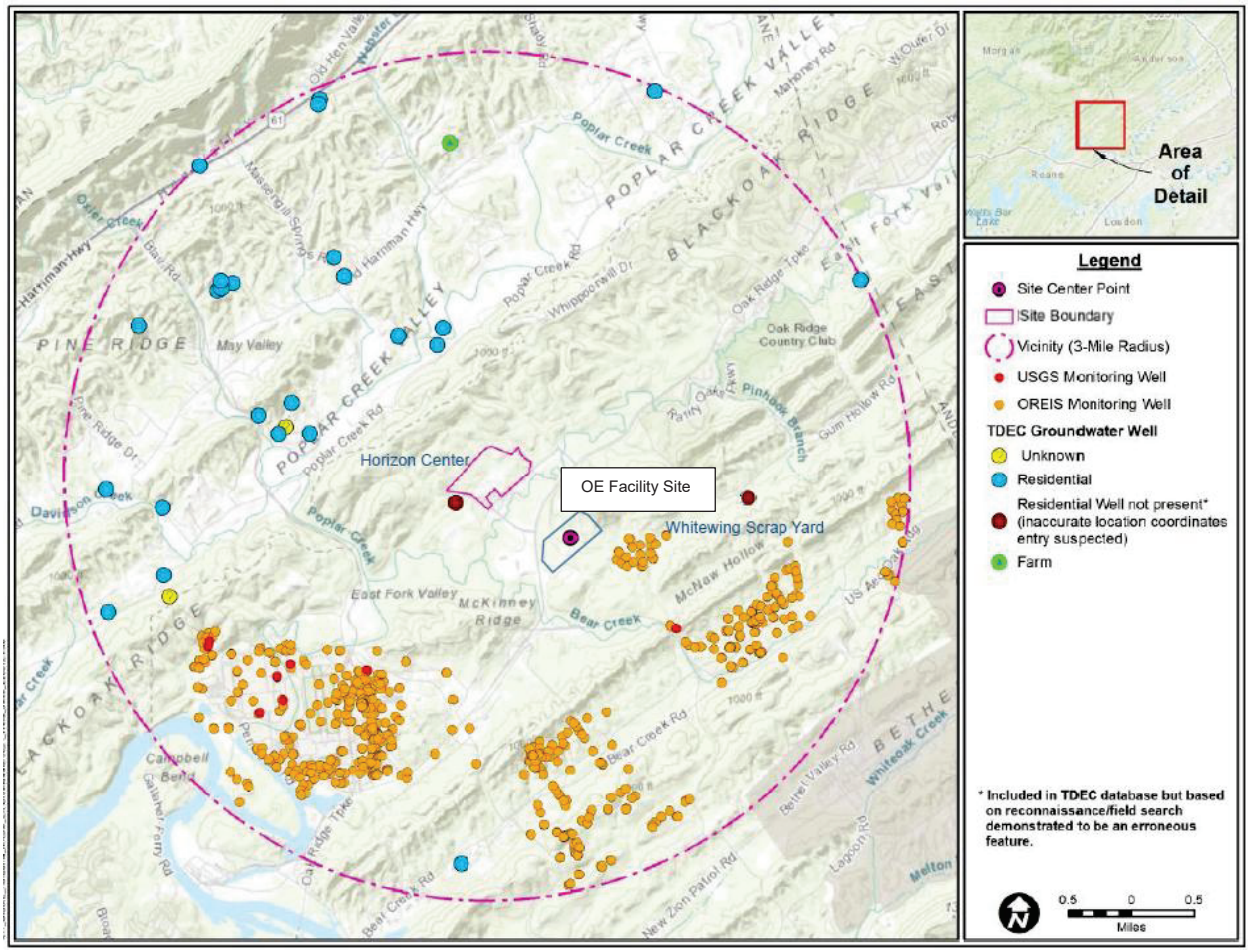



**Figure 3-22: Groundwater Wells in the Vicinity of the Facility from TRISO-X ER Figure 3.4.1-2 (NRC 2022)**

The monitoring wells located immediately east-southeast of the Facility are part of the National Priorities List (NPL) site (Whitewing Scrap Yard) where preexisting groundwater contamination exists. However, these locations are located hydraulically cross gradient and are within the Bear Creek Valley watershed.

### 3.4.1.1 Groundwater at the Facility

#### 3.4.1.1.1 Site Hydrogeology

Groundwater on the ORR occurs both in the unsaturated zone as transient, shallow subsurface storm flow and within the deeper saturated zone (ORNL 2006). An unsaturated zone of variable thickness separates the storm-flow zone and the water table. Adjacent to surface water features or in valley floors, the water table is found at shallow depths, and the unsaturated zone is thin. Along the ridge tops or near other high topographic areas, the unsaturated zone is thick, and the water table often lies at considerable depth (49 to 164 ft deep). In low-lying areas in which the water table occurs near the surface, the stormflow and saturated zones are indistinguishable (DOE 2025). Two broad hydrologic units have been identified on the ORR: (1) the Knox Aquifer, which includes the Maynardville Limestone and is highly permeable, and (2) the ORR aquitards, which consist of less permeable geologic units. The geologic regime referred to as the ORR

aquitards is comprised of bedrock and residuum of the Cambrian-age Rome Formation and Conasauga Group (excluding the Maynardville Limestone) and the Chickamauga Group. Bedrock included in these formations is predominantly clastic sediment (shales, siltstones, well-cemented sandstones, and clayey to silty limestones). The ORR aquitards include local zones in which groundwater occurs in quantities sufficient to provide a potential resource of limited use. These zones typically occur within karstic carbonate members of the clastic bedrock formations or in fractured bedrock. Although marginal localized groundwater resources occur within the ORR aquitards, these formations are far less important to regional water resources than is the Knox Aquifer (DOE 2025). The typical yield of a well in the aquitards is less than 1 gal/min , and the base flows of streams draining areas underlain by the aquitards are poorly sustained because of such flow rates. The water table at the ORR generally mimics topography with shallow groundwater flowing from higher topographic areas to the nearby surface water bodies. Based on this generalization, groundwater flow in the area of the Facility site would be controlled by the East Fork Ridge and the associated surface water drainages, and an unnamed ridge located between the Facility site and the White Wing Scrap Yard. This unnamed ridge serves as a groundwater divide between the Facility site and the White Wing Scrap Yard (WWSY) and is also the watershed boundary between the Poplar Creek Watershed and the Bear Creek Watershed (Figure 3-23). Topographic relief on the ORR is such that most active subsurface groundwater flow occurs at shallow depths (DOE 2025). U.S. Geological Survey modeling has suggested that 95% of all groundwater flow occurs in the upper 49 to 98 ft of the saturated zone in the ORR Aquitards. As a result, flow paths in the active-flow zones (particularly in the aquitards) are relatively short, and nearly all groundwater discharges to local surface water drainages on the ORR. For the Facility, groundwater is likely discharged to surface springs and drainages associated with East Fork Poplar Creek. Groundwater, if present, is interpreted to flow away from the topographic ridge to the northwest and southwest off of the East Fork Ridge and to the northwest off of an unnamed ridge to surface drainage swales before turning west towards East Fork Poplar Creek (Figure 3-23).

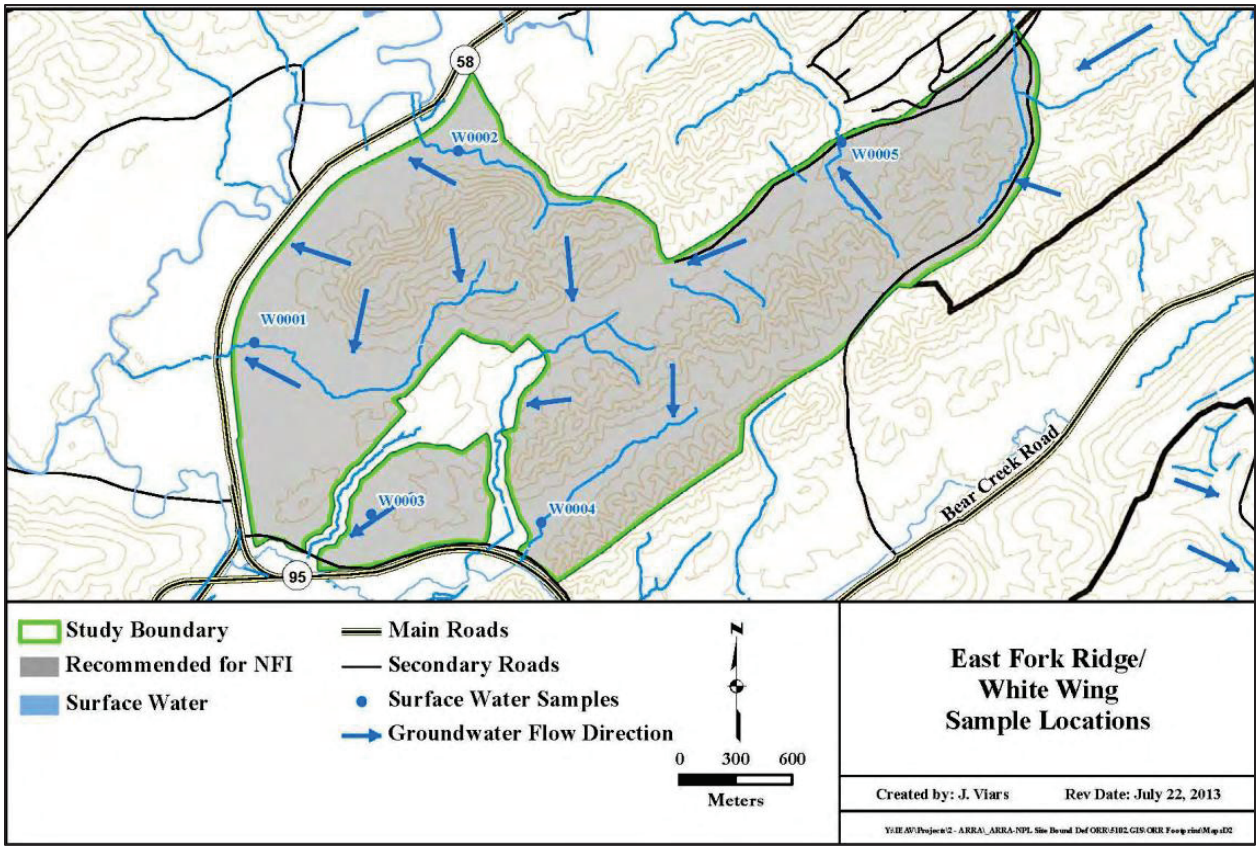



**Figure 3-23: Generalized Groundwater Flow in the Vicinity of the Facility (DOE 2025)**

This unnamed ridge, which demarcates the boundary between the Poplar Creek Watershed and the Bear Creek Watershed, is important not only in controlling surface runoff and groundwater flow within the Facility site but also restricting surface water and groundwater movement from the White Wing Scrap Yard into the Facility site. Based on review of published literature and on review of topographic maps, the general horizontal hydraulic gradient is away from the Facility site and onto adjacent properties.

Surface water and groundwater flow from the WWSY is likely limited to the ET3 and ET4 drainages, which are discharge points for groundwater and are adjacent property to the Facility boundary (Figure 3-23) Therefore, with respect to surface water as a transport mechanism, the potential for the migration of contaminants onto the Facility site from contaminated, off-site sources is not likely. Shallow groundwater flow from off-site sources (i.e., WWSY) will likewise flow to the ET-3 and ET-4 drainages from the surrounding areas (Figure 3-24). Deeper groundwater flow in bedrock is less certain due to complex flow paths through fractures, and solutionally enlarged features in the carbonates, located west and southwest of WWSY, but is anticipated to predominantly follow the geologic strike and regional gradient to the southwest from the WWSY. Groundwater sampling conducted in 2025 indicated that only arsenic in well 799 and trichloroethylene in well 1246 were detected above federal maximum contaminant levels (MCL) (Figure 3-24). Arsenic was detected at 0.017 milligram per liter (MCL of 0.010 milligram per liter). Trichlorethylene was reported at 18.2 micrograms per liter (MCL of 5 micrograms per liter). Trichloroethylene has historically been detected in well 1246 at concentrations ranging from approximately 24 to 58 micrograms per liter. In addition, trichloroethylene was previously reported

in well 1143 at concentrations ranging from approximately 5 to 20 micrograms per liter but was not detected in 2025. The groundwater contamination is bound laterally to the north, south and east by existing monitoring wells, indicating that groundwater is limited in extent in this area and does not impact the Facility site. Groundwater at the Whitewing Scrap Yard likely discharges to surface water drainages (ET-4) and associated springs in the area (UCOR 2025).

A potentiometric map for the White Wing Scrap Yard is shown in Figure 3-24 (DOE 2024b), and well information described in Table 3-5 (DOE 2024b).

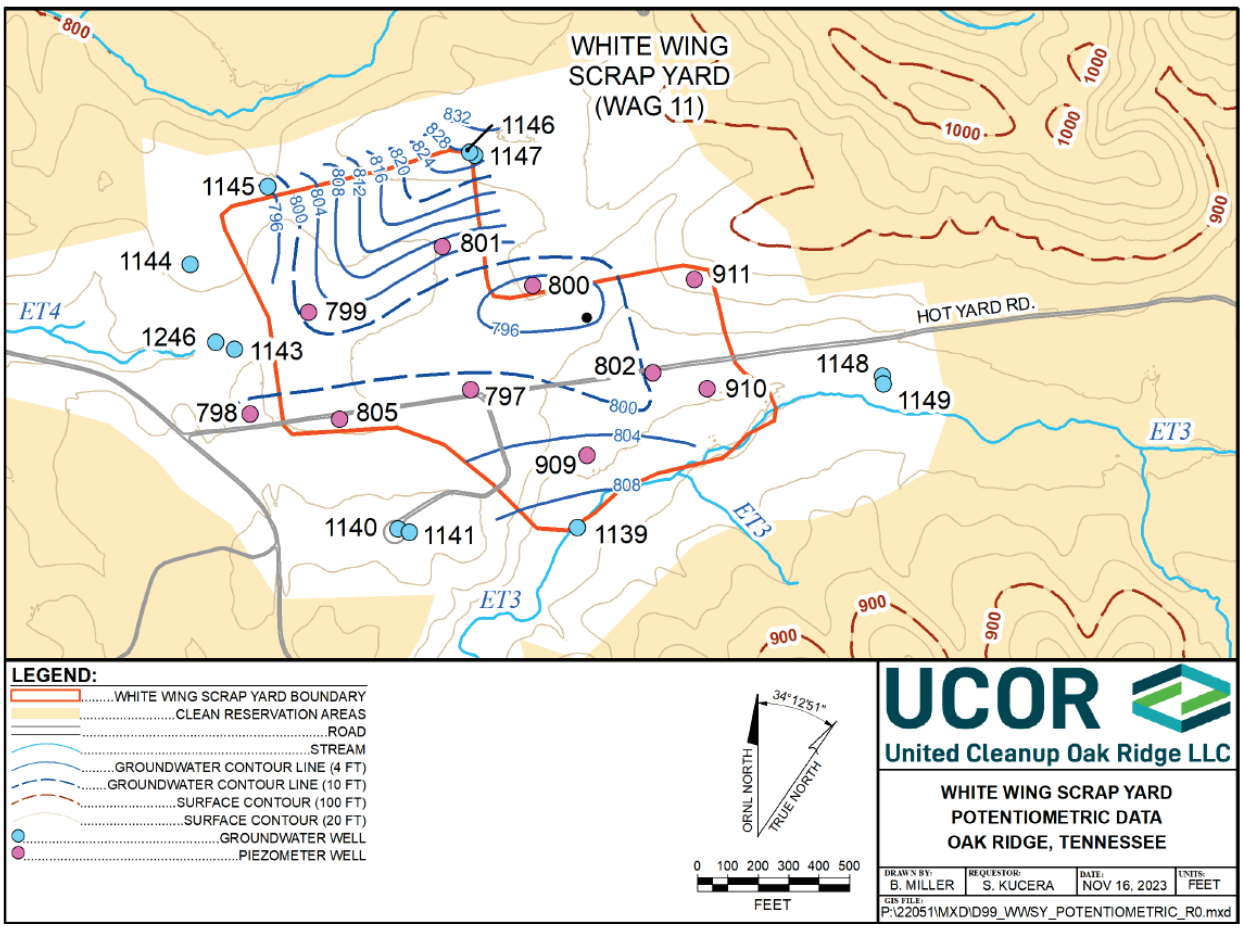



**Figure 3-24: Generalized Potentiometric Surface Beneath the White Wing Scrap Yard (DOE 2024b)**

## Table 3-5 White Wing Scrap Yard Well Summary

| Well identifier | Installation date | Coordinates | | Riser | Total depth (ft bgs) | Total depth elevation (ft amsl) | Top of screen (ft bgs) | Top of screen elevation (ft amsl) | Bottom of screen (ft bgs) | Bottom of screen elevation (ft amsl) | Bedrock (ft bgs) | Bedrock elevation (ft amsl) | Groundwater depth (ft bgs) | Groundwater elevation (ft amsl) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Y-12 Easting | Y-12 Northing | | | | | | | | | | | |
| 1139 | 01/22/90 | 28700.70 | 34507.97 | 2-in. SS | 33.5 | 780.8 | 7.8 | 806.5 | 32.8 | 781.5 | 33.5 | 780.8 | 5.1 | 809.2 |
| 1140 | 03/05/90 | 28111.21 | 34497.98 | 2-in. SS | 62.5 | 809.4 | 32.2 | 839.7 | 62.3 | 809.6 | 56.0 | 815.9 | 51.1 | 820.8 |
| 1141 | 02/14/90 | 28148.90 | 34488.64 | 4-in. SS | 97.5 | 775.1 | 82.2 | 790.4 | 97.2 | 775.4 | 58.0 | 814.6 | 58.3 | 814.3 |
| 1143 | 03/06/90 | 27569.56 | 35068.41 | 4-in. SS | 52.5 | 775.3 | 37.5 | 790.3 | 52.2 | 775.6 | 27.5 | 800.3 | 24.8 | 803.0 |
| 1144 | 02/15/90 | 27421.61 | 35339.33 | 4-in. SS | 122.3 | 723.9 | 102.1 | 744.1 | 122.1 | 724.1 | 39.1 | 807.1 | 21.1 | 825.1 |
| 1145 | 01/15/90 | 27674.96 | 35589.35 | 2-in. SS | 59.1 | 785.2 | 38.0 | 806.3 | 58.9 | 785.4 | 59.1 | 785.2 | 52.3 | 792.0 |
| 1146 | 02/27/90 | 28337.71 | 35704.20 | 4-in. SS | 132.5 | 742.6 | 107.1 | 768.0 | 117.1 | 758.0 | 38.0 | 837.1 | 79.4 | 795.7 |
| 1147 | 01/29/90 | 28354.41 | 35696.50 | 4-in. SS | 97.9 | 777.3 | 77.7 | 797.5 | 97.7 | 777.5 | 39.5 | 835.7 | 82.1 | 793.1 |
| 1148 | 03/01/90 | 29698.70 | 35000.42 | 4-in. SS | 67.5 | 763.5 | 52.2 | 778.8 | 67.2 | 763.8 | 16.0 | 815.0 | 9.5 | 821.5 |
| 1149 | 03/01/90 | 29702.28 | 34973.56 | 2-in. SS | 35.0 | 795.4 | 17.5 | 812.9 | 32.5 | 797.9 | 12.5 | 817.9 | 10.2 | 820.2 |
| 1246 | 09/26/90 | 27507.53 | 35090.06 | 2-in. SS | 86.63 | 739.3 | 56.4 | 769.5 | 71.4 | 754.5 | 22.5 | 803.4 | 31.5 | 794.4 |
| 797 | 12/24/86 | 28376.36 | 34947.52 | 2-in. PVC | 60.0 | 790.7 | 50.0 | 800.7 | 60.0 | 790.7 | 57.0 | 793.7 | 49.51 | 801.14 |
| 798 | 12/29/86 | 27651.88 | 34866.72 | 2-in. PVC | 47.0 | 796.7 | 37.0 | 806.7 | 47.0 | 796.7 | 24.0 | 819.7 | 43.11 | 800.57 |
| 799 | 12/31/86 | 27842.50 | 35193.10 | 2-in. PVC | 35.0 | 793.9 | 25.0 | 803.9 | 35.0 | 793.9 | -- | -- | 25.96 | 802.89 |
| 800 | 12/30/86 | 28578.86 | 35280.77 | 2-in. PVC | 73.0 | 789.8 | 63.0 | 799.8 | 73.0 | 789.8 | 72.0 | 790.8 | 68.58 | 794.25 |
| 801 | 12/30/86 | 28282.09 | 35403.98 | 2-in. PVC | 39.0 | 802.5 | 29.0 | 812.5 | 39.0 | 802.5 | 33.0 | 808.5 | 35.49 | 805.98 |
| 802 | 12/31/86 | 28974.64 | 35004.40 | 2-in. PVC | 49.9 | 783.0 | 34.9 | 798.0 | 49.9 | 783.0 | -- | -- | 32.91 | 800.02 |
| 803 | 12/31/86 | 27700.93 | 35546.79 | 2-in. PVC | 50.0 | 794.1 | 40.0 | 804.1 | 50.0 | 794.1 | 50.0 | 794.1 | Dry | Dry |
| 804 | 12/31/86 | 28351.59 | 35766.70 | 2-in. PVC | 79.0 | 797.1 | 69.0 | 807.1 | 79.0 | 797.1 | 74.0 | 802.1 | 44.62 | 831.50 |
| 805 | 02/26/87 | 27946.23 | 34851.31 | 2-in. PVC | 60.0 | 777.4 | 32.0 | 805.4 | 47.0 | 790.4 | -- | -- | 35.53 | 801.86 |
| 907 | 02/27/87 | 28301.34 | 34632.21 | 2-in. PVC | 75.0 | 783.4 | 54.0 | 804.4 | 74.0 | 784.4 | 72.0 | 786.4 | 51.76 | 806.61 |
| 908 | 02/27/87 | 28711.27 | 34521.08 | 2-in. PVC | 24.0 | 789.2 | 12.0 | 801.2 | 22.0 | 791.2 | 24.0 | 789.2 | 3.84 | 809.40 |
| 909 | 02/27/87 | 28759.86 | 34738.48 | 2-in. PVC | 24.0 | 799.1 | 14.0 | 809.1 | 24.0 | 799.1 | 24.0 | 799.1 | 16.98 | 806.08 |
| 910 | 02/27/87 | 29153.50 | 34953.80 | 2-in. PVC | 29.0 | 793.0 | 18.0 | 804.0 | 28.0 | 794.0 | 8.0 | 814.0 | 21.60 | 800.40 |
| 911 | 03/19/87 | 29109.59 | 35303.06 | 2-in. PVC | 102.0 | 764.1 | 82.0 | 784.1 | 102.0 | 764.1 | 27.0 | 839.1 | 65.36 | 800.76 |

-- = not available

amsl = above mean seal level
bgs = below ground surface
PVC = polyvinyl chloride
SS = stainless steel
WWSY = White Wing Scrap Yard

Source: (DOE 2024b)

The Facility site is located in the Chickamauga Formation, which as previously noted, is considered an aquitard because of its low permeability (ORNL 2006). The Facility site is approximately 3.0 miles northwest of a source water protection area for groundwater in Bethel Valley (DOE 2020a).

#### 3.4.1.1.2 Groundwater Elevations and Levels

Groundwater monitoring wells have not been installed at the Facility. However, observations during geotechnical drilling indicated that groundwater was absent during the time of drilling (November 2024 through February 2025) (Kiewit 2025a). Geotechnical borings completed at the Facility site ranged in depth from approximately 15 feet to 90 feet below ground surface during three phases of drilling. Groundwater was not encountered in any of the Phase 2 and Phase 3 borings. which were completed within the area of the Facility site. The elevation of the bottom of the borings ranged from approximately 735 to 793 feet AMSL, indicating that groundwater, if present, is well below the planned building grade of 825 feet AMSL. Groundwater was encountered during Phase I drilling in one boring (boring B-02-SE at a depth of 30.2 feet below ground surface) and was suspected in a second boring (B-03-SE) based on caving of the borehole at 20.3 feet below ground surface. However, both borings are located well outside the Facility site in the vicinity of the Whitewing Scrap Yard. The lack of onsite monitoring wells precludes the use of dye tracing and calculation of groundwater velocities. In addition, wells installed at the Whitewing Scrap Yard adjacent to the Site are installed in the Rome Formation and are not pertinent to groundwater within the formations of the Chickamauga Group at the Facility.

The lack of groundwater encountered during the geotechnical investigation indicates that groundwater was not present at the Site in the shallow subsurface during drilling (Kiewit 2025a). It should be noted that the borings were completed during the winter wet season when groundwater levels are typically higher due to lack of evapotranspiration. Typically, in this region perched groundwater is present along the top of rock after a period of precipitation. Over a few days the perched water migrates down through the fractures in the bedrock to the stable groundwater table deep into the bedrock or seeps into surface drainage channels through springs.

The perched groundwater fluctuates with the seasonal precipitation, higher in the spring and lower in the summer (Kiewit 2025a). The movement of perched groundwater usually follows the dip of the bedrock. Upgradient recharge area(s) will affect the amount and duration of perched groundwater during construction. It is anticipated that water during construction is perched water associated with rainfall events. The stable groundwater table will not be encountered during grading. Excavations into bedrock along the northeast portion of the Facility site may encounter water especially after rainfall events, given the amount of bedrock proposed to be removed in this area. Water will flow into the excavations through the fractures and bedding planes in the bedrock. The inflow will diminish over time until the next rainfall event where the recharge will generate a new volume of construction water. Dewatering using sumps and pump, and ditches is the most productive method to manage construction water. Dewatering using wellpoints or pumping wells is not an efficient method as these elements would have to intersect a fracture in the rock to be productive.

#### 3.4.1.1.3 Groundwater Use

As previously noted, 26 groundwater wells were identified within the vicinity of the Facility site. The majority of these wells are located in Roane County. None of these wells as listed in the TDEC database is recorded as industrial or commercial water supply use. Further, no public water supply wells exist within the Facility area. The well search of the OREIS and USGS databases identified 952 groundwater monitoring and observation wells within the search radius (NRC 2022). These wells are associated with the adjacent DOE facilities - Y-12 National Security Complex and East Tennessee Technology Park (ETTP, former K25 Plant) as well as parts of the general area defined as the ORR and are not potable water sources.

### 3.4.2 SURFACE WATER HYDROLOGY

#### 3.4.2.1 Regional Hydrology

The Facility site is located within the Valley and Ridge physiographic province. The Facility is located within the East Fork Valley, a valley between two parallel ridges, Blackoak Ridge on the north and East Fork Ridge to the south (Figure 3-23). East Fork Poplar Creek (EFPC) flows southwesterly through this valley and is just west of the Facility site and just east of the TRISO-X facility. The Facility and the EFPC channel are separated by Highway 95. The EFPC drainage area at the Novus Drive crossing location near the southwestern end of the TRISO-X site is 20.38 sq. mi. The EFPC watershed extends to the northeast and encompasses much of the western portion of the City of Oak Ridge. EFPC is a tributary to Poplar Creek, which flows southwesterly in the valley north of East Fork Valley and Blackoak Ridge. The EFPC confluence with Poplar Creek is located southwest of Facility. Poplar Creek is a tributary to the Clinch River at Clinch River Mile 12.0 above the Tennessee River and Watts Bar Lake. Numerous small tributaries drain to EFPC from the ridges along the East Fork Valley. Named tributaries to EFPC identified on USGS quadrangle maps near the Facility include Gum Hollow Branch and Pinhook Branch upstream of the Facility as well as Bear Creek downstream of the Facility. Bear Creek flows southwesterly in the valley south of the East Fork Valley and cuts through Pine Ridge to flow into EFPC southwest of the Facility.

The EFPC headwaters are located west of the Facility and in the City of Oak Ridge. The upper reaches of the EFPC watershed consist predominantly of developed land such as residential subdivisions and commercial development, particularly near the center of Oak Ridge (USGS 2025a). The downstream portion of the watershed is substantially less developed and is mostly wooded.

As noted in Section 3.6, the annual average precipitation near the Facility is approximately 55.8 in., and average snowfall is approximately 5.7 in. Evapotranspiration, the amount of water transferred from the land and water surface to the atmosphere by evaporation and plant transpiration, has been estimated for the Oak Ridge area to be approximately 29 to 30 in. The difference in annual precipitation and evapotranspiration, approximately 21 to 22 in, is the amount of water in combined surface runoff and the net flow to groundwater.

Numerous USGS streamflow monitoring stations are located near the Facility, including a station on EFPC just upstream of the Facility that is no longer active; however, no streamflow data exist at the Facility for the small surface drainages flowing directly onto the Facility (Figure 3-25).

### 3.4.2.2 Local Hydrology

The Facility is located adjacent to East Fork Ridge to the northeast (Figure 3-25). Topographically, the East Fork Ridge oriented northeast to southwest rises from approximately 770 feet AMSL near Highway 95 to over 1,100 feet AMSL immediately northeast of the Facility. A smaller unnamed ridge parallel to the East Fork Ridge provides a boundary between the Facility site and the Whitewing Scrap Yard. It is this smaller ridge that separates the two main watersheds in the area – the East Fork Poplar Creek Watershed and the Bear Creek Watershed. Surface water discharge within the Facility falls within the East Fork Poplar Creek Watershed with all drainage to the East Fork Poplar Creek. East Fork Poplar Creek flows southwesterly through a valley along the eastern side of the Facility This watershed divide separates surface drainage the Facility site from that of the Whitewing Scrap Yard. This essentially limits the potential for any potential contamination from the Whitewing Scrap Yard entering the Facility site.

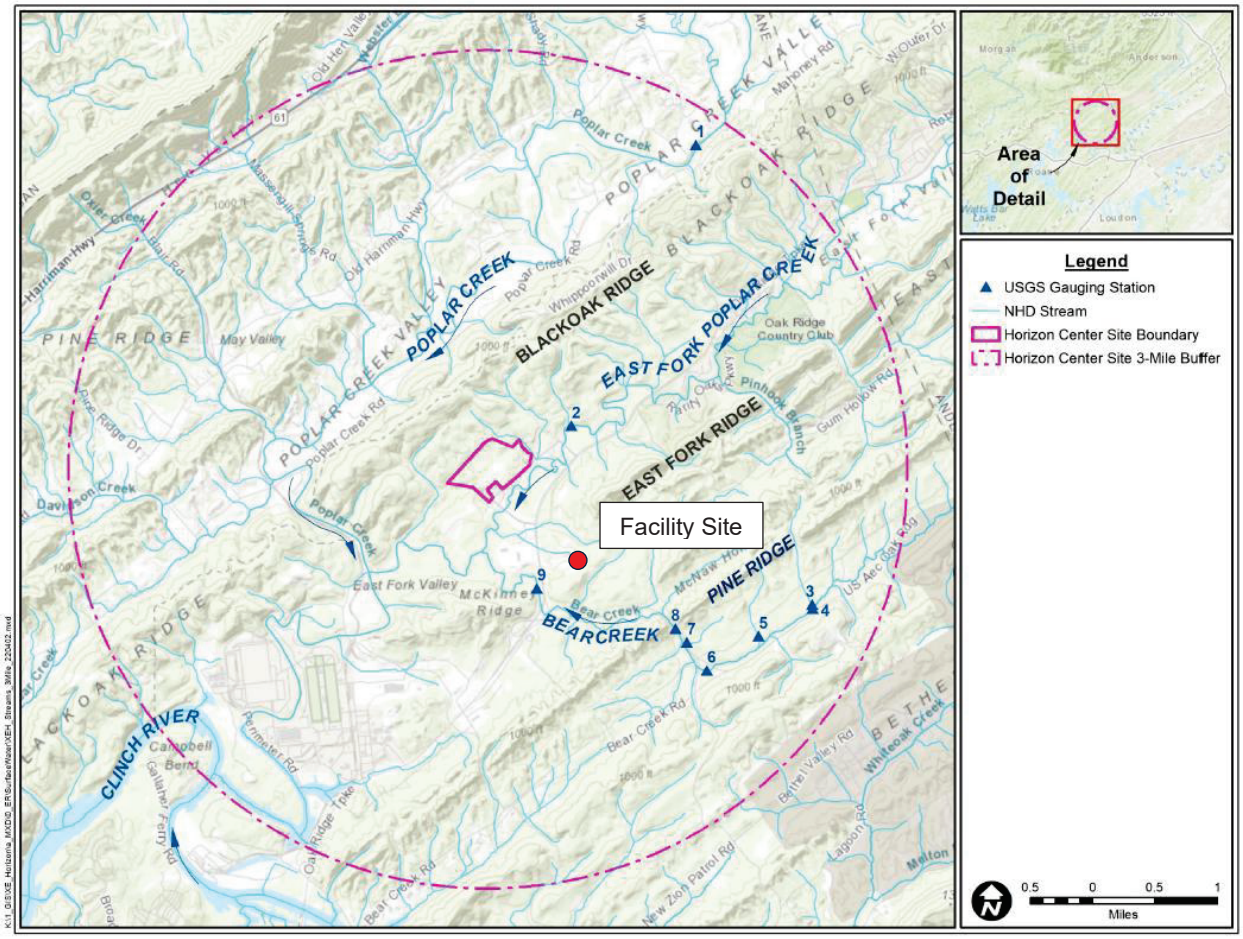



**Figure 3-25: Streams and Topography in the Vicinity of the site (NRC 2022)**

The Facility and the East Fork Poplar Creek channel are separated by the Highway 95. The East Fork Poplar Creek drainage area at the Novus Drive crossing west of the Facility is 20.38 sq. mi. The EFPC watershed extends to the northeast and encompasses much of the western portion of the City of Oak Ridge. East Fork Poplar Creek is a tributary to Poplar Creek, which flows southwesterly in the valley north of East Fork Valley and Blackoak Ridge. The EFPC confluence with Poplar Creek is located southwest of Facility. Poplar Creek is a tributary to the Clinch River

at Clinch River Mile 12.0 above the Tennessee River and Watts Bar Lake. Bear Creek flows southwesterly in the valley south of the Facility and flows into EFPC. Whitewing Scrap Yard drainages ET-3 and ET-4 feed into Bear Creek in the Bear Creek Watershed.

#### 3.4.2.2.1 Water Usage

Water use information has been developed by the USGS and water use data at the State and the county levels through the year 2015 have been made publicly available through the USGS National Water Information System Web Interface. A further breakdown of water use by public water supply organizations and by other basic types of users (e.g., self-supplied industrial) is available for the year 2010 from and is included in the summary below.

In the five-county area around the Facility (Roane, Knox, Loudon, Anderson, and Morgan Counties), the public water supply source is primarily derived from surface water. In 2015, the last year with available data, the five-county total public water supply provided by 24 public water providers from surface water sources was 91.99 million gallons per day (MGD), which was 97 percent of the total public water supply withdrawal with the remainder coming from groundwater sources. Streams flow generally to the southwest in this five-county area to the Tennessee River and Watts Bar Lake, which flows westerly, and only two of the 24 local public water providers, the Kingston Tennessee River water plant and the Rockwood Water System, use water withdrawn from stream locations hydrologically downstream of the Facility and in Roane County. These two public water systems combined withdrew 3.25 MGD, or 5.0 cubic feet per second (cfs) in 2010. For comparison, the average flow of the Tennessee River at Loudon during the 32-year period from 1923 to 1954 was 18,810 cfs. For the current condition, the Tennessee River and Clinch River flows and reservoir storages, including Watts Bar Lake, are managed by the Tennessee Valley Authority dam and reservoir system to meet multipurpose objectives of power generation, navigation, water supply, flood control, recreation, and water quality (NRC 2022).

Self-supplied industrial surface water use in the five-county region in 2015 was 8.73 MGD. The USGS database indicates no self-supplied industrial surface water use in Roane County in 2015 (NRC 2022).

The largest self-supplied surface water use in Roane County in 2015 by user category defined by the USGS is 348 MGD for thermoelectric power once-through cooling water. The USGS estimates that 99 percent of thermoelectric power once-through cooling water is returned to the water source with one percent of the withdrawn water lost to evaporation and other consumptive losses (NRC 2022).

### 3.4.2.3 Floodplains

A floodplain is the land area along a stream or river that is subjected to periodic flooding. The area subject to a one percent chance of flooding in any given year is normally called the 100- year floodplain. The area subject to a 0.2 percent chance of flooding in any given year is normally called the 500-year floodplain. A regulatory floodway is a regulatory tool normally associated with the National Flood Insurance Program (NFIP) that refers to the channel of a river or other watercourse and the adjacent land areas that must be reserved to convey the 100- year flood without cumulatively increasing the water surface elevation more than a designated height.

As shown in Figure 3-26 EFPC flows southwesterly through an adjacent valley and to the west of the Facility site. The NFIP Flood Insurance Rate Map (FIRM) depicting floodplain mapping within

and in the vicinity of the Facility is presented on Figure 3-26. The FIRM map indicates that the Facility and the area surrounding the Site are Zone X (unshaded), which is defined as “areas determined to be outside of the 0.2 percent annual chance floodplain.” Near the vicinity of the Site, only the EFPC have NFIP-mapped floodplains. An NFIP regulatory floodway is also defined on the EFPC. However, detailed mapping of EFPC on the FIRM ends upstream of the Facility at the Highway 95 crossing of EFPC. The EFPC channel downstream of the detailed study area is encompassed by the Zone X (unshaded) area. However, the FIRM does not appear to accurately depict the EFPC 100-year or 500-year floodplain through this Zone X (unshaded) area (i.e., no floodplain shown along this segment of the EFPC channel).

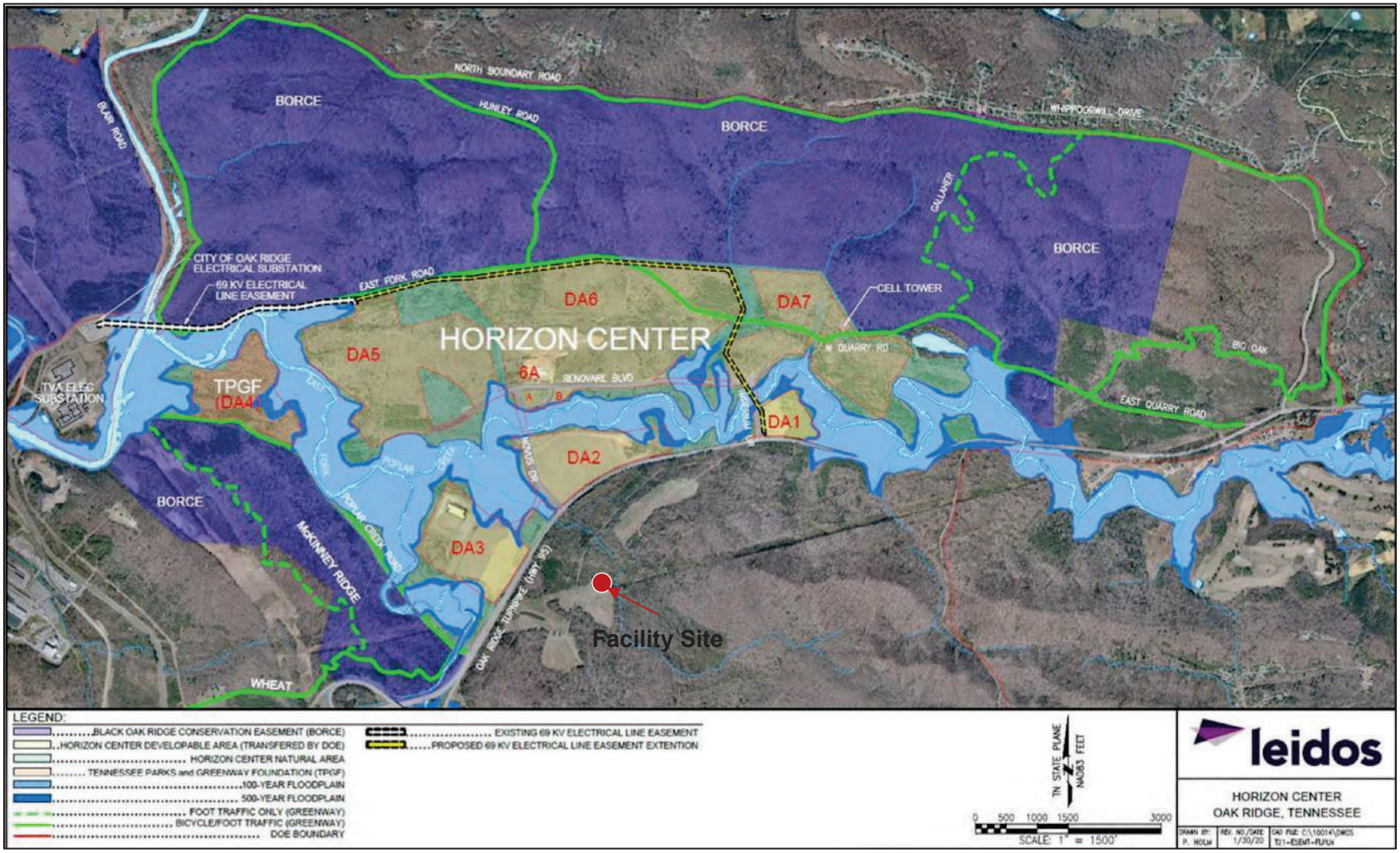



**Figure 3-26: East Fork Poplar Creek Floodplain Map (NRC 2022)**

A floodplain study for EFPC was completed by the Tennessee Valley Authority (TVA) in 1991. The TVA floodplain study demonstrates that the maximum 100-year flood elevation along EFPC in the vicinity of the Facility is 764.9 ft. mean sea level at Mile 2.94 upstream of the Facility, and 759.9 ft. at Mile 2.14 (Figure 3-27). A tabulation of water surface elevations at hydraulic model cross sections is provided in that report, but no mapping of the floodplain was provided. The USACE subsequently obtained the TVA floodplain information for EFPC and created EFPC floodplain maps and a report. The TVA study data was also recently used to create a floodplain map for EFPC for another project located near the Facility (Figure 3-26). The map does not show the EFPC 100-year or 500-year floodplain extending onto the Facility site. At the southeastern corner of the Facility, immediately adjacent to, the lowest ground elevation along the Facility boundary is approximately 770 ft. and the TVA 100-year flood elevation is approximately 759.4 ft. mean sea level (Mile 1.92 of the hydraulic model).

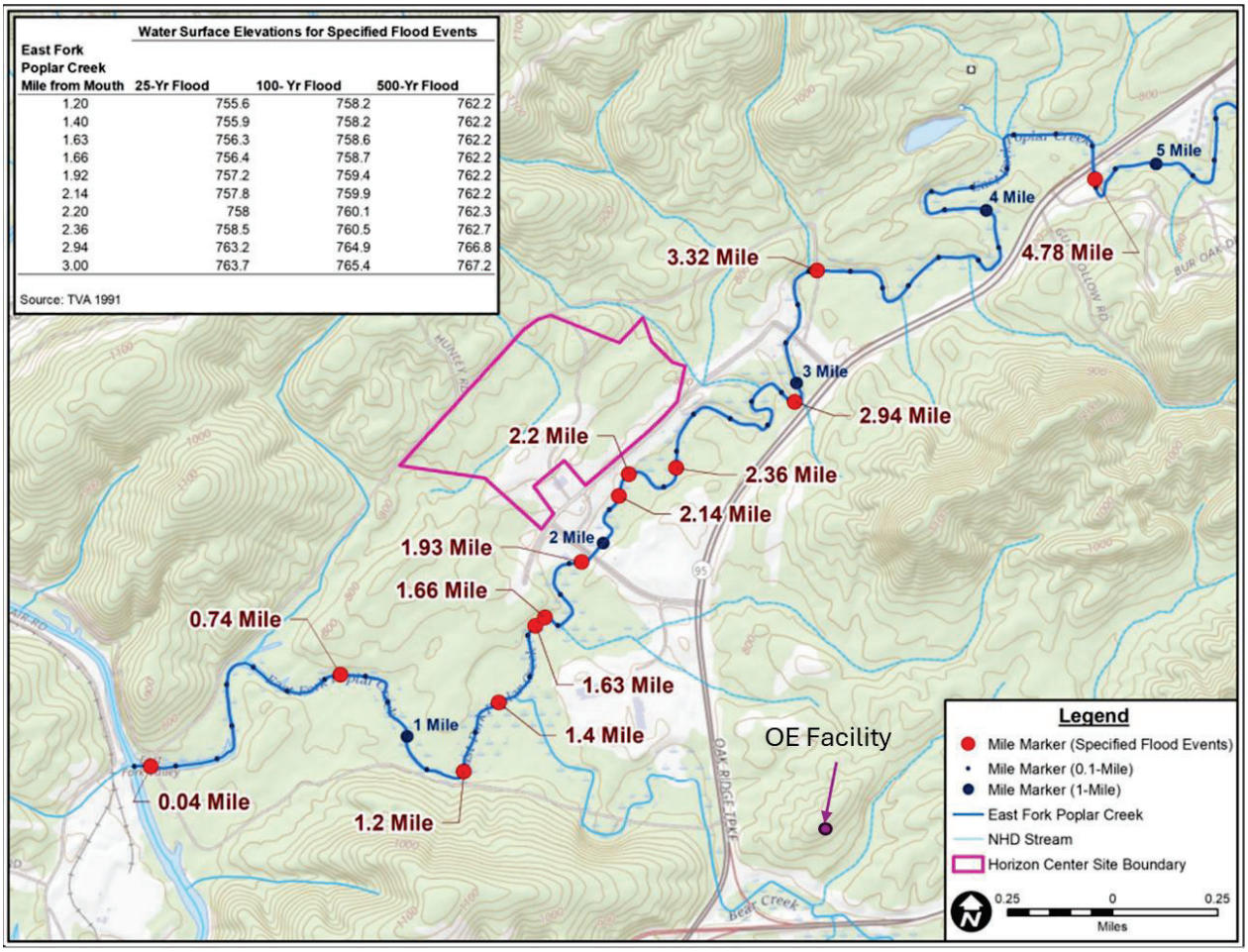



**Figure 3-27: East Fork Poplar Creek Flood Elevations (NRC 2022)**

As indicated by the FEMA Floodplain Hazard in Figure 3-28, the Facility is classified in an Area of Minimal Flood Hazard. The full map is broken down into sections (Figure 3-28A-C).

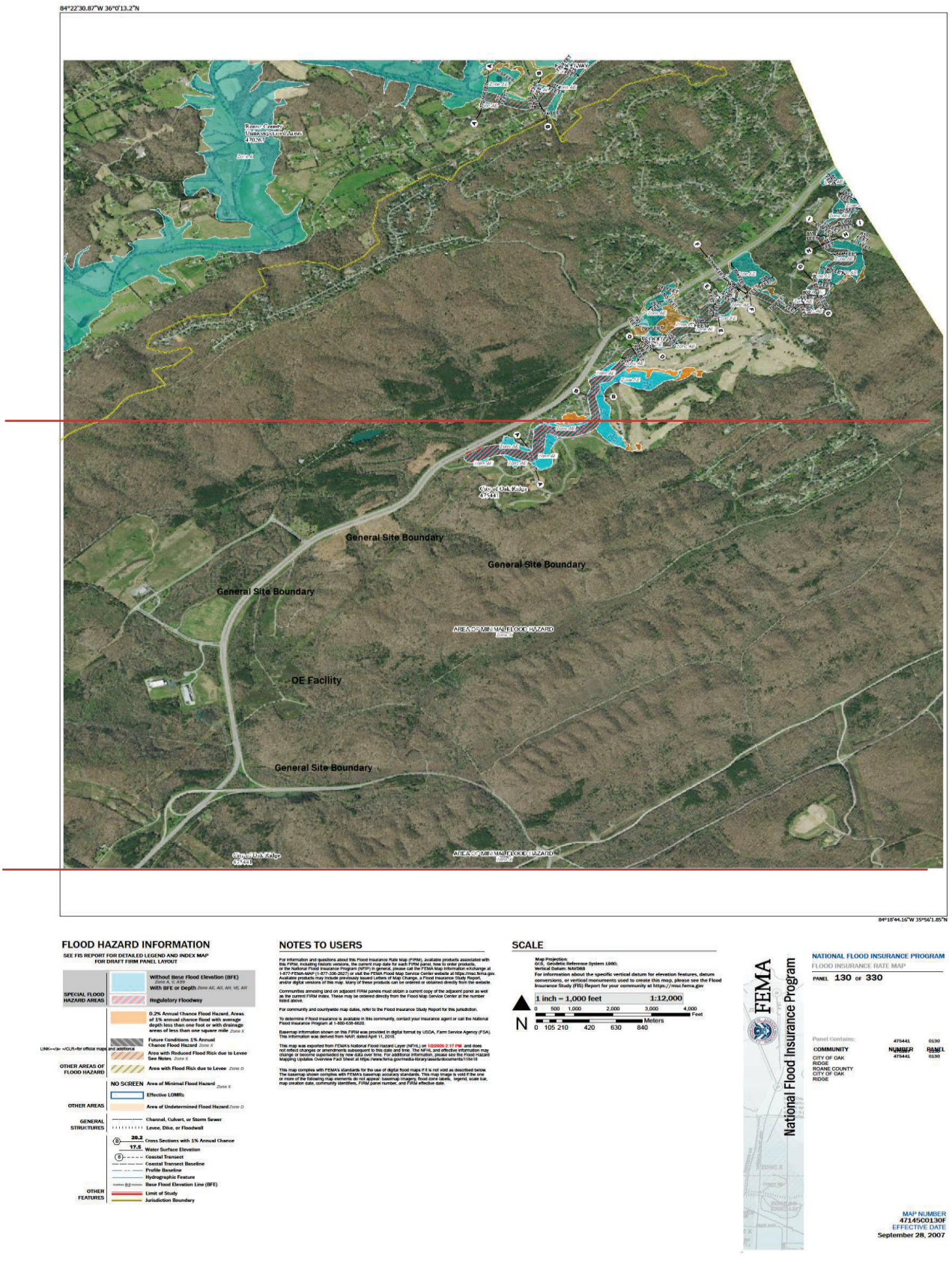



**Figure 3-28 Facility Floodplain Hazard Map (FEMA 2007)**

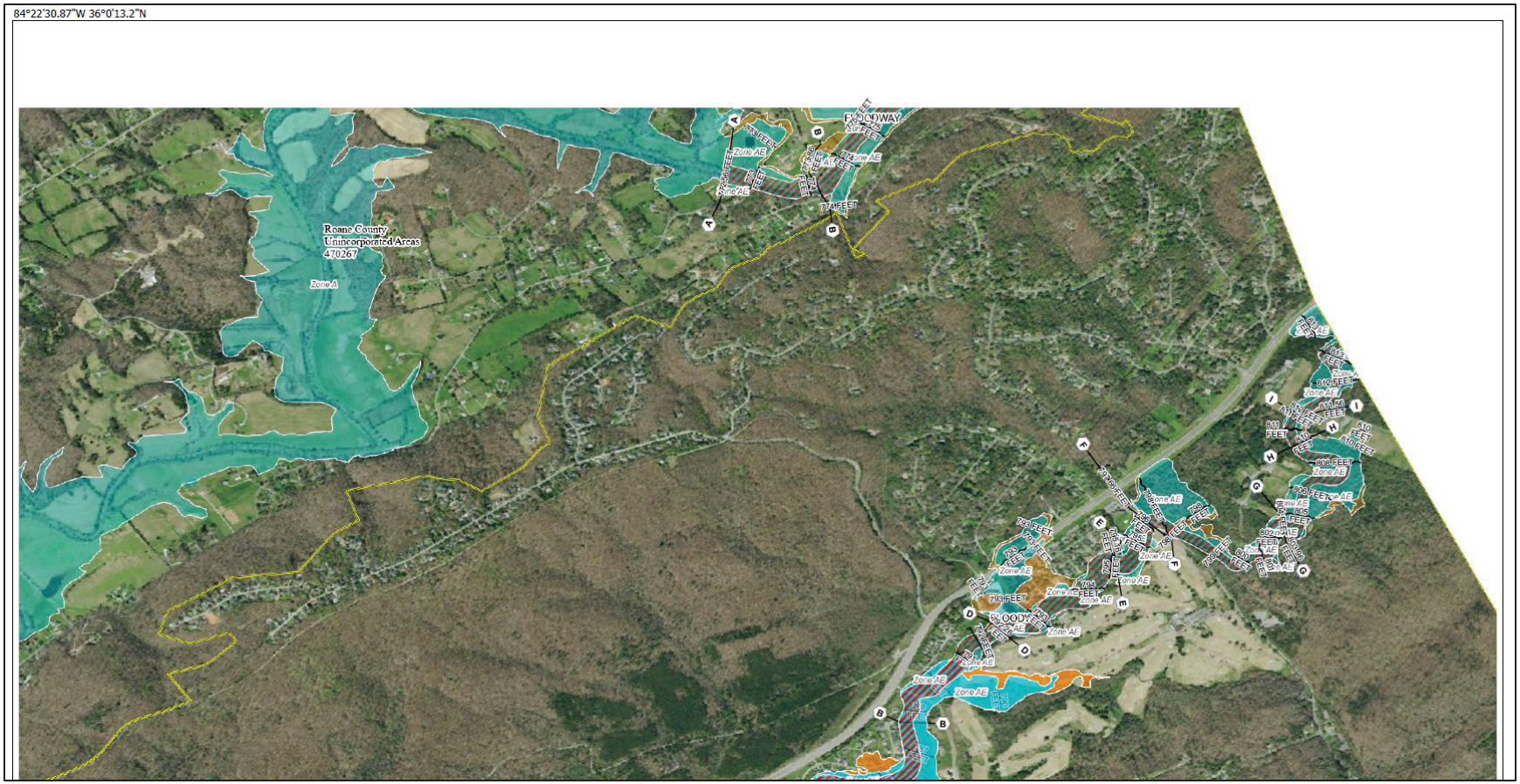



**Figure 3-27 A  Floodplain area North of Site Boundary**

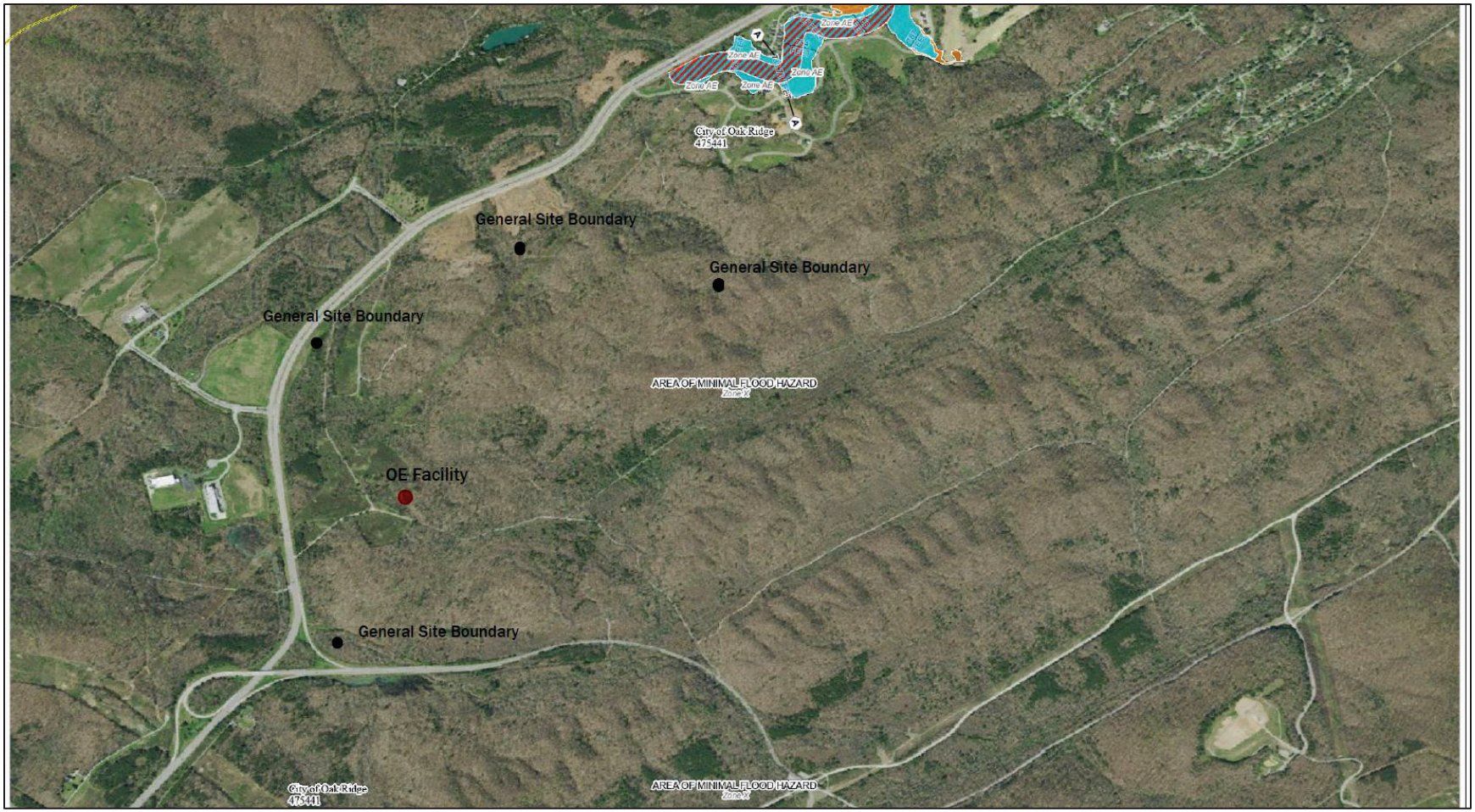



**Figure 3-27 B  Floodplain area within 1 mi of Site Boundary**

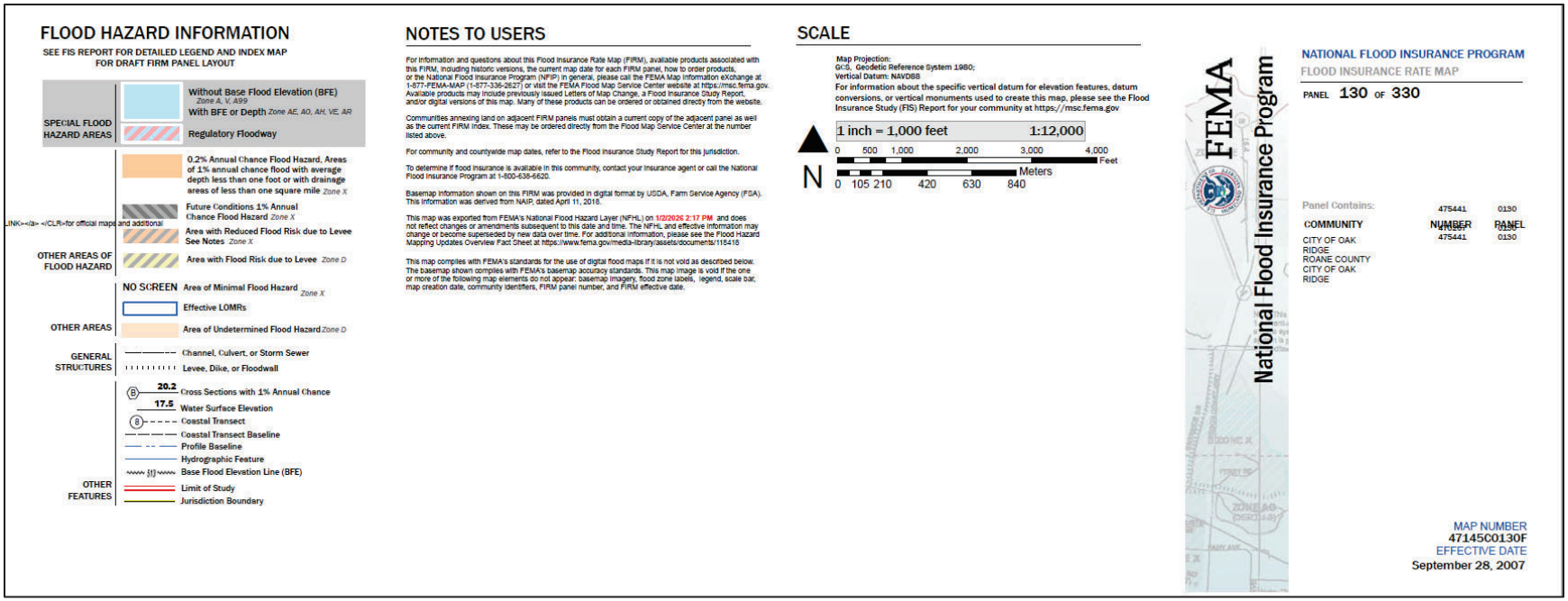



**Figure 3-27 C Floodplain Hazard Map Legend**

#### 3.4.2.4 Streams and Wetlands

As defined in 33 CFR 328.3, wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Types of wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands and wetland fringe areas can also be found along the edges of many watercourses and impounded waters (both natural and man- made). As stated in 33 CFR 328.39(b), wetland habitat provides valuable public benefits including flood storage, erosion control, water quality improvement, wildlife habitat, and recreation opportunities.

Wetlands located within the Facility may potentially be regulated under Section 404 and 401 of the Clean Water Act (CWA) (33 US Code 1251). The USACE regulates the discharge of dredged or fill material into Waters of the U.S. (WOTUS), including wetlands, under the CWA Section 404 Permit program (33 US Code 1344). In Tennessee, physical alterations to properties of waters of the State require an Aquatic Resource Alteration Permit (ARAP) or a Section 401 Water Quality Certification, both of which are administered by TDEC. The USACE Jurisdictional Determination (USACE 2025) and TDEC Jurisdictional Concurrence (TDEC 2025) are included in Appendix A1.

The U.S. Fish and Wildlife Service (USFWS), through its online Wetland Mapper tool, produces the National Wetland Inventory (NWI). NWI mapping within the Facility includes two riverine features, one located in the central portion of the Facility site, and the other located along ET-4 tributary (USGS 2025a).

A jurisdictional waters assessment was conducted on an approximately 688-acre Facility property located at the Highway 58/State Route (SR) 95 (Gallaher Road and White Wing Road) intersection in Oak Ridge, Roane County, Tennessee (Figure 3-29) (CEC 2025).

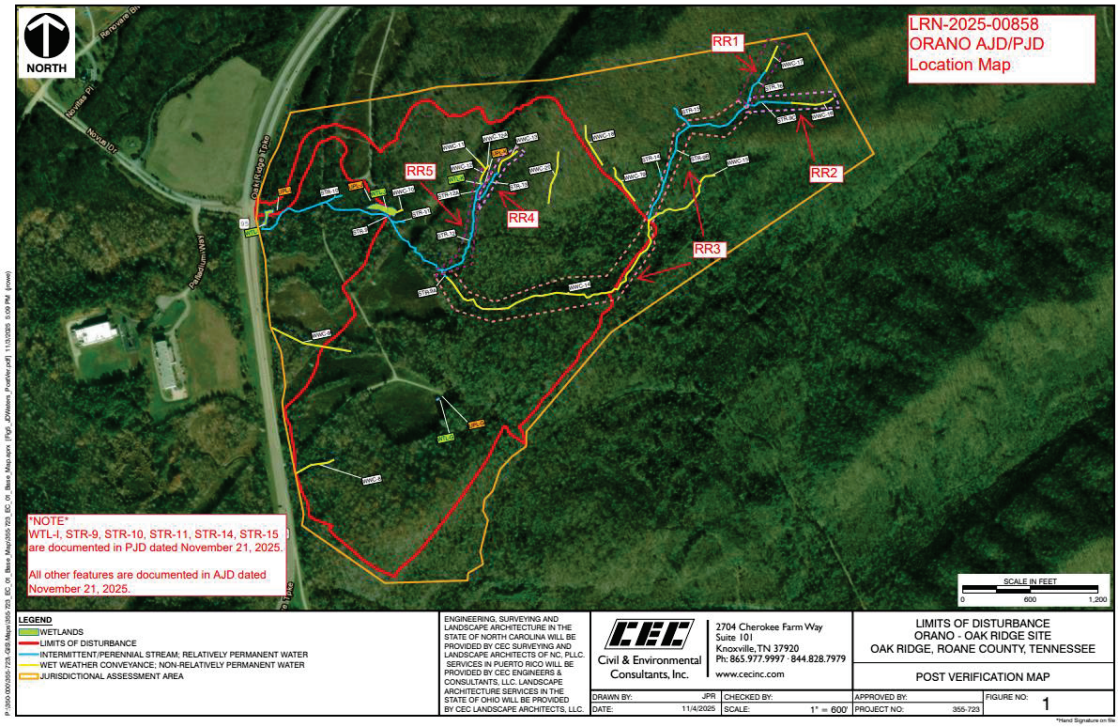



**Figure 3-29: USACE Jurisdiction Waters Delineation of Affected Area**

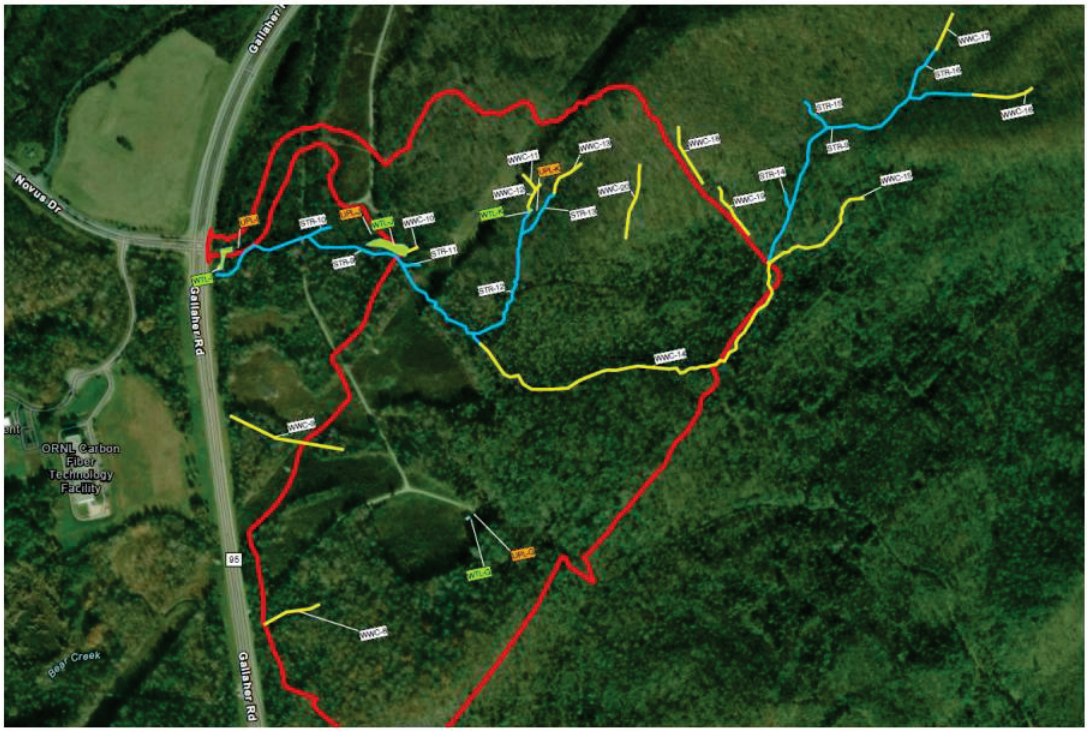



**Figure 3-30 TDEC Jurisdictional Waters Determination of Affected Area (TDEC 2025)**

Twenty-eight streams/relatively permanent waterways and 42 wet weather conveyances/non-relatively permanent waterways were identified at the Site. They range from approximately one to five feet wide, and have depths up to one foot deep, and silt/cobble substrates. The riparian

zones are generally wooded with a diversity of trees and shrubs. The wet weather conveyances/non-relatively permanent waterways are typically headwater ephemeral channels located within the forested valleys through the Site. They range from one to five feet wide and generally have silt/gravel substrates with a few instances of cobble. The riparian zones are generally wooded. Due to the limited water present in these wet weather conveyances/non-relatively permanent waterways, temporal variations in water quality characteristics and flow are not available. Figure 3-29 and Figure 3-30 focus on the affected areas water resources. USACE and TDEC jurisdictional streams, wetlands and wet weather conveyances with relative reach are listed in Table 3-6.

**Table 3-6 Side by Side comparison of USACE and TDEN Jurisdictional Wetlands in Affected area**

| TDEC | USACE |
|---|---|
| STR-9 | STR-9/9C |
| STR-10 | STR-10 |
| STR-11 | STR-11 |
| STR-12 | STR-12/12A |
| STR-13 | STR-13 |
| STR-14 | STR-14 |
| STR-15 | STR-15 |
| STR-16 | STR-16 |
| WTL I | WWC12 |
| WTLK | WWC13 |
| | WWC16 |
| | WWC17 |
| | WTL I |
| | WTLK |

Seventeen wetlands were identified on the Site. All but three wetlands are palustrine forested (PFO) features; with the remaining three being palustrine emergent (PEM) wetlands. Ten of the wetlands are groundwater-fed PFOs located along the floodplain of Bear Creek and its tributaries along the northeastern, southeastern, and southern boundaries of the Site. Four wetlands (WTL-C, WTL-I, WTL-J and WTL-K) are slope wetlands fed by groundwater seeps along some of the intermittent tributaries within the center of the Site. Two of the wetlands are located within the transmission line easement near the northern corner of the property that appears to be frequently maintained with herbicides. The remaining wetland is a small, depressional, isolated feature located adjacent to the gravel drive that transects the Site.

## 3.5 ECOLOGICAL RESOURCES

This section describes and characterizes the existing terrestrial and aquatic ecosystems potentially affected by the planned construction and operation of the Facility by OE. A topographic map for the Facility is shown on Figure 3-31.

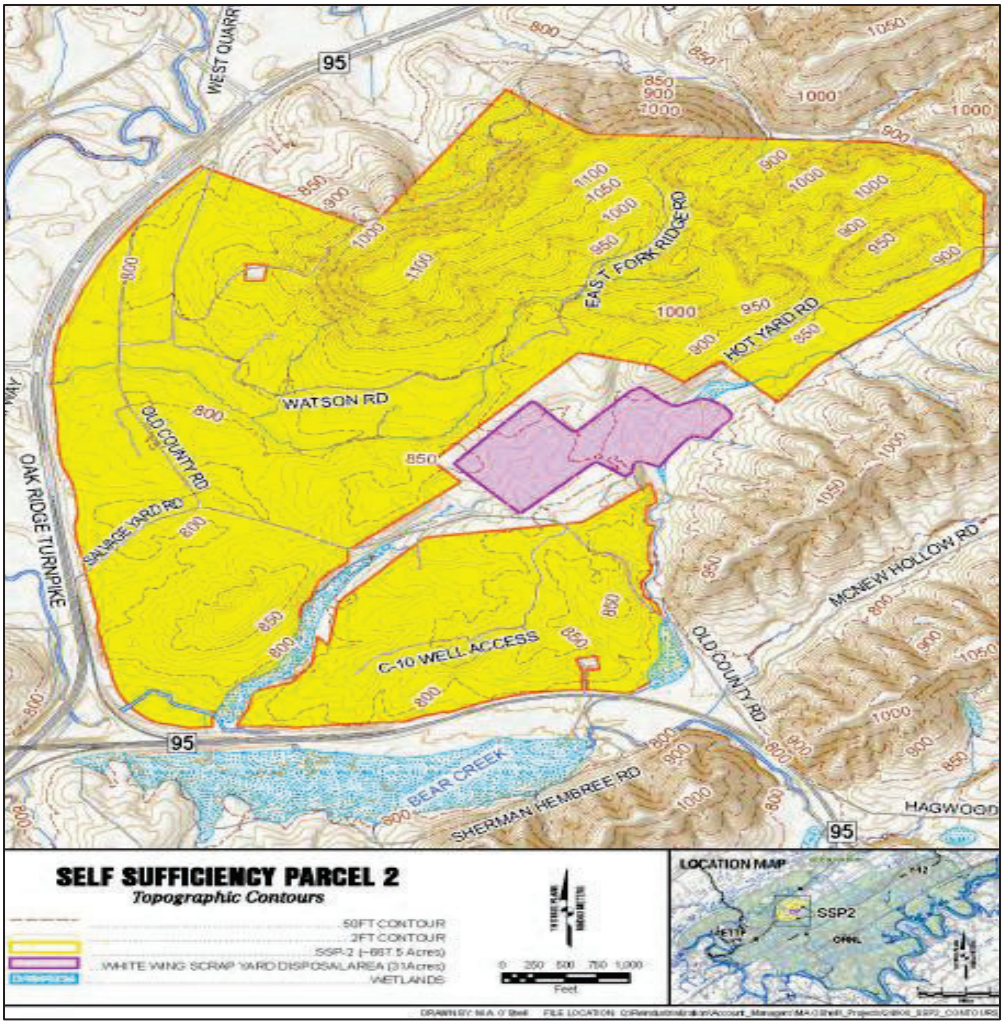



**Figure 3-31: Topographic Map for the Site**

The Facility site is located on the ORR. The ecological vicinity as illustrated in Figure 3-32 is defined as bordered by:

- SR-95/Oak Ridge Turnpike/Gallaher Road to the west,
- The 81 acres that the ORETTC is located on, Gum Hollow Road, and forested areas to the north,
- SR-95/White Wing Road to the south, and
- Forested areas to the east.

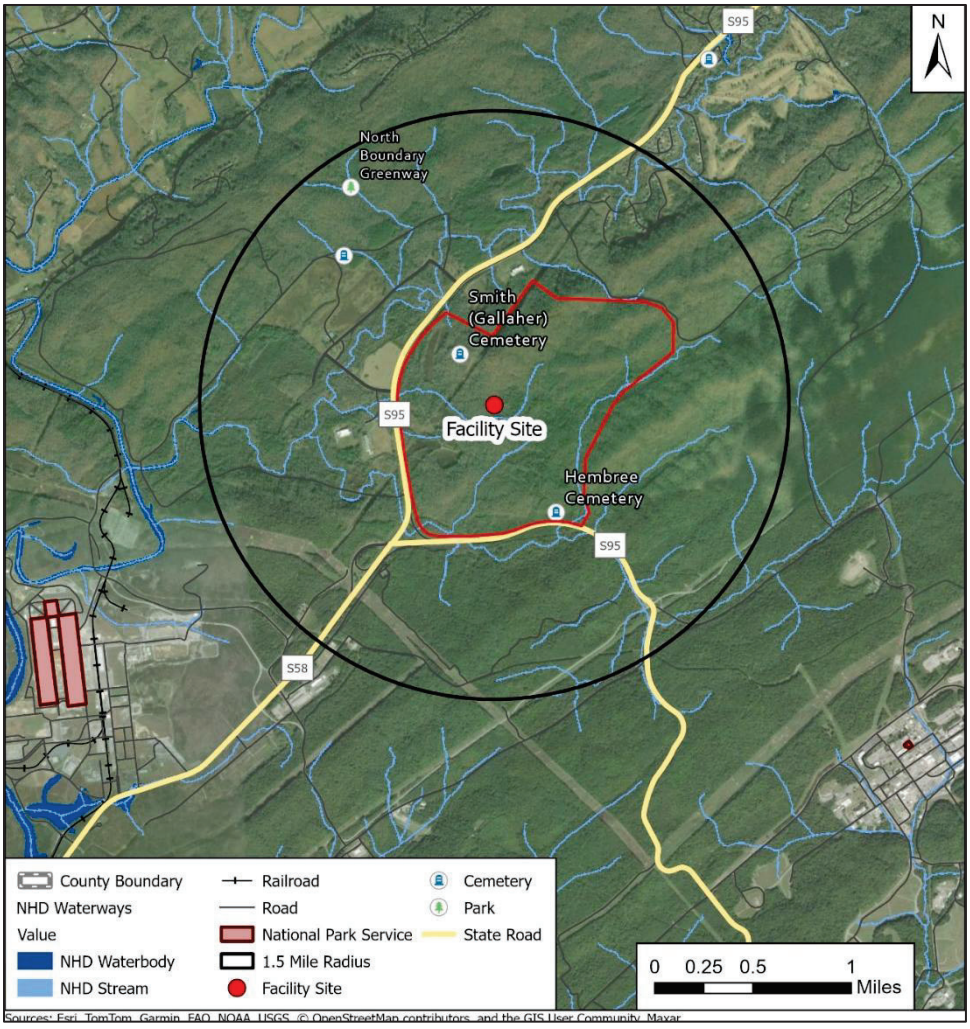



**Figure 3-32: SSP-2 Borders**

Ecological features such as vegetation communities, habitats, and sensitive plant and animal species in the region have been well documented as illustrated by the following 3 references:

1. The HCS sits approximately one mile across the Oak Ridge Turnpike (SR-95) from the planned center point for the Facility. Ecological surveys were performed and documented for the HCS as part of TRISO-X Fuel Fabrication Facility Environmental Report (ER) submitted to the U.S. Nuclear Regulatory Commission (NRC) in September 2022 (NRC 2022) and updated September 2025 (NRC 2025b).
2. Immediately north of and abutting the Facility site, the DOE conducted a ”sensitive“ resources assessment in 2020 documenting natural resources associated with potential land use changes to this area in support of an environmental assessment for the ORETTC location. The ORETTC site was originally a part of the SSP-2 area before approximately 81 acres, originally identified as Parcel SSP-2A, were partitioned off for the ORETTC facilities (ORNL 2020).

3. The Facility site is currently part of DOE's ORR. DOE's latest version of its annual environmental report for the ORR is for 2023 (DOE 2024a). This report potentially contains information on ecological resources relevant to the Facility site.

Thus, the ecological resources as documented in these three references were reviewed and are representative for the Facility site, particularly the assessment for the ORETTC site, SSP-2A. Listings of Federal- and State-listed threatened or endangered species currently listed or proposed for listing that are known to occur on the ORR and thus may occur within the project site area were obtained from DOE's annual site environmental report for 2023 (DOE 2024a). Since the SSP-2A parcel was previously a part of the overall SSP-2 parcel, the compilation of endangered, threatened, or other sensitive species for SSP-2A is representative for the current SSP-2 area. Thus, DOE's environmental assessment for SSP-2A (ORETTC site) was used to identify potential ecological resources on SSP-2 (OE site). Federal- and State-listed threatened and endangered species are discussed in Section 3.5.4.

At approximately 33,000 acres, ORR is the largest contiguous and protected land ownership in the southern Valley and Ridge Physiographic Province of East Tennessee. ORR contains approximately 24,000 acres of forestland. ORR's natural resources are managed by the ORNL Natural Resources Management Program for DOE (ORNL 2020). The ORR is mostly contiguous native eastern deciduous oak-hickory (Quercus-Carya spp.) hardwood forest. Other forest cover types include hemlock (Thuja canadensis), white pine (Pinus strobus), and bottomland hardwood forests. Forty-one tree species were identified in 2015.

Interaction with the U.S. Fish and Wildlife Services (USFWS) was initiated in May 2025 to understand information needed and the process for USFWS to render a biological opinion. The USFWS online information for planning and consultation (IPaC) system was queried in July 2025 to generate a list of species and other resources such as critical habitat that are under the USFWS jurisdiction that are known or expected to be on or near the project area. This interaction is documented in Table 1-3.

### 3.5.1 BIOTIC COMMUNITIES

The Facility site is located on the western boundary of the Valley and Ridge Physiographic Province whose distinguishing feature is narrow parallel ridges and valleys trending southwest to northeast. The regional geology surrounding the Facility site is the same as described in Section 3.5.1 of the TRISO-X Environmental Report (NRC 2022), which is incorporated here by reference. It includes several thrust faults that upturned the normally flat lying bedrock resulting in a series of formation outcrops across the site. The Valley and Ridge level ecoregion is a relatively low-lying region between the Blue Ridge Mountains to the east and the Cumberland Plateau to the west. As a result of extreme folding and faulting events, the region's roughly parallel ridges and valleys come in a variety of widths, heights, and geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Springs and caves are relatively numerous. Present-day forests cover about 50 percent of the region. The Southern Limestone/Dolomite Valleys and Low Rolling Hills level IV ecoregion is characterized by low rolling hills and valleys underlain by limestone and dolomite. Prevalent natural communities include white oak forests, bottomland oak forest, and sycamore-ash-elm riparian forests.

In the more immediate area surrounding the Facility site, the ORR is situated in the Great Valley of East Tennessee between the Cumberland and Great Smoky Mountains. The ORR interior forest habitat is an important component of biologically diverse systems, offering habitat critical to the survival of neotropical migratory bird species.

## 3.5.2 TERRESTRIAL RESOURCES

### 3.5.2.1 Plant Communities

Ecological surveys characterizing the presence of terrestrial plant communities and vascular plant species that were performed as referenced above for the HCS, the ORETTC site, and ORR were reviewed to characterize plant communities both regionally and for the SSP-2 site.

#### 3.5.2.1.1 Plant Communities Within the Vicinity of the Facility Site

Regional land use surrounding the Site is presented in Figure 3-3 based on information obtained from the National Land Cover Database (USGS 2024). The principal land cover type surrounding the immediate site is deciduous forest. Expanding further to the indicated 5-mile radius, additional land cover types include pasture/hay with some limited medium and high intensity development (ORNL and East Tennessee Technology Park / Manhattan Project National Historic Park).

The ORR is mostly contiguous native eastern deciduous oak-hickory (Quercus-Carya spp.) hardwood forest. Other forest cover types include hemlock (Thuja canadensis), white pine (Pinus strobus), and bottomland hardwood forests. Forty-one tree species were identified in 2015. Figure 3-33 presents the area encompassed by the ORR, its natural areas including interior forests, and the locations of both the Site and SSP-2A (ORETTC site).

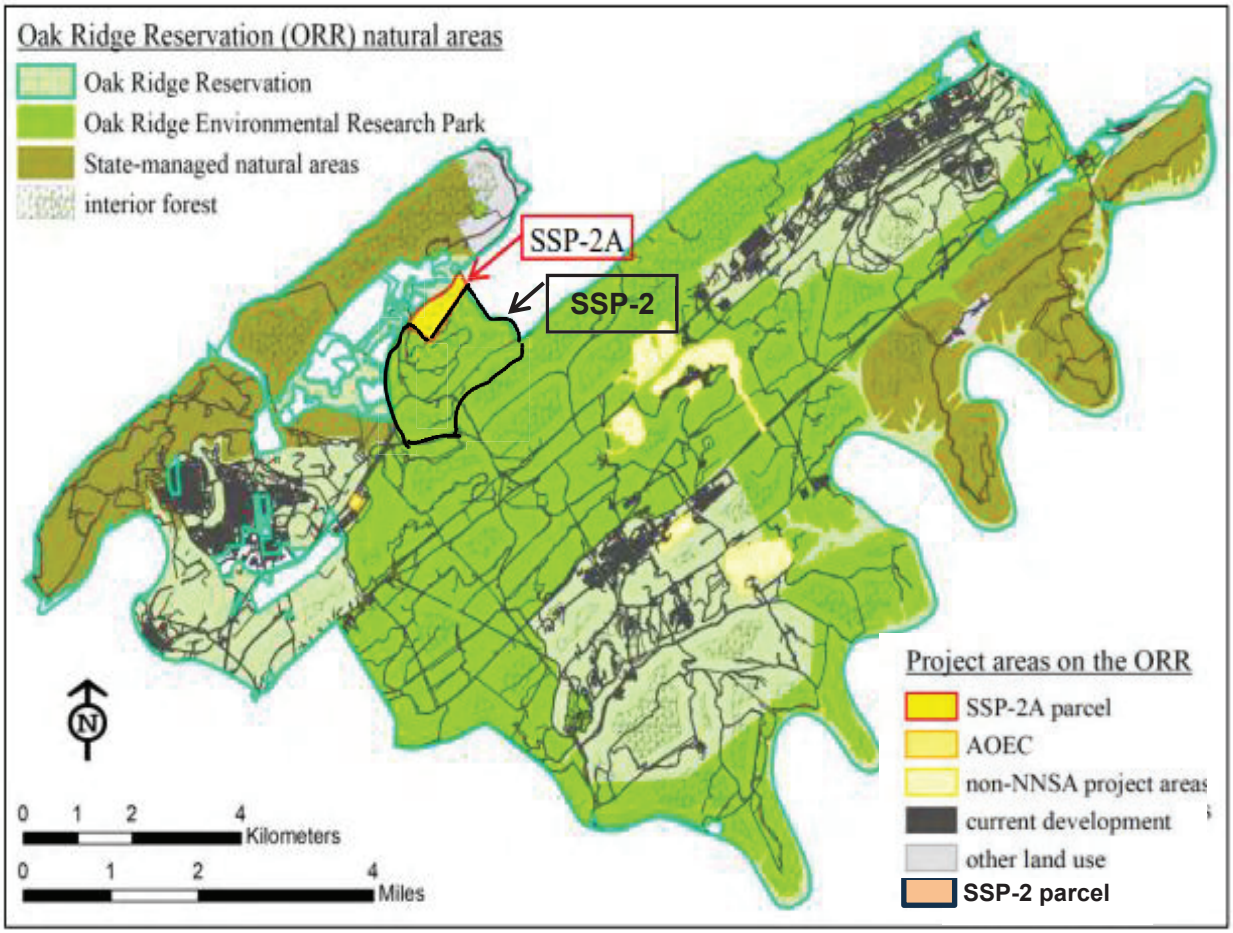



**Figure 3-33: Oak Ridge Reservation Area Natural Areas and SSP-2 and SPP-2A Sites**

Vascular plant species of concern known to have been sighted or reported on or near the ORR are presented in Table 3-8. This listing is presented in DOE's annual site environmental report for 2023 (DOE 2024a).

#### 3.5.2.1.2 Plant Communities Within the Site

The Site is comprised of mostly mixed deciduous/evergreen forest transected by gravel access roads owned and constructed by DOE. During prior use by the DOE, some areas were cleared with some portions allowed to revegetate as successional growth; however, the majority of the site is comprised of young to mature forest. Typical trees within the forest and upland ridges identified during the recent February 2025 jurisdictional waters survey (CEC 2025) included various red and white oaks, maples, hackberry, loblolly pine, hickories, American beech, sweetgum, eastern red cedar, black cherry, redbud, dogwood, and elms. Trees along the drainages and lowlands include sycamore and black willow. Understory shrubs include tree saplings of the previously mentioned species, privet, honeysuckle, spicebush, coralberry, and silky dogwood. The majority of the Facility site is comprised of undeveloped, dense forest of hardwood trees mixed with dense underbrush.

The forested SSP-2 area was identified by the Nature Conservancy in 1996 as very high significance with relatively intact natural communities (DOE 2020a). Evergreen mixed forest

was/is the most common mixed forest type observed. This forest is concentrated along low hillslopes and the slopes of draws on the SSP-2 site. Old-growth characteristics such as large tree size, multiple layers in the canopy, diversity of species, and diversity of ecosystem function occur in areas adjacent to streams, seeps, and smaller wetlands. As noted in the ORETTC Environment Assessment (DOE 2020a), the ORETTC site contains forest stands that are largely younger, second growth, as characterized by dominant species considered to be pioneering types such as yellow poplar, eastern redcedar, loblolly pine, Virginia pine, and ash. The ORETTC site is adjacent to interior forest habitat based on the presence of relatively large contiguous tracts of forest. This description characterizes the Facility site area also.

Table 3-8 presents those sensitive plant species with the potential to occur within the SSP-2A parcel. For each species, a determination was made as to whether how likely, if at all, that each species might be present on the SSP-2A parcel. Also, the status for both the federal and state is listed for each species is included. Since the ORETTC site (SSP-2A) was originally a part of the overall SSP-2 site now designated for the Facility, information on the ORETTC site is incorporated by reference (DOE 2020a) as representative for the Facility site as well.

#### 3.5.2.2 Wildlife

The ORR provides wildlife habitat in the form of forested land, areas of undisturbed wetlands, open waterways, and riparian vegetation, and several hundred acres of grassland communities and fallow fields. Given the proximity of both the TRISO-X and ORETTC facilities to the Facility, information from their respective environmental reports (NRC 2022) (DOE 2020a) was used as the basis for identifying wildlife that has the potential to be found at the areas surrounding the Facility on the Site. Thus, the wildlife descriptions from these two resources are incorporated by reference and presented here.

TRISO-X (Horizon Center Site): Field surveys were conducted in 2021 and 2022 for wildlife including surveys for avifauna, mammals, and herpetofauna. Lists of wildlife observed and that have the potential to use the HCS, and potentially SSP-2, for habitat.

Several species of terrestrial mammals, such as white-tailed deer, bobcat, gray fox, red fox, raccoon, eastern cottontail, groundhog, gray squirrel, striped skunk, eastern chipmunk, Virginia opossum, coyote, eastern mole, several bat species, and many small rodents and shrews are likely to inhabit these areas. White-tailed deer, gray squirrel, and eastern cottontail are recreationally valuable as game species.

Some reptile and amphibian species expected to occur in the vicinity of the ephemeral and intermittent streams in these areas and the East Fork Poplar Creek in proximity to the HCS area include northern cricket frog, American bullfrog, northern green frog, northern spring peeper, southern leopard frog, gray treefrog, red-spotted newt, northern dusky salamander, painted turtle, snapping turtle, and northern water snake. Herpetofauna expected to occur within the herbaceous and forested upland areas of the study area include eastern box turtle, eastern American toad, northern fence lizard, common five-lined skink, eastern worm snake, black racer, gray ratsnake, black kingsnake, and eastern garter snake.

Abundant and common bird species observed during the 2021 summer field survey include American crow, blue jay, mourning dove, white-eyed vireo, Carolina wren, downy woodpecker, and tufted titmouse. Abundant and common species observed during the fall field survey include

blue jay, northern cardinal, Carolina chickadee, Eastern phoebe, American goldfinch, and Carolina wren. Abundant and common species observed during the spring 2022 field survey include northern cardinal, tufted titmouse, common yellowthroat, yellow-breasted chat, and field sparrow. Based on the methodology and observed species, no protected bird species (State or Federally listed) or colonial nesting sites (e.g., heronries) are documented within the study area. Wild turkey and mourning dove are the only avian species observed in the study area that are recreationally valuable since they are game species. Wood duck, mallard, and Canada goose are other recreationally valuable bird species likely to occur in the study area.

ORETTC (SPP-2A Site): The eastern deciduous hardwood forest on ORR provides habitat for numerous wildlife species. The diversity of wildlife species ranges from common species found in urban and suburban environments to more specialized species such as interior forest bird species. The USFWS Environmental Conservation Online System indicated that there were 18 species of Birds of Conservation Concern, plus seven USFWS Birds of Management Concern under the Migratory Bird Treaty Act (MBTA) with potential to occur in SSP-2A. In addition, the Bald Eagle may also be present and is protected under both the MBTA and the Bald and Golden Eagle Protection Act. The overall goals of wildlife management on the ORR are directed toward preserving populations and habitat, maintaining and enhancing biodiversity, integrating multiple use objectives, and minimizing wildlife damage to property and public safety. Featured species management includes installation of nest boxes for wood ducks (Aix sponsa), salamander inventories, forest management practices to enhance habitat for woodland bat species, and maintenance of habitat for forest-area-sensitive neotropical birds. Game-species management is conducted for public recreation and public health-and-safety reasons. Active hunting programs are conducted for white-tailed deer (Odocoileus virginianus), wild turkey (Meleagris gallopavo), and Canada goose (Branta canadensis). The SSP-2A area has historically had the highest deer harvest numbers on the ORR. Nuisance wildlife species include raccoon (Procyon lotor), skunk (Mephitis mephitis), opossum (Didelphis virginiana), and woodchuck (Marmota monax).

Additional information on types of species of mammals, birds, etc., that have the potential to occur on SSP-2 and SSP-2A is presented in Table 3-8.

#### 3.5.2.3 Wildlife Corridors

Travel corridors are passageways used by species to access various foraging, nesting, and breeding habitats. Depending upon the species of interest, travel corridor requirements vary widely in size, quality, and biotic community. The TRISO-X ER (NRC 2022) discusses wildlife corridors (1) at the regional level surrounding the HCS, which would include the area surrounding the SSP-2 site as well, and (2) in the more immediate vicinity of the HCS that is relevant to SPP-2 also. Thus, these wildlife corridor descriptions are incorporated by reference and presented here.

##### 3.5.2.3.1 Wildlife Corridors in the Vicinity of SSP-2

Mobile animals on the HCS, such as white-tailed deer, coyotes, bobcats, foxes, raccoons, rodents, rabbits, and other terrestrial mammals, collectively create diffuse travel corridors across various biotic communities on the site and to and from adjacent properties, such as the ORR. The longest and most complex travel corridors are typically established by white-tailed deer. Other species may use portions of these regularly traveled trails. Tracks of common wildlife species, such as white-tailed deer, coyote, and raccoon, were observed across the entire HCS during the

2021 and 2022 field surveys, indicating that travel corridors are highly variable. Use of undeveloped areas within the site by these common species does not appear to be impacted by the current level of human and industrial activities occurring on and in proximity to the study area. The animals likely take advantage of connected forested parcels and human-induced corridors, such as wet weather conveyances and other riparian areas, fence lines, edge habitat, road corridors, and utility corridors.

With respect to reptiles and amphibians, no specific travel corridors were identified on the HCS during the field surveys. In general, these species are smaller and have smaller home ranges than mammals, and they may only use travel corridors seasonally, rather than daily, to travel to habitats used for breeding or for hibernation. Amphibians and many reptiles utilize both aquatic or wetland habitat as well as nearby uplands; therefore, travel corridors may be present between breeding and foraging habitat. Much of the habitat areas on the HCS are previously disturbed, periodically mowed, and not considered high-value ecological systems. However, the HCS does provide habitat for many different bird species, including resident and migratory birds. Resident and breeding migratory bird species likely use variable on-site flight corridors, mostly within the undeveloped portions of the site, for obtaining food, traveling to and from nesting sites, and as escape routes from predators. The SSP-2A parcel intersects a known wildlife corridor in East Tennessee.

## 3.5.3 AQUATIC RESOURCES

### 3.5.3.1 Characterization of the Aquatic Environment

At the western edge of the Ridge and Valley as it transitions to the Interior Plateau, the ORR contains a variety of freshwater aquatic features characterized by palustrine wetlands and streams as riverine and freshwater emergent. The water table at the ORR generally mimics topography with shallow groundwater flowing from higher topographic areas to the nearby surface water bodies. Groundwater flow through bedrock is primarily controlled by fractures, bedding planes, and hydraulic gradient, and specific flow paths are difficult to discern; however, investigations on the ORR have shown that a primary flow direction is along geologic strike (NRC 2022).

Waters drained from the ORR eventually reach the Tennessee River via the Clinch River, which forms the southern and eastern boundaries of the ORR. Surface-water hydrology on the ORR is characterized by a network of small streams that are tributaries of the Clinch River. Water levels in the Clinch River are regulated by the Tennessee Valley Authority (TVA), and fluctuations in the river can have an effect on streams draining the ORR (NRC 2022).

TDEC lists two non-supporting 303d listed streams [Bear Creek and East Fork Poplar Creek (EFPC)] (CEC 2025). See Figure 3-34 to identify the locations of Bear Creek and EFPC relative to SSP-2. The SSP-2 site is located within the eight-digit Lower Clinch River (06010207) and the 12-digit East Fork Poplar Creek (060102070302) hydrologic unit codes (HUCs), as well as the 67f (Southern Limestone/Dolomite Valleys and Low Rolling Hills) and 67i (Southern Dissected Ridges and Knobs) Level IV ecoregions (CEC 2025).

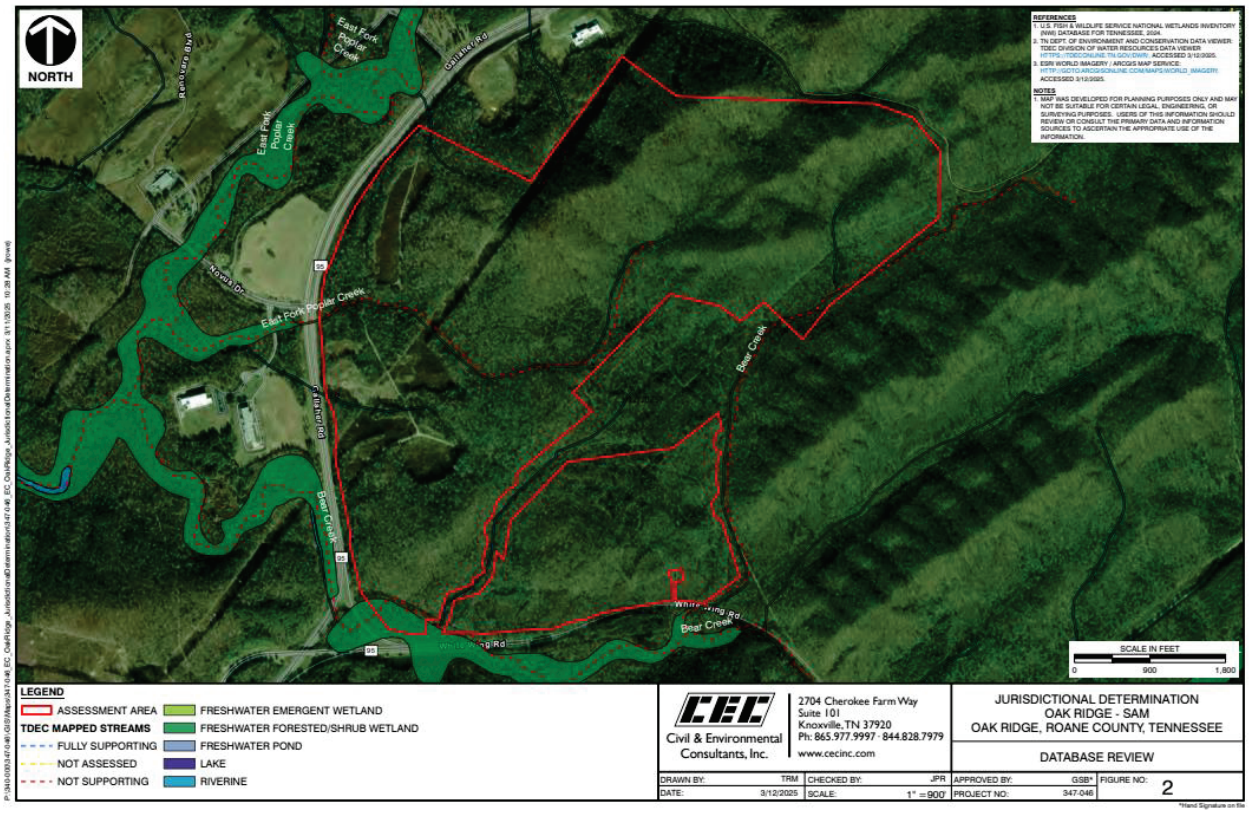



**Figure 3-34: Locations of Bear Creek and East Fork Poplar Creek on and Around the Site**

The survey performed in support of the jurisdictional waters assessment identified 17 wetlands, 28 streams (relatively permanent waters (RPWs)), and 42 wet-weather conveyances (WWCs) / non-relatively permanent waters (NRPWs) (CEC 2025). These are briefly summarized in the following sections. Figure 3-35 provides an overview of these aquatic resources. The areas encircled on Figure 3-35 with yellow are expected to be minimally impacted if all from construction-related activities. Potential impacts on the area in the center is discussed in Section 4.5.

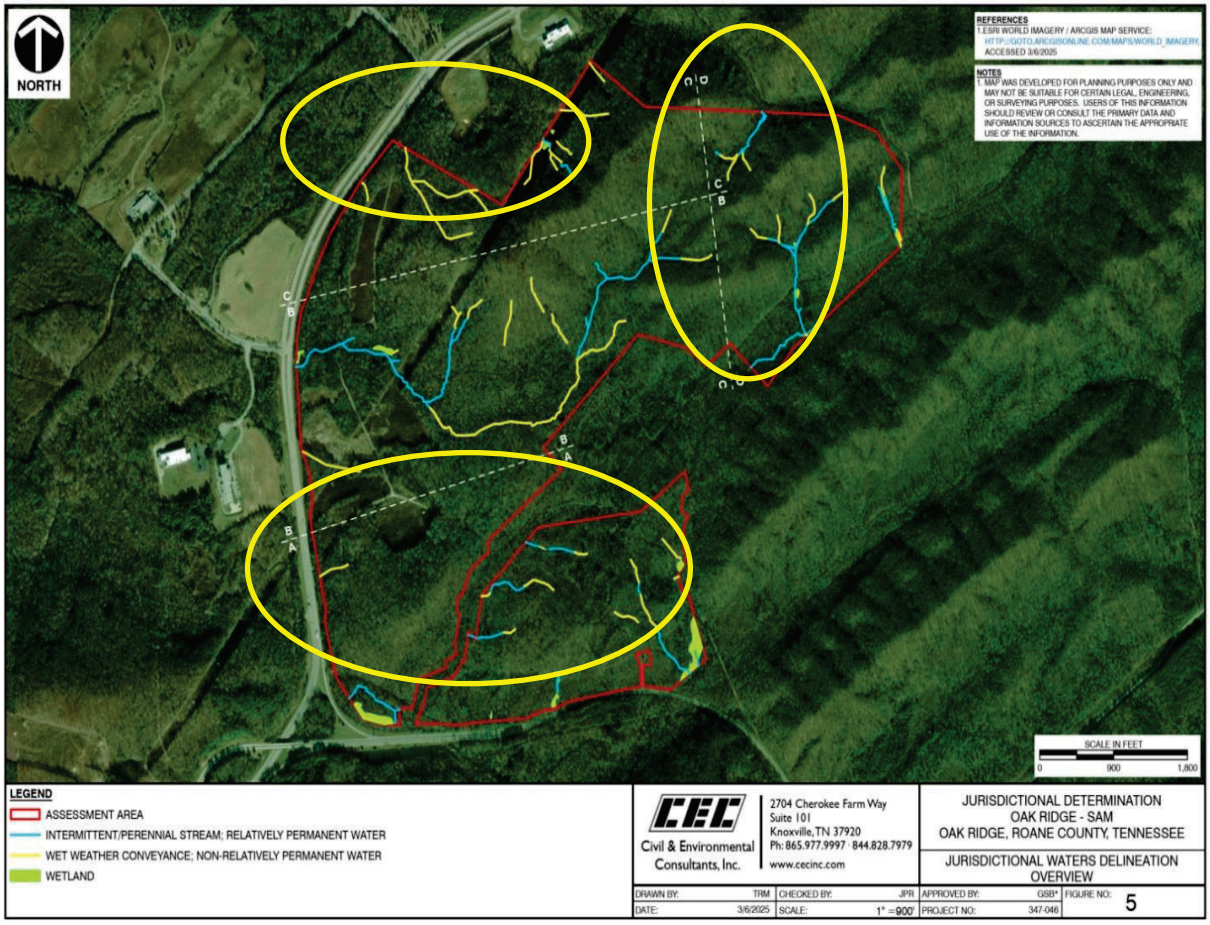



**Figure 3-35: Aquatic Resources on the Site**

### 3.5.3.2 Waters Survey Results

#### 3.5.3.2.1 Wetlands

Seventeen wetlands were identified on the site totaling 3.86 acres. All but three wetlands are PFO features; these other three are PEM wetlands. Ten are groundwater-fed PFOs located along the floodplain of Bear Creek and its tributaries along the northeastern, southeastern, and southern boundaries of the site. Four slope wetlands fed by groundwater seeps along some of the intermittent tributaries within the center of the site. Two are PEM wetlands and are located within the transmission line easement near the northern corner of the property. One wetland is a small, depressional, isolated feature located adjacent to the gravel drive that transects the site. Hydrology for the wetlands is generally supported by a high-water table, geomorphic position, overbank flooding along streams, and groundwater seeps. Vegetation is comprised of obligate, facultative, and facultative wetland tree and shrub species, including sycamore, sweetgum, hackberry, red maple, spicebush, and alder (Alnus serrulata). Herbaceous species consist of primarily soft rush (Juncus effusus), Japanese stiltgrass (Microstegium vimineum), sedges (Carex spp.), giant cane (Arundinaria gigantea), and Japanese honeysuckle (Lonicera japonica). Soils within the wetlands depict a depleted matrix with significant redox concentrations within 12 inches of ground surface. All wetlands but three are connected to downstream RPWs and would likely be considered jurisdictional WOTUS under Section 404 of the Clean Water Act (CWA) and

jurisdictional Water of the State (WOTS) under Section 401 for the State of Tennessee (CEC 2025). Three are isolated features that lack a connection to a RPW, and therefore, would likely not be considered WOTUS. However, isolated wetlands are typically regulated by TDEC and considered WOTS.

#### 3.5.3.2.2 Streams and Wet-Weather Conveyances

Twenty-eight streams/RPWs were identified at the site. These 28 streams totaled 15,243 linear feet or 2.88 miles in length. The drainages were observed and scored at least 48- hours following a rain event (the later site visits were performed seven days following a rain event) and during "normal" weather conditions. The onsite streams are primarily headwater and first-order tributaries that contribute hydrology to Bear Creek and East Fork Poplar Creek. They range from approximately one to five feet wide, and have depths up to one foot deep, and silt/cobble. The riparian zones are generally wooded with a diversity of trees and shrubs.

Forty-two WWCs/NRPWs were identified and are typically headwater ephemeral channels located within the forested valleys throughout the site. These 42 WWCs/NRPWs totaled 16,042 linear feet or 3.04 miles in length. They range from one to five feet wide and generally have silt/gravel substrates with a few instances of cobble. The riparian zones are generally wooded.

See Section 3.4 for additional information on streams, wet weather conveyances, and wetlands.

### 3.5.3.3 Commercial and Sport Fisheries

The results from an aquatic survey conducted in 2021 of streams in proximity to the HCS is applicable to the SSP-2 site as well. That information is incorporated by reference from the TRISO-X ER (NRC 2022). The only recreationally important aquatic species found from the survey was bluegill. The EFPC has a recreational fishery, with targeted fish species including white bass and white crappie (Pomoxis annularis). As a result of mercury accumulation as well as bacteriological contamination in EFPC, the TDEC posted an advisory in 2020 against the consumption of all fish from EFPC (NRC 2022). Following hurricane Helene in late September 2024, TDEC issued a water contact advisory on November 20, 2024 for several waterways in the region as a reminder as to long-standing fish consumption warnings. EFPC continued to be listed warning against consumption of all fish (WBIR 2024).

Recreational fisheries also exist within Clinch River, located south of the SSP-2 site.

Commercial fishing is specifically not allowed in the Watts Bar Reservoir of the Clinch River (NRC 2022).

### 3.5.3.4 Key Aquatic Indicator Organisms

According to NUREG-1748, key aquatic indicators are expected to gauge changes in the distribution and abundance of species populations that are particularly vulnerable to impacts from the Proposed Action. Historically, benthic macroinvertebrates have been monitored within EFPC to assess impacts of previous activities and remediation, as these communities per TDEC can serve as indicators of overall system health. Benthic macroinvertebrate monitoring in 2019 indicated that the macroinvertebrate score in EFPC ranged from 'non-impaired' to 'moderately impaired' along its length (NRC 2022). The macroinvertebrate score is based upon measures of presence, species richness, and community diversity within the stream.

### 3.5.3.5 Important Ecological Systems

#### 3.5.3.5.1 Ecological Systems in the Vicinity of SSP-2

According to NUREG-1748, important ecological systems are areas that are especially vulnerable to change or that contain important species habitats, such as breeding areas (e.g., nesting areas), nursery areas, feeding areas, resting areas, wintering areas, or other areas of seasonally high concentrations of individuals of important species. Important ecological areas may include national or state forests, wilderness areas, scenic areas, nature preserves, wildlife management areas, Nationwide Rivers Inventory streams, and wild and scenic rivers.

Given the proximity of the center of the SSP-2 site and the HCS site (TRISO-X) at approximately one mile, the important ecological systems described surrounding the TRISO-X ER are representative of those within the vicinity of the SPP-2 site as well. Therefore, this information on important ecological systems is incorporated by reference from the TRISO-X ER (NRC 2022) and included here.

The ORR, as a federally-owned site covers approximately 33,000 ac. located in Anderson and Roane counties, is within the vicinity of the HCS. The ORNL Natural Resources Management program maintains a list of special habitats within the ORR that are collectively termed Sensitive Areas. Sensitive Areas are those containing State- or Federal-listed species, ecologically significant habitat, and/or particular management requirements. Sensitive Areas on the ORR and other ecologically important areas in the vicinity of both the HCS and SSP-2 sites are shown on Figure 3-36. These are applicable for the SSP-2 site as well.

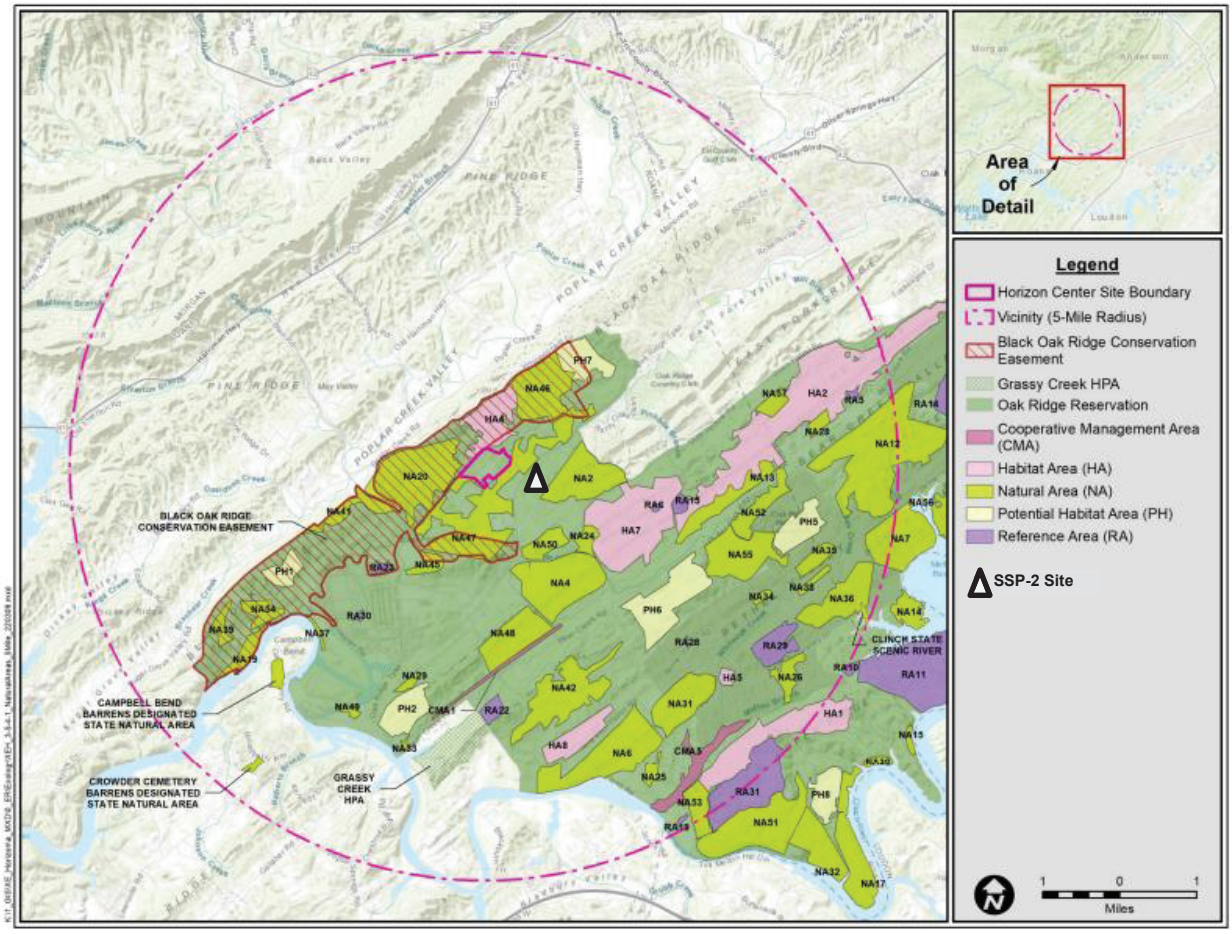



**Figure 3-36: Important Ecological Areas Within the Vicinity of HCS and the Site (NRC 2022)**

With the support of the Tennessee Wildlife Resources Agency (TWRA), this reservation has been designated as an Important Bird Area by the National Audubon Society in 2022. According to the TWRA:

> "*the Oak Ridge Reservation has large expanses of mature hardwood forest, unbroken by development or farmland; brushy corridors and cutover forest; abandoned pastures; grasslands; cedar glades and barrens; and wetlands. These habitats make the area attractive to a large and diverse number of species*."

Several access points on the reservation are open to the public and available for hiking and bird watching. Nearly 200 species of birds have been documented on the reservation by the National Audubon Society in 2022.

Forested areas provide important habitat for migrating and breeding woodland neotropical migrant species. Biologically and ecologically significant natural areas and habitats on the reservation, including forests, grasslands, bogs, barrens, bluffs, outcrops, and other areas, represent high-quality examples of natural communities and/or habitats for populations of rare species and species of concern. In April 2005, DOE and the State designated almost 3,000 acres of ORR land in the vicinity of the HCS (see Figure 3-36) as the Black Oak Ridge Conservation Easement. This natural area, managed by TWRA in cooperation with TDEC, contains the largest block of

unfragmented forest on the ORR. It provides valuable rare forest interior that serves as habitat for uncommon wildlife and nesting and migratory birds. An analysis by the ORNL of natural areas, managed areas, and other designated areas within the ORR identified categories and numbers of terrestrial or wetland areas.

While Figure 3-36 presents a map of the ORR designated ecologically significant areas within nominally five miles of the HCS and SSP-2 sites, the following four designated areas on the ORR are within 0.5 miles of the sites:

- Poplar Creek Cliffs (NA20) is a 476-ac. Natural Area (NA) within the Black Oak Ridge Conservation Easement with a steep, southwest-facing slope in the water gap that bisects Blackoak Ridge. It is located a short distance upstream from the confluence of EFPC with Poplar Creek. Small limestone cliffs occur near the stream. Many species that are unusual within the ORR occur here.
- East Fork Limestone Quarry/Blackoak Ridge Limestone Quarry/Blackoak Ridge Forest (NA46) is a 300-ac. NA with mature mixed hardwoods and pines. NA46 is located northwest of Lambert's Quarry within the Black Oak Ridge Conservation Easement.
- East Fork (Poplar Creek) Floodplain (NA47). This 609-ac. NA includes floodplain hardwood forest with large sycamores and an abundant understory of giant cane in places. Floodplain forests with canebrakes are rapidly disappearing in the southeastern United States because of development. The site also includes adjacent upland areas with rare plant communities.
- Habitat Area (HA) HA4 is an area of mature mixed hardwoods and pines within the Black Oak Ridge Conservation Easement. This area of forest interior includes habitat for rare species.

Upland forested and open-land community types on Tennessee Valley Authority (TVA)-owned land parcels surrounding TVA reservoirs and reservations provide a broad range of habitats that can support a wide array of terrestrial wildlife species. Habitat Protection Areas are managed by TVA to protect populations of species identified as threatened or endangered by the USFWS, State-listed species, and any unusual or exemplary biological communities/geological features.

The Campbell Bend Barrens and Crowder Cemetery Barrens are both registered as State natural areas within the vicinity of the HCS (see Figure 3-36). Campbell Bend Barrens is a 35-acre natural area that is approximately 1 mile northeast of the 15-acre Crowder Cemetery Barrens. These areas were once part of a larger natural area complex on the ORR before the land was sold in the mid-1980s. Barrens natural communities are rare in the Ridge and Valley Physiographic Province of East Tennessee. They occur on thin, cherty soil over dolomitic limestone and are dominated by warm-season grasses, legumes, and composites with eastern red cedar, white pine, and hardwoods scattered throughout.

The Clinch River is another important ecological resource within the vicinity of the HCS. A section of the Clinch River, from Melton Hill Dam upstream to the Pellissippi Parkway, is designated as a Class III Partially Developed River Area under the Tennessee Scenic Rivers Program (TDEC, 2021b). A partially developed river is defined by TDEC as rivers or sections of rivers that are free flowing, unpolluted and with shorelines and vistas essentially more developed. The Tennessee Scenic Rivers Program is a voluntary community-based partnership intended to preserve and

protect the free flowing, unpolluted, and outstanding scenic, recreational, geologic, botanical, fish, wildlife, historical, or cultural values of selected rivers or river segments in the State (TDEC).

#### 3.5.3.5.2 Ecological Systems on SSP-2

The ecological system of principal concern is that of forest-dwelling bats and suitable bat roosting habitat on SSP-2. The only federally listed animal species observed on ORR in recent years are bat species (DOE 2024a). Results from the July 30, 2025, IPaC query for the SSP-2 site listed four species of bats of federal concern (USFWS 2025). These include:

- Gray Bat *Myotis grisescens*) – Endangered
- Indiana Bat (*Myotis sodalist*) – Endangered
- Northern Long-Eared Bat (*Myotis septentrionalis)* – Endangered
- Tricolored Ba (*Perimyotis subflavus*) – federally proposed for listing as endangered.

A bat survey was conducted in June 2024. Seven sites were surveyed for five nights, and eight sites were surveyed for seven nights. A total of 15 different bat species were identified during the survey, including the four bat species just discussed.

Two of the endangered bat species, Indiana bat and northern long-eared bat, roost in trees. The other endangered species– gray bat – may use the area as foraging habitat. The tricolored bat, which is federally proposed for listing as endangered, and the state-listed (threatened) little brown bat may roost in trees to some extent and forage throughout the area. Any trees, either dead or alive, with exfoliating bark, cracks or crevices can provide potential roosting habitat.

As discussed in Section 3.5.3 on aquatic resources and shown in Figure 3-35, there are a number of streams and wetlands both on the SSP-2 and in areas immediately adjacent to SSP-2. The onsite streams are primarily headwater and first-order tributaries while the wet-weather convenances are typically headwater ephemeral channels located within the forested valleys through the site. Of the 17 wetlands, 14 were identified as palustrine forested, and the remaining three were identified as palustrine emergent. These areas, both onsite and adjacent to the SPP-2 site, have the potential to be a habitat for both federal listed (endangered) and state listed (threatened) species of orchids. Further discussion of endangered species of plants, including orchids, is presented in Section 3.5.4.2.

### 3.5.3.6 Potential sources of Ecological Stress

On a regional basis, habitat in the surrounding Knoxville Metropolitan Area and Oak Ridge continues to be lost to fragmentation caused by clearing for agriculture, industry, commercial and residential development, roads, and utility corridor. DOE and the private sector companies currently engaged in siting major facilities on transferred land from DOE will need to continually monitor such development to ensure that ORR ecosystems are not adversely impacted. OE will engage both the USFWS and TDEC to support appropriate conservation and protective measures in the construction, operation, and eventual decommissioning of the Facility. Fragmentation creates an “edge effect” that alters habitat conditions, such as moisture regime and light penetration, and can result in the introduction and spread of invasive species and predators harmful to forest-dependent species.

Certain non-native species are considered invasive and pose a significant threat to ecological systems. Executive Order 13112, Invasive Species signed February 3, 1999 (published February 8, 1999, in 64 Federal Register [FR] 6183), directs all Federal agencies to address invasive-species concerns and refrain from actions likely to increase invasive-species problems. This executive order was issued for the following purposes:

- Prevent the introduction of invasive species.
- Provide for their control.
- Minimize the economic, ecological, and human health impacts such species cause.

Nonnative terrestrial animal species observed on the HCS and/or on the ORR include the European starling, Eurasian collared dove, and rock dove. The ORR has developed integrated pest management programs for invasive insects that pose a threat to forest health, including southern pine beetle (Dendroctonus frontalis), hemlock woolly adelgid (Adelges tsugae), and emerald ash borer (Agrilus planipennis), and for nonnative invasive plants (NRC 2022). These programs will benefit the SSP-2 area given the proximity of the SSP-2 site relative to the ORR.

### 3.5.4 RARE, THREATENED, AND ENDANGERED SPECIES

The Endangered Species Act (ESA) (16 United States Code [USC] §§ 1531-1543) was passed to conserve the ecosystems upon which endangered and threatened species depend, and to conserve and recover those species. An endangered species is defined by the ESA as any species in danger of extinction throughout all or a significant portion of its range. A threatened species is likely to become endangered within the foreseeable future throughout all or a significant part of its range. Critical habitats, essential to the conservation of listed species, also can be designated under the ESA. The ESA establishes programs to conserve and recover endangered and threatened species and makes their conservation a priority for Federal agencies (NRC 2022).

Provisions under Section 7 of the ESA, as amended, require that any action likely to adversely affect a species classified as Federally protected be subject to review by the USFWS. Other species may receive additional protection under separate laws. Table 3-8 contains the listing of Federally threatened or endangered species currently classified or proposed for classification that may occur within the site was obtained from the USFWS IPaC website on July 30, 2025 (USFWS 2025). The USFWS IPaC identified three endangered species, one proposed for listing the specie as endangered, three threatened species, one proposed for listing specie as threatened, and one specie as “experimental population, non-essential.” According to the IPaC, designated critical habitats do not occur within the SSP-2 site.

Under the Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act of 1974 (TN Code § 70-8-101-112 [2020]), the State of Tennessee provides protection for species considered threatened, endangered, or deemed in need of management within the State other than those Federally listed under the ESA. The listings are handled by the TDEC; additionally, the Tennessee Natural Heritage Program maintains a database of species that are considered threatened, endangered, special concern, or tracked in Tennessee.

The listings of endangered species, results of field observations, and analysis from the ORETTC EA (DOE 2020a), TRISO-X ER (NRC 2022), and ORNL’s annual environmental report for 2023 (DOE 2024a) provide the basis for identifying potentially rare, threatened, and endangered species. Given that the SSP-2 site is (a) adjacent to the SSP-2A site, (2) the TRISO-X site

approximately one mile away from the center point of the location of the Facility on the SSP-2 site, and that all three facilities have been historically a part of or encompassed by the ORR, information for all three sites provide background information applicable to SSP-2. Thus, these references are incorporated by reference here for this section.

### 3.5.4.1 Rare, Threatened, and Endangered Species on ORR

#### 3.5.4.1.1 Fish, Amphibians and Reptiles, Birds, Mammals

This section presents a summary of lists of species of concern by state, federal, or international organizations know to have occurred on ORR as presented in DOE's 2023 Annual Site Environmental Report (ASER) (DOE 2024a). ASER is a summary of environmental data that characterizes environmental performance, lists environmental occurrences reported during the year, confirms compliance with environmental standards and requirements, and highlights significant environmental program activities. The ASER meets the requirements of DOE Order 231.1B, Environment, Safety, and Health Reporting, and its Attachment 2 regarding the preparation of an integrated annual site environmental report. The report includes sections on geology, climate, surface water, wetlands, air quality, wildlife, and endangered species. As of May 2024, Tennessee had 58 species listed under the federal Endangered Species Act, including 25 endangered and 33 threatened species (DOE 2024a). The complete Tennessee Threatened and Endangered List is available at Tennessee Ecological Services Field Office | Species | U.S. Fish & Wildlife Service.

##### 3.5.4.1.1.1 Bats on ORR

Birds, fish, reptiles and amphibians, and aquatic invertebrates are the most thoroughly surveyed animal groups on ORR. Nevertheless, the only federally listed animal species observed on ORR in recent years are mammals. The only federally listed animal species known to occur on the ORR in recent years are bat species. Endangered gray bats have been detected in acoustic surveys and mist net captures for more than 30 years. Endangered Indiana bats and northern long-eared bats have been detected in acoustic surveys and mist net captures since 2013. Surveys conducted in 2022 indicate use of several caves on the ORR by gray bats and other bat species. Suitable roosting and foraging habitat for the three federally listed bat species is abundant across the ORR. Additional bat species found on the ORR include the tricolored bat (state-listed as threatened and proposed for federal listing), little brown bat (state-listed as threatened and under consideration for federal listing), Rafinesque's big-eared bat (state-listed as in need of management), and eastern small-footed bat (state-listed as in need of management).

##### 3.5.4.1.1.2 Birds on ORR

Birds recorded on ORR and its boundary waters include the 228 species plus the cackling goose (Branta hutchinsii), purple gallinule (Porphyrio martinicus), American bittern (Botaurus lentiginosus), and federally threatened wood stork (Mycteria Americana) for a total of 236 species. Most of these species are protected under the Migratory Bird Treaty Act (MBTA 1918) and Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (EO 2001). DOE's updated 2016 memorandum of understanding on migratory birds with the USFWS strengthens migratory bird conservation on ORR through enhanced collaboration between DOE and USFWS. Breeding bird surveys conducted along varying numbers of up to 10 routes on ORR provide data for the Partners in Flight Program.

Several state-listed bird species such as the golden-winged warbler, cerulean warbler, and little blue heron are uncommon migrants or visitors to the reservation. The cerulean warbler, listed by the state as in need of management, often appears during the breeding season on ORR, but it is currently listed as a potential breeding bird on the reservation, because its actual breeding status is still uncertain.

The bald eagle, which was removed from the federal list of threatened and endangered species on August 9, 2007, is a year-round resident in Tennessee, though it can be difficult to find on ORR from September through November. At least three bald eagle nests were confirmed on the reservation in 2023, all located along the Clinch River/Melton Hill Lake.

Uncommon birds for ORR recorded in recent years include several species associated with wetland habitats. Due to efforts in the early 2000s to mitigate pond at East Tennessee Technology Park into a high-quality wildlife habitat, purple martin (Progne subis) and willow flycatcher (Epidonax tralillii) make their home here every spring and summer. The limpkin (Aramus guarauna), which is not usually observed in Tennessee, was seen utilizing the ponds in June 2023. The first documented appearance of a purple gallinule (Porphyrio martinicus) was made in 2017 on a trail camera at the Heritage Center Greenway Powerhouse Trail.

##### 3.5.4.1.1.3 Salamanders

ORNL is continuing monitoring of state-listed four-toed salamanders (Hemidactylium scutatum) at the ORR. Although the ORR contains some of the highest densities of this species in eastern Tennessee, they are considered by the state as in need of management. Several of their largest subpopulations on the ORR occur in areas that are slated for development. ORNL has also documented what appear to be state-listed black mountain salamanders (Desmognathus welteri), considered by the state as in need of management) on the ORR, just south of the HCS.

##### 3.5.4.1.1.4 Reptiles

Two state-listed reptiles have inhabited the ORR: the northern pinesnake (Pituophis melanoleucus, state-listed as threatened) and the eastern slender glass lizard (Ophisaurus attenuatus longicaudus, state-listed as in need of management). However, there is limited evidence to suggest the number of either species on the reservation.

##### 3.5.4.1.1.5 Fish

Several fish species listed and noted for management concern are known to inhabit areas in and around the ORR. One fish species, the spotfin chub (Erimonax monachus), which is listed as threatened by both the state and the federal government, has been sighted and collected in the city of Oak Ridge and may be present on the ORR. The tangerine darter (Percina aurantiaca), a species listed by the state as in need of management, has also been recorded near the ORR. The lake sturgeon (Acipenser fulvescens), state-listed as endangered, is known to inhabit the adjacent Clinch River. The Tennessee dace, listed by the state as in need of management, appears in the Bear Creek watershed, tributaries to the lower East Fork watershed, and Ish Creek.

#### 3.5.4.1.2 Threatened and Endangered Plants on ORR

Four plant species known to be on ORR (spreading false foxglove, Appalachian bugbane, tall larkspur, and butternut) have been under review for federal listing and were previously listed under the Category 2 candidate designation. FWS now informally refers to these as special concern species.

The state of Tennessee lists 16 plant species occurring on ORR as endangered, threatened, or of special concern; these are included in Table 3-8. An additional 10 threatened, endangered, or special concern species occur in the area and may be present on ORR, although currently unconfirmed. These are also included in Table 3-8.

### 3.5.4.2 Rare, Threatened, and Endangered Species Potentially on SSP-2

There have not been any development activities nor disturbances on SSP-2 since the first building was completed at ORETTC (SSP-2A) in 2023 beyond routine environmental monitoring activities. Figure 3-37 shows an aerial view of SSP-2 circa 2022 illustrating the grading and construction of facilities at ORETTC (SSP-2A) while the SSP-2 area remains essentially undisturbed. Since the SSP-2A parcel was previously a part of the overall SSP-2 parcel, the compilation of endangered, threatened, or other sensitive species for SSP-2A is representative for the current SSP-2 area. Referenced in the ORETTC EA (DOE 2020a).

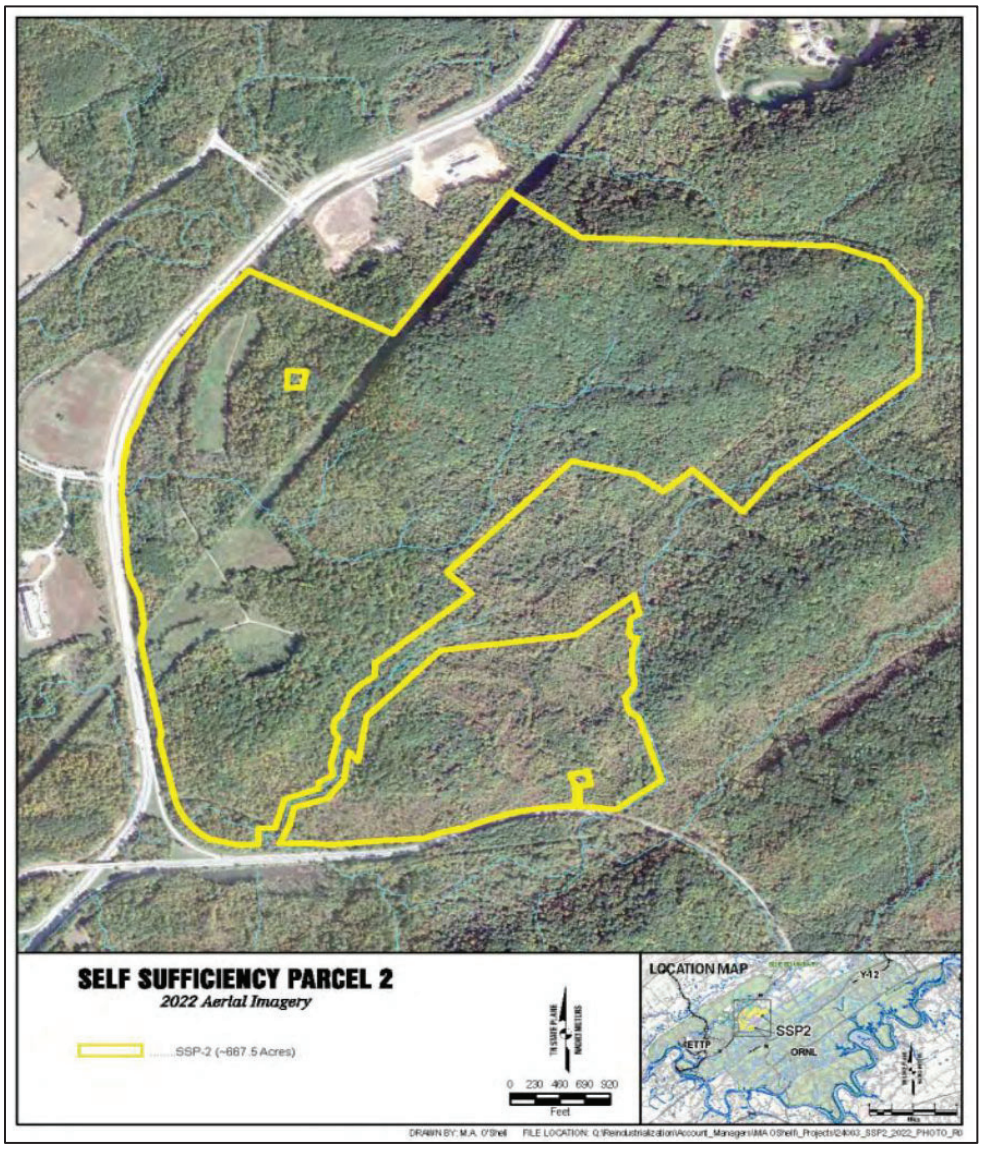



**Figure 3-37: Aerial Photograph of the Site Circa 2022**

- The list was compiled using resources identified by the USFWS Information for Planning and Consultation tool (USFWS 2025), using the SSP-2A parcel as the input area.

Note that an IPaC was generated for SSP-2 and is discussed below in Section 3.5.4.2.3.

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).

#### 3.5.4.2.1 Forest-Dwelling Bats on SSP-2 (OE Facility)

Of particular concern is the potential presence of forest-dwelling bats that were identified on the SSP-2 based on past surveys, listings from ORNL's annual site environmental report, and the 2024 bat survey. The northern long-eared bat, while not included in the USFWS listing, is included in this evaluation as endangered given that it has been included in the ORR listings and ORETTC EA (DOE 2020a).

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

In discussions with USFWS, there is a time period identified as the "bat pup season" when potential roost trees for listed species may not be cut nor surrounding habitat disturbed. This window covers the time period from when bats are emerging from winter hibernaculum (caves), and through the tree roosting/maternity season and "swarming" season when bats mate and get ready to return to winter roosts. Another consideration for avoiding potential impacts is whether the area is within a distance specified by the USFWS from any caves used for hibernation by the listed species. The USFWS and Tennessee Ecological Services Field Office developed a conservation strategy document in 2017 to formalize goals and priorities regarding the conservation and recovery of forest dwelling bats in Tennessee.

The 2024 survey locations of bat acoustic monitors are shown in Figure 3-38 both within and adjacent to SSP-2. Table 3-7 lists the 15 bats identified from the survey and their respective listing status. The three bat species (gray, northern long-eared, and Indiana) identified as "endangered" per the July 30, 2025 IPaC listing are included in the table as well as the bat species federally proposed for listing (tricolored).

**Table 3-7: Bats Identified from 2024 Survey and Listing Status**

| Scientific Name | Common Name | 4-letter Bat Species Identification | Listing Status** |
|---|---|---|---|
| Corynirhinus rafinesqueii | Rafinesque's big-eared bat | CORA | SD |
| Eptescus fuscus | Big brown bat | EPFU | |
| Lasiurus borealis | Eastern red bat | LABO | |
| Lasiurus cinereus | Hoary bat | LACI | |
| Lasionycteris noctivagans | Silver-haired bat | LANO | |
| Lasiurus seminolus | Seminole bat | LASE | |
| Myotis austroriparius | Southeastern bat | MYAUS | |
| Myotis grisescens | Gray bat | MYGR | E |
| Myotis leibii | Eastern small-footed bat | MYLE | SD |
| Myotis lucifugus | Little brown bat | MYLU | C; ST |
| Myotis septentrionalis | Northern long-eared bat | MYSE | E |
| Myotis sodalis | Indiana bat | MYSO | E |
| Nyctesius humeralis | Evening bat | NYHU | |
| Perimyotis subflavus | Tricolored bat | PESU | P; ST |
| Tadarida braziliensis | Brazilian free-tailed bat | TABR | |

**Status Codes:
E=federally listed endangered
T=federally listed threatened
P=federally proposed for listing
C=federal candidate for listing
CH=designated critical habitat
ST=state listed threatened
SD= state listed in need of management

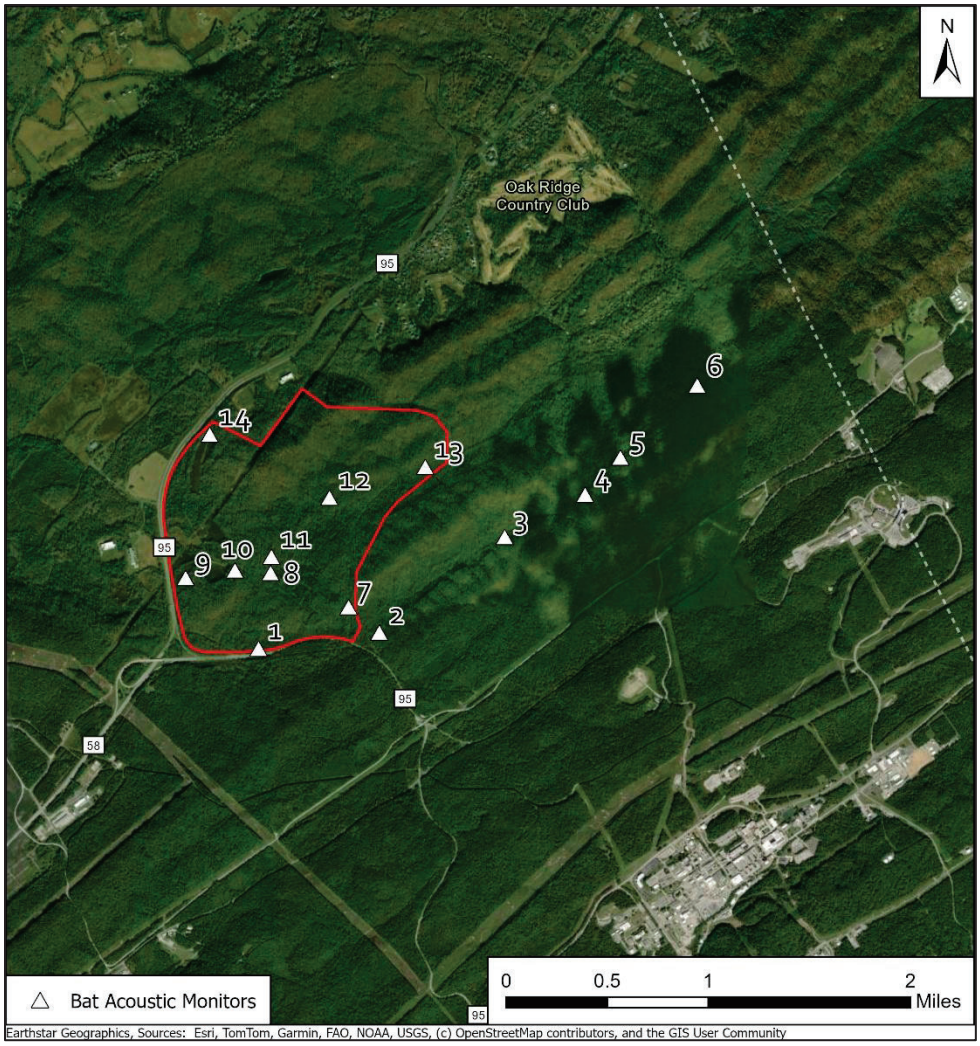



**Figure 3-38: Locations of Bat Acoustic Monitors Within and Adjacent to SSP-2**

#### 3.5.4.2.2 Plants

Results from the July 30, 2025, IPaC (USFWS 2025) query for the SSP-2 site listed the Virginia spiraea and White fringeless orchid on the federal list as threatened.

Table 3-8 notes that the Virginia spiraea is on the federal list as well as threatened but cited as “unlikely” to occur on the SSP-2A site that is adjacent to the SSP-2 site. Secondly, the Virginia spiraea is not on the list of known or previously reported vascular plant species reported on or near the ORR.

There are wetland areas that potentially include habitats conducive to supporting the White fringeless orchid.

#### 3.5.4.2.3 IPaC Listing for SSP-2

Table 3-8 (USFWS 2025) is summarized as follows.

- Six federally listed threatened or endangered species with the potential to occur:
  - Gray bat
  - Indiana bat
  - Norther Long-Eared Bat
  - Spotfin Chub
  - Virginia Spiraea
  - White Fringeless Orchid
- One proposed species for potentially adding to the federal list as threatened:
  - Tri-colored Bat
- One proposed species for potentially adding to the federal list as threatened for which its critical habitat does not overlap this site:
  - Monarch Butterfly
- One experimental population, non-essential species for which its critical habitat does not overlap this site:
  - Whooping Crane has never been known to nest in Tennessee and a very rare migrant and winter resident in Middle and East Tennessee per TDEC (TDEC n.d.).
- Zero critical habitats at this site per the IPaC listing.

**Table 3-8: Federally Listed Species and Habitats within Site vicinity (USFWS 2025)**

| Species Common and Scientific Name | Status[1] | Potential to Occur | Critical Habitat | Rationale for Exclusion[2] | General Habitat Description and Range |
|---|---|---|---|---|---|
| **Mammals** | | | | | |
| Gray Bat<br>Myotis grisescens | E | Yes | No | | Inhabit caves year-round but may sometimes use manmade tunnels as their summer quarters. Forages within 12 miles from summer roost, generally over water or in adjacent riparian. |
| Indiana Bat<br>Myotis sodalist | E | Yes | No<br>(Final critical habitat – does not overlap site) | | Females deliver their young in hollow trees or beneath tree bark, both live and dead trees. Forages in a wide variety of habitats, especially near water. Overwinters in limestone caves. |
| Northern Long-Eared Bat<br>Myotis septentrionalis | E | Yes | | | Roosts primarily under tree bark, both live and dead trees. Small maternity colonies also form in trees. Forages in the forest. Overwinters in caves and mines. |
| Tricolored Bat<br>Perimyotis subflavus | PE | Yes | No | | During winter, hibernate in caves, abandoned mines, and abandoned tunnels ranging from small to large in size. In the southern U.S., may hibernate in road-associated culverts. During spring, summer and fall months, they roost primarily among leaf clusters of live or recently dead deciduous hardwood trees. |
| **Birds** | | | | | |
| Whooping Crane<br>Grus americana | EXPN | No | No | ODR, HAB | Breeds in freshwater marshes and prairies. Uses grain fields, shallow lakes and lagoons, and saltwater marshes on migration and in winter. |
| **Fishes** | | | | | |
| Spotfin Chub<br>Erimonax monachus | T | Yes | No<br>(Final critical habitat – does not overlap site) | HAB | Relatively low-silt substrates in good flows. Subadults appear more commonly on sand and small gravel. |

| Species Common and Scientific Name | Status[1] | Potential to Occur | Critical Habitat | Rationale for Exclusion[2] | General Habitat Description and Range |
|---|---|---|---|---|---|
| **Insects** | | | | | |
| Monarch Butterfly Danaus Plexippus | PT | Yes | Proposed (Critical habitat – does not overlap site) | HAB | Range over both large areas and various habitat types. Proximity to surface water, elevation, and vegetative cover are most important criteria for monarch roost site selection. Overwinters in Mexico, then disperses across eastern North America during March to August. During September-December, they return south using two flyways, one that spans central United States and another that follows the Atlantic coast. |
| **Flowering Plants** | | | | | |
| Virginia Spiraea Spiraea virginiana | T | Yes | No | ODR | Found along scoured banks of high gradient streams or on meander scrolls, point bars, natural levees, and braided features of lower stream reaches. |
| White Fringeless Orchid *Platanthera integrilabia* | T | Yes | No | | Wet, boggy areas near stream heads and sloping areas kept moist by groundwater seeps. Often associated with Sphagnum in partial shade. |

Table Notes:
[1] Status Codes:
E – federally listed endangered,
PE – federally proposed for listing as endangered,
EXPN – Experimental population, Non-essential,
PT – federally proposed for listing as threatened,
T – federally listed threatened.
[2] Exclusion Codes:
ODR – outside known distributional range of the species
HAB – no habitat present in action area,

## 3.6 METEOROLOGY, CLIMATOLOGY, AND AIR QUALITY

The description of the general climate of the Site includes information on climatological averages of temperature, relative humidity, precipitation, wind speed and direction, and atmospheric stability. Information on measured extremes and diurnal ranges is also provided. The climatological discussion also includes information on special and severe meteorological phenomena such as thunderstorms, tornadoes, floods/flash flooding, snow fall/blizzards, icing/ice storms, and lightning.

As noted in NUREG-1748, Revision 0, Sections 5.6.2 and 5.13, Regulatory Guide 1.23, Revision 1 is referenced for Onsite Meteorological Programs. While this Regulatory Guide was written for Nuclear Power Plants, its guidance for meteorological parameters is directly applicable to a Part 70 facility and would bound the Part 70 facility. As stated in Regulatory Guide 1.23, *Section B – Discussion*:

> "*The minimum amount of onsite meteorological data to be provided at the time of application (1) for a construction permit is a representative consecutive 12-month period; (2) for an operating license is a representative consecutive 24-month period, including the most recent 1-year period; and (3) for an early site permit or a combined license that does not reference an early site permit is a consecutive 24-month period of data that is defendable, representative and complete, but not older than 10 years from the date of the application. However, 3 or more years of data are preferable and, if available, should be submitted with the application*".

The Regulatory Guide also specifies the height of the meteorological towers for collecting the data and what parameters should be obtained.

- "10-meter (33-foot) level and 60-meter (197-foot) levels and, if necessary, between the 10-meter (33–foot) level and a higher level that is representative of diffusion conditions from release points that are 85 meters (279 feet) or higher."
- Wind Speed and Direction, Vertical Temperature Difference, Ambient Temperature at 10 m, Precipitation, Atmospheric Moisture (Relative Humidity), Atmospheric Pressure, Cloud Cover, Visibility

In support of the Facility, eleven meteorological towers (Met Towers) with instrumentation set at various heights are located on the reservation of the ORNL and operated by ORNL. These towers surround the Facility site and give a detailed estimate of meteorological conditions that would exist at the site. These towers range from 2.49 miles to 6.32 miles from the site and surround the Site. A second set of meteorological tower data was obtained from nearby airports with ASOS or AWOS-3 certified towers. These towers range from 8.5 miles to 57.2 miles from the site. These towers all meet the typical 50-mile radius requirements that is denoted in most of the regulations. By obtaining data from each of these towers, a detailed pattern for the climate can be obtained and this data can then be used for release / dispersion calculations. A summary of the meteorological diurnal data was obtained and is captured in Table 3-9. As noted in the Wind Rose Data column, the number of years of data obtained for each Met Tower is documented. This data therefore meets and exceeds the general requirements of Regulatory Guide 1.23.

All data is hourly. Data for the ORNL Met Towers was obtained from the ORNL, ORR Meteorology web page (ORNL 2023)]. Data for the regional airports Met Towers was obtained from the Iowa State University, Iowa Environmental Mesonet (ISU 2025). This data is summarized in Table 3-9.

As noted in Table 3-9, the height of the meteorological tower instrumentation is identified in the temperature and wind related columns. The minimum height is 10 meters as stipulated by Regulatory Guide 1.23. As noted in Automated Surface Observing System (ASOS) User's Guide (NOAA 1998), current federal standards for sitting meteorological equipment specify (with some minor variance permitted) a height of 32.8 feet. The ASOS is considered to be the flagship automated observing network. Located at airports, the ASOS stations provide essential observations for the National Weather Service (NWS), the Federal Aviation Administration (FAA), and the Department of Defense (DOD). The primary function of the ASOS stations is to take minute-by-minute observations and generate basic weather reports. The AWOS III (AWOS 3) is a FAA Certified, ICAO/WMO Compliant Automated Weather Observing System (AWOS) for Meteorological Reporting at any size airport. The International Civil Aviation Organization (ICAO) and the World Meteorological Organization (WMO) are two United Nations specialized agencies that collaborate on aeronautical meteorology services.

Figure 3-39 shows the position of the eleven meteorological towers relative to the Facility site. Figure 3-40 shows the position of the twelve airports based meteorological towers relative to the Facility site.




**Figure 3-39 Location of the Facility and Oak Ridge National Laboratory Nearby Meteorological Monitoring Towers**

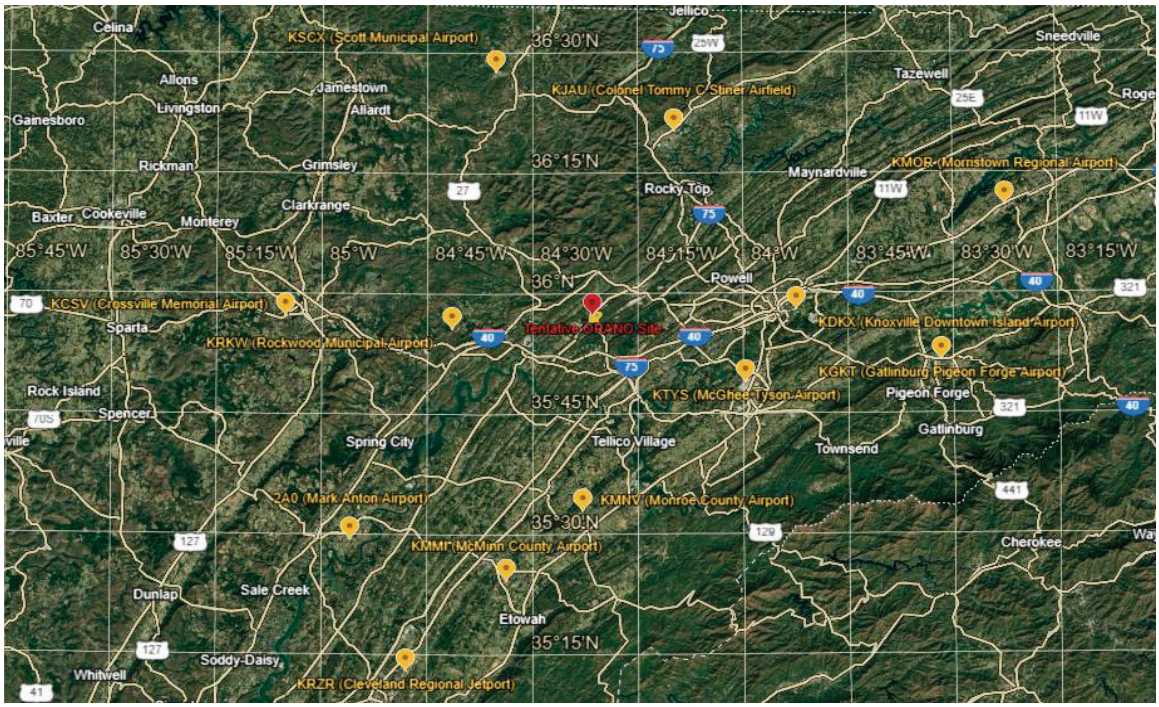



**Figure 3-40 Location of the Facility and Nearby Airport ASOS Meteorological Monitoring Towers**

## Table 3-9 Consolidated Meteorology Variations Based on Diurnal Data Supporting the Facility

| | Source | Distance to Site (Miles) | Azimuth from Site to Met Tower or Airport (deg) | Wind Rose Data # of yrs and elevation of data | Predominate Direction Wind Blows From, >10% (see Wind Roses) | Atmospheric Pressure Data Min/Max (in) | Precipitation Data Max per Hr. (in) | Annual Relative Humidity Min/Max (%) | Annual Air Temperature Min/Max (°F) | Cloud Cover (5 categories, 3 altitudes) | Visibility Data Min/Max (Miles) | Wind Direction Data (deg from *true* north) | Wind Speed Data Avg / Max (miles per hour) | Wind Gust Data Max (miles per hour) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DOE Met Tower K (ETTP) (non-airport) (Deactivated in 2016. Tower L has replaced Tower K.) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 2.49 | 235 | 10 yrs10 (10 m / 60 m) | SW (10 m) SW, ENE, WSW (60 m) | 28.37 / 29.75 | 1.96 | 2.1 / 100.0 | [-]0.9 / 94.8 (10 m) [-]0.2 / 93.3 (60 m) | Varies | N/A | Varies | 2.57 (10 m) / 20.7 (10 m) 5.77 (60 m) / 32.5 (60 m) | 79.2 (10 m) 74.9 (30 m) |
| DOE Met Tower D (C) (non-airport) Tower D replaces Tower C which is deactivated | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 2.58 | 134 | 10 yrs (Tower C) (10 m / 30 m / 100 m) 5 yrs (Tower D) (15 m / 35 m / 60 m) | WSW, W, SW (10 m) ENE, SW, WSW, NE (30 m) SW, NE, ENE, WSW (100 m) SW, WSW, NE, W (15 m) ENE, SW, WSW, NE (35 m) NE, SW, WSW, ENE (60 m) | 28.1 / 29.99 | 1.55 | 2.2 / 100.0 | [-]3.2 / 94.9 (15 m) [-]3.7 / 94.1 (35 m) [-]4.0 / 94.7 (60 m) | Varies | N/A | Varies | 2.95 / 20.8 (15 m) 3.97 / 23.0 (35 m) 5.07 / 29.9 (60 m) | 56.5 (15 m) 91.8 (35 m) 92.3 (60 m) |
| DOE Met Tower L (non-airport) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 2.74 | 229 | 10 yrs (10/15 m / 30 m) | SW (10/15 m) SW, SSW (30 m) | 27.98 / 29.89 | 1.96 | 12.4 / 100.0 | [-]3.8 / 94.8 (10/15 m) [-]2.1 / 94.1 (30 m) | Varies | N/A | Varies | 3.14 (10/15 m)/ 21.4 (10/15 m) 3.96 (30 m) / 24.9 (30 m) | 78.3 (10/15 m) 84.5 (30 m) |
| DOE Met Tower E (non-airport) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 2.95 | 121 | N/A | N/A | 28.29 / 29.84 | Not measured | 0.0 / 98.4 | 6.9 / 94.8 (15 m) | Not measured | N/A | Not measured | Not measured | Not measured |
| DOE Met Tower F (non-airport) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 3.03 | 88 | 3.2 yrs (10 m) | WSW, NE, ENE, W (10 m) | 28.09 / 29.53 | 1.81 | 6.7 / 100.0 | 5 / 93.6 (10 m) | Not measured | N/A | Varies | 4.58 / 25.7 (10 m) | 66.7 (10 m) |
| DOE Met Tower B (non-airport) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 3.36 | 112 | 10 yrs (15 m / 30 m) | NE, ENE, SW (15 m) NE, SW, WSW, ENE (30 m) | Not measured | 1.8 | 11.3 / 100.0 | [-]2.6 / 102.3 (10/15 m) 0.0 / 101.7 (30 m) | Varies | N/A | Varies | 2.71 / 16.6 (10/15 m) 3.53 / 21.1 (30 m) | 78.1 (10/15/m) 78.1 (30 m) |
| DOE Met Tower M (non-airport) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 3.36 | 211 | 10 yrs (10 m) | NNE, SW, N, NE (10 m) | Not measured | Not Measured | 8.6 / 100.0 | [-]4.8 / 95.7 (10 m) | Not measured | N/A | Varies | 1.97 / 15.9 (10 m) | 62.3 (10 m) |
| DOE Met Tower A (non-airport) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 3.64 | 126 | 10 yrs (10/15 m / 30 m) | WSW, ENE, NE (10/15 m) ENE, WSW (30 m) | 28.25 / 29.99 | 1.8 | 4.3 / 100.0 | [-]1.4 / 102.4 (10/15 m) 0.2 / 101.9 (30 m) | Varies | N/A | Varies | 2.86 / 18.5 (10/15 m) 4.14 / 26.7 (30 m) | 83.7 (10/15/m) 83.4 (30 m) |
| DOE Met Tower W (non-airport) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 5.11 | 66 | 10 yrs (10 m / 30 m / 60 m) | SW, NE, ENE, WSW (10 m) SW, WSW, NE, ENE (30 m) SW, NE, WSW, W (60 m) | 26.59 / 29.94 | 1.73 | 9.6 / 100.0 | [-]0.9 / 94.2 (10 m) [-]1.6 / 92.5 (60 m) | Varies | N/A | Varies | 3.51 / 17.2 (10 m) 5.37 / 25.9 (30 m) 6.52 / 30.8 (60 m) | Not measured |

| | Source | Distance to Site (Miles) | Azimuth from Site to Met Tower or Airport (deg) | Wind Rose Data # of yrs and elevation of data | Predominate Direction Wind Blows From, >10% (see Wind Roses) | Atmospheric Pressure Data Min/Max (in) | Precipitation Data Max per Hr. (in) | Annual Relative Humidity Min/Max (%) | Annual Air Temperature Min/Max (°F) | Cloud Cover (5 categories, 3 altitudes) | Visibility Data Min/Max (Miles) | Wind Direction Data (deg from *true* north) | Wind Speed Data Avg / Max (miles per hour) | Wind Gust Data Max (miles per hour) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DOE Met Tower S (non-airport) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 6.11 | 70 | 5 yrs (25 m) | NE, SW, WSW (25 m) | Not measured | Not measured | Not measured | 4.9 / 94.3 | Varies | N/A | Varies | 6.56 / 84 (25 m) | Not measured |
| DOE Met Tower Y (non-airport) | OAK RIDGE RESERVATION METEOROLOGY (ornl.gov) | 6.32 | 66 | 10 yrs (15 m / 33 m) | ENE, SW, WSW, NE (15 m) WSW, NE, SW, ENE (33 m) | 28.18 / 29.92 | 1.56 | 5.7 / 100.0 | 0.8 / 94.6 (15 m) 0.3 / 93.5 (33 m) | Varies | N/A | Varies | 4.22 / 20.3 (15 m) 4.87 / 23.9 (33 m) | Not measured |
| Oak Ridge Met Tower (OQT) (non-airport) | ASOS | 8.51 | 55 | 10 yrs [2] | E, NNE | 29.18 / 30.77 | 2.01 | 11.04 / 100.0 | 0.0 / 98.0 | Varies | 0.25 / 10.0 | Varies | 2.22 / 26.45 | 56.35 |
| Rockwood Municipal Airport (KRKW) | AWOS-3 | 18.75 | 263 | 6 yrs [1] | NE, NNE | 29.21 / 30.69 | 1.46 | 11.65 / 100.0 | [-]0.4 / 93.2 | Varies | 0.25 / 10.0 | Varies | 4.87 / 32.20 | 47.15 |
| McGhee Tyson Airport (KTYS) | AWOS-3 | 22.47 | 115 | 10 yrs [1] | NE, E, ENE, NNE | 29.13 / 30.90 | 1.80 | 11.74 / 100.0 | 1.0 / 98.0 | Varies | 0.00 / 10.0 | Varies | 6.30 / 73.60 | 87.40 |
| Knoxville Downtown Island Airport (KDKX) | AWOS-3 | 27.14 | 87 | 10 yrs [1] | ENE, E | 29.19 / 30.74 | 1.62 | 9.90 / 100.0 | [-]18.4 / 98.6 | Varies | 0.25 / 10.0 | Varies | 2.28 / 28.75 | 50.60 |
| Monroe County Airport (KMNV) | AWOS-3 | 28.05 | 182 | 8 yrs [1] | NE, NNE, ENE | 29.18 / 30.70 | 1.53 | 0.81 / 100.0 | 1.4 / 98.6 | Varies | 0.25 / 10.0 | Varies | 4.31 / 57.50 | 57.50 |
| Colonel Tommy C Stiner Airfield Airport (KJAU) | AWOS-3 | 28.54 | 22 | 9 yrs [1] | N, NNE, NE | 29.20 / 31.22 | 1.52 | 1.64 / 100.0 | [-]5.8 / 96.8 | Varies | 0.25 / 10.0 | Varies | 2.25 / 57.50 | 70.15 |
| Scott Municipal Airport (KSCX) | AWOS-3 | 37.03 | 339 | 5 yrs [1] | NNE | 29.13 / 30.70 | 1.49 | 8.54 / 100.0 | [-]9.4 / 95.0 | Varies | 0.25 / 10.0 | Varies | 4.83 / 69.00 | 77.05 |
| McMinn County Airport (KMMI) | AWOS-3 | 39.75 | 198 | 10 yrs [1] | NE, ENE | 29.20 / 30.78 | 2.13 | 9.29 / 100.0 | [-]2.2 / 96.8 | Varies | 0.25 / 10.0 | Varies | 2.76 / 80.50 | 88.55 |
| Crossville Memorial Airport-Whitson Field (KCSV) | AWOS-3 | 40.79 | 270 | 10 yrs [1] | N, E | 29.18 / 30.69 | 1.88 | 9.82 / 100.0 | [-]8.0 / 93.0 | Varies | 0.25 / 10.0 | Varies | 5.51 / 35.65 | 60.95 |
| Mark Anton Airport (2A0) | AWOS-3 | 45.49 | 225 | 7 yrs [1] | NNE, NE, S | 29.12 / 30.71 | 1.53 | 13.46 / 100.0 | 5.0 / 100.4 | Varies | 0.25 / 10.0 | Varies | 3.05 / 33.35 | 55.20 |
| Gatlinburg-Pigeon Forge Airport (KGKT) | AWOS-3 | 46.9 | 98 | 10 yrs [1] | E, NE, ENE | 29.17 / 30.75 | 1.30 | 8.03 / 100.0 | [-]4.0 / 100.4 | Varies | 0.25 / 10.0 | Varies | 2.90 / 35.65 | 57.50 |
| Cleveland Regional Jetport Airport (KRZR) | AWOS-3 | 56.73 | 206 | 10 yrs [1] | NNE | 29.09 / 30.76 | 2.06 | 8.87 / 100.0 | [-]4.0 / 98.6 | Varies | 0.25 / 10.0 | Varies | 4.09 / 35.65 | 57.50 |
| Moore-Murrell Airport (KMOR) | AWOS-3 | 57.16 | 74 | 10 yrs [1] | E, ENE | 29.15 / 32.18 | 1.78 | 0.80 / 100.0 | 1.4 / 100.4 | Varies | 0.25 / 10.0 | Varies | 4.31 / 34.50 | 55.20 |

Notes:

1. Per FAA Advisory Circular 150/5220-16E, Section 3.3.c, nominal height of towers is 30 to 33 ft.
2. Per Automated Surface Observing System User Guide, Section 3.2, states that current federal standards for sitting meteorological equipment specify (with some variance permitted) a height of 32.8 feet. Typical ASOS wind sensor heights are 33 feet or 27 feet, depending on local site-specific restrictions or requirements.

### 3.6.1 METEOROLOGY AND CLIMATOLOGY

The Facility site lies on the Site, at the base of the White Oak Mountain which is one of a series of paralleling ridges running approximately north-northeast in the Tennessee Valley between the Cumberland Plateau/Mountains to the west and the Blue Ridge and Smoky Mountains to the east. The ridge averages 1,368 feet AMSL, the highest point being 1,495 feet AMSL. The Facility site is approximately 800 to 825 feet AMSL. The Clinch River lies approximately 3.3 miles south-west of the Facility site, which is approximately 750 feet AMSL. This location, on the Clinch River, is approximately 24 miles southwest of the Norris Dam and Norris Reservoir. While a breach of the dam (retaining $1.11x10^{11}$ $ft^3$ of water) would not cause a flooding problem for the Facility site due to the elevation difference between the site and the Clinch River, heavy rains and significant snow melt from the nearby ridge could result in localized flooding of streams coming off the mountain. These streams have been identified, and appropriate terracing of the site and redirection of streams is planned.

Portions of the following discussion has been obtained from the Clinch River Nuclear (CRN) ESP (TVA 2016) and modified to address the Facility. The Facility Site is in the eastern Tennessee portion of the southern Appalachian region, which is dominated much of the year by the Azores-Bermuda anti-cyclonic circulation. This dominance is most pronounced in late summer and early fall and is accompanied by extended periods of fair weather and widespread atmospheric stagnation. In winter and early spring, eastward moving migratory high- or low-pressure systems bring alternately cold and warm air masses into the area. The resultant changes in wind, atmospheric stability, precipitation, and other meteorological elements cause the normal circulation to become more diffuse over the region. In the summer and early fall, the migratory systems are less frequent and less intense. Frequent incursions of warm, moist air from the Gulf of Mexico and occasionally from the Atlantic Ocean are experienced in the summer. The site is primarily affected by cyclones from the southwest and Gulf coast that translate toward the northeast U.S. by passing along either the west side or the east side of the Appalachian chain and by cyclones from the plains or mid-west that move up the Ohio River Valley.

At the mesoscale level, topography influences the weather and climate of the region around the Facility Site. The site, located approximately 6.5 miles southwest of the City of Oak Ridge, Tennessee, is situated in “The Great Valley” between two major mountain regions. To the northwest lie the Cumberland Mountains and to the southeast are the Great Smoky Mountains. These mountainous regions orient “The Great Valley” in a southwest-to-northeast alignment. Prevailing winds in the region reflect the channeling of air flow caused by the orientation of the valleys and ridges. Wind speeds are low, with an average (mean) annual wind speed of 4.02 miles per hour (mph) for all the ORNL Met Towers regardless of elevation and 4.31 mph for all the surrounding airports near Oak Ridge (Table 3-9). During winter when the jet stream moves southward, the Cumberland Mountains also serve to retard or moderate cold outbreaks by blocking dense, cold polar continental air masses. In summer, the topography in the region may enhance thunderstorm activity due to orographic lift.

### 3.6.1.1 Temperature

Area temperatures measured in Oak Ridge indicate warm summers and mild winters. In January, the normal daily maximum temperature is 47.8 °F with a normal daily minimum temperature of 29.4 °F based on 30 years of data. In July, the normal daily maximum temperature is 88.6 °F, while the normal daily minimum temperature is 68.2 °F based on 30 years of data (Oak Ridge 30 Year Climate Average)(Table 3-10) (ORNL n.d.). The highest and lowest temperatures recorded during a 72-year period of record at Oak Ridge are 105 °F and -17 °F respectively (ORNL n.d.). The 72-year data was obtained from the same table as the 30-year data. Refer to Figure 3-41.

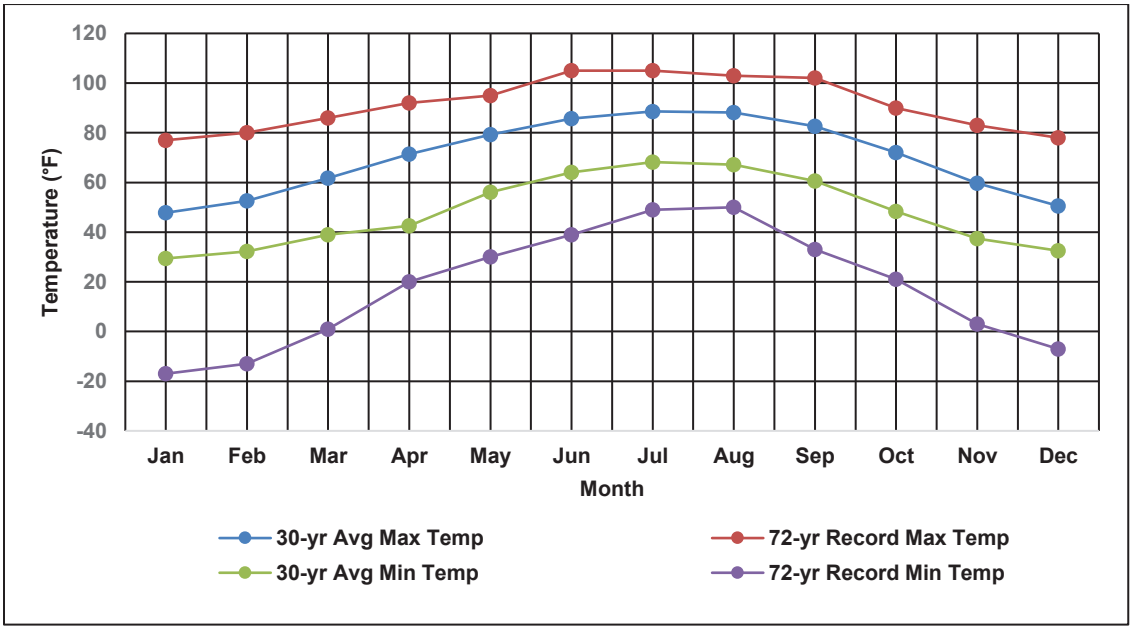



**Figure 3-41 Monthly Temperature**

Relative humidity in the region averaged 74.45 percent based on a 22-year period of record from Oak Ridge Relative Humidity Summary – ORNL 1998-2013 (captured in Table 3-11) and Oak Ridge Relative Humidity Summary – ORNL 2015-2021 (captured in Table 3-12) (ORNL 2023).

As seen in Table 3-11 and Table 3-12, the average monthly relative humidity values range from the mid-60% to the 80%. The maximum daily relative humidity values are in the +90% range and the minimum daily relative humidity are in the range of 20% to 50%. There is negligible seasonal dependence for the relative humidity. Refer to Figure 3-42.

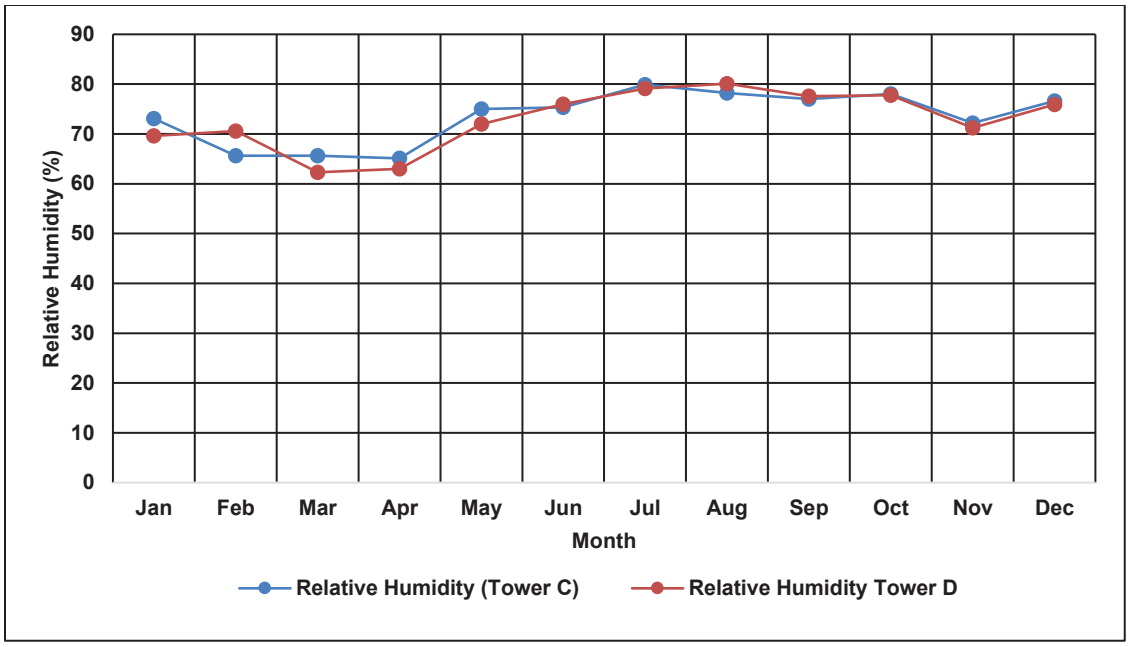



**Figure 3-42 Monthly Relative Humidity (%)**

### 3.6.1.2 Precipitation

The type of precipitation that occurs on the Site varies with the seasons. Convective showers and thunder showers occur in the summer. Precipitation during the spring and fall can be characterized as showery or as steadier rainfall. Winter precipitation is typically in the form of snow. Snow can occur anytime from November through April.

Precipitation averages about 55.8 inches annually based on 30 years of data (Oak Ridge 30 Year Climate Average) (Table 3-10) (ORNL n.d.). Late winter (January–March) is usually the wettest season, with more than 15.78 inches annually, while late summer–early autumn (August–October) is the driest season, with less than 10.43 inches annually. Droughts are uncommon in this region of the United States. Refer to Figure 3-43.

Snowfall in the Oak Ridge area, though normally light, usually occurs from November through March with an average of about 5.70 inches of snow annually based on 30 years of data (Oak Ridge 30 Year Climate Average) (Table 3-10, Figure 3-44) (ORNL n.d.). Severe storms are relatively infrequent as the region is east of maximum tornado activity, south of the most significant snowstorms, and inland from hurricane and tropical storm tracks.

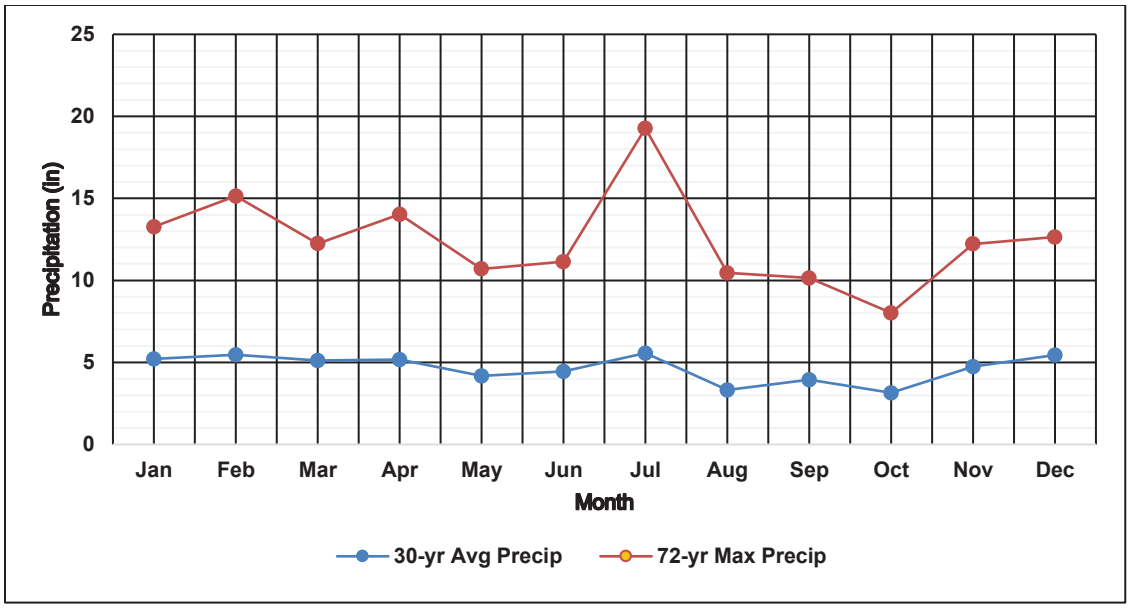



**Figure 3-43 Monthly Precipitation (inches)**

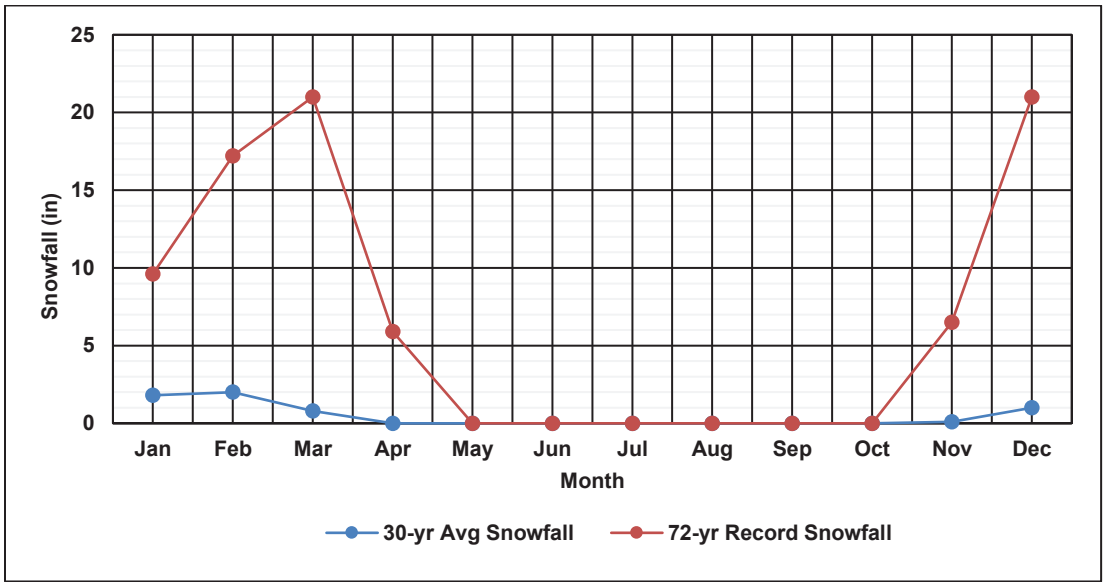



**Figure 3-44 Monthly Snowfall (inches)**

**Table 3-10 Climate Normals (1991-2020) and Extremes (1948-2021) for Oak Ridge National Laboratory, Oak Ridge, Tennessee with 2021 ORNL Comparisons**

| Monthly Variables | JAN | | FEB | | MAR | | APR | | MAY | | JUN | | JUL | | AUG | | SEP | | OCT | | NOV | | DEC | | ANNUAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Temperature** | **F** | | **F** | | **F** | | **F** | | **F** | | **F** | | **F** | | **F** | | **F** | | **F** | | **F** | | **F** | | **F** | |
| 30-Yr Avg. Max. Temp. | 47.8 | | 52.6 | | 61.7 | | 71.4 | | 79.2 | | 85.7 | | 88.6 | | 88.1 | | 82.6 | | 72.0 | | 59.7 | | 50.5 | | 70.0 | |
| 2021 Avg. Max. Temp. | 46.9 | | 52.5 | | 64.8 | | 69.1 | | 75.7 | | 84.0 | | 86.5 | | 86.6 | | 79.9 | | 71.6 | | 57.6 | | 60.4 | | 69.6 | |
| 72-Yr Record Max. Temp. | 77.0 | | 80.0 | | 86.0 | | 92.0 | | 95.0 | | 105.0 | | 105.0 | | 103.0 | | 102.0 | | 90.0 | | 83.0 | | 78.0 | | 105.0 | |
| 30-Yr Avg. Min. Temp. | 29.4 | | 32.3 | | 39.0 | | 42.5 | | 56.1 | | 64.1 | | 68.2 | | 67.1 | | 60.6 | | 48.4 | | 37.4 | | 32.5 | | 48.1 | |
| 2021 Avg. Min. Temp. | 30.7 | | 30.9 | | 39.0 | | 46.7 | | 51.3 | | 63.0 | | 66.5 | | 66.9 | | 59.1 | | 52.9 | | 31.9 | | 38.9 | | 48.2 | |
| 72-Yr Record Min. Temp. | -17.0 | | -13.0 | | 1.0 | | 20.0 | | 30.0 | | 39.0 | | 49.0 | | 50.0 | | 33.0 | | 21.0 | | 3.0 | | -7.0 | | -17.0 | |
| 30-Yr Avg. Temp. | 38.5 | | 42.4 | | 50.4 | | 55.7 | | 67.5 | | 74.7 | | 78.1 | | 77.3 | | 71.3 | | 59.9 | | 48.4 | | 41.4 | | 58.8 | |
| 2021 Avg. Temp. | 38.9 | | 40.8 | | 52.6 | | 56.0 | | 65.2 | | 73.8 | | 76.7 | | 77.0 | | 69.8 | | 62.5 | | 45.1 | | 49.9 | | 59.0 | |
| 2021 Departure from Avg. Temp. | 0.4 | | -1.6 | | 2.2 | | 0.3 | | -2.3 | | -0.9 | | -1.4 | | -0.3 | | -1.5 | | 2.6 | | -3.3 | | 8.5 | | 0.2 | |
| 30-Yr Avg. Heating Degree Days | 811.0 | | 631.0 | | 453.0 | | 198.0 | | 54.9 | | 2.0 | | 0.0 | | 0.0 | | 16.0 | | 181.0 | | 487.0 | | 718 | | 3552.0 | |
| 2021 Heating Degree Days | 808.0 | | 679.0 | | 451.0 | | 279.0 | | 109.0 | | 0.0 | | 0.0 | | 0.0 | | 20.0 | | 155.0 | | 597.0 | | 467 | | 3565.0 | |
| 30-Yr Avg. Cooling Degree Days | 0.0 | | 1.0 | | 12.0 | | 32.0 | | 144.0 | | 306.0 | | 423.0 | | 398.0 | | 215.0 | | 39.9 | | 2.0 | | 0.0 | | 1573.0 | |
| 2021 Cooling Degree Days | 0.0 | | 0.0 | | 12.0 | | 9.0 | | 114.0 | | 236.0 | | 363.0 | | 372.0 | | 164.0 | | 77.0 | | 0.0 | | 0.0 | | 1347.0 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Precipitation** | **Mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** |
| 30-Yr Avg. Precipitation | 132.4 | 5.21 | 138.7 | 5.46 | 129.8 | 5.11 | 131.6 | 5.18 | 106.5 | 4.19 | 113.1 | 4.45 | 141.5 | 5.57 | 84.6 | 3.33 | 100.4 | 3.95 | 80.0 | 3.15 | 120.7 | 4.75 | 138.5 | 5.45 | 1417.8 | 55.80 |
| 2021 Precipitation | 63.3 | 2.49 | 124.8 | 4.91 | 249.8 | 9.83 | 36.3 | 1.43 | 115.6 | 4.55 | 147.4 | 5.80 | 78.8 | 3.10 | 285.3 | 11.23 | 98.8 | 3.89 | 149.1 | 5.87 | 26.2 | 1.03 | 116.9 | 4.60 | 1492.2 | 58.73 |
| 2021 Departure from Avg. Precipitation. | -69.1 | -2.72 | -14.0 | -0.55 | 119.9 | 4.72 | -95.3 | -3.75 | 9.1 | 0.36 | 34.3 | 1.35 | -62.8 | -2.47 | 200.7 | 7.90 | -1.5 | -0.06 | 69.1 | 2.72 | -94.5 | -3.72 | -21.6 | -0.85 | 74.4 | 2.93 |
| 72-Yr Record Max. Precipitation | 337.2 | 13.27 | 384.7 | 15.14 | 311.0 | 12.24 | 356.5 | 14.03 | 271.9 | 10.70 | 283.0 | 11.14 | 489.6 | 19.27 | 265.8 | 10.46 | 257.6 | 10.14 | 203.8 | 8.02 | 310.5 | 12.22 | 321.2 | 12.64 | 1939.4 | 76.33 |
| 72-Yr Record Max. 24-hour Precipitation | 108.0 | 4.25 | 131.6 | 5.18 | 120.4 | 4.74 | 158.5 | 6.24 | 112.0 | 4.41 | 94.0 | 3.70 | 124.8 | 4.91 | 190.1 | 7.48 | 160.1 | 6.30 | 67.6 | 2.66 | 130.1 | 5.12 | 130.1 | 5.12 | 190.1 | 7.48 |
| 72-Yr Record Min. Precipitation | 23.6 | 0.93 | 21.3 | 0.84 | 54.1 | 2.13 | 46.2 | 1.82 | 20.3 | 0.80 | 13.5 | 0.53 | 31.3 | 1.23 | 13.70 | 0.54 | Trace | Trace | Trace | Trace | 34.80 | 1.37 | 17.00 | 0.67 | 911.4 | 35.87 |
| 30-Yr Avg. Snowfall | 45.7 | 1.80 | 50.8 | 2.00 | 20.3 | 0.80 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.50 | 0.10 | 25.4 | 1.00 | 144.8 | 5.70 |
| 2021 Snowfall | Trace | Trace | 27.9 | 1.10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27.9 | 1.10 |

| Monthly Variables | JAN | | FEB | | MAR | | APR | | MAY | | JUN | | JUL | | AUG | | SEP | | OCT | | NOV | | DEC | | ANNUAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature | F | | F | | F | | F | | F | | F | | F | | F | | F | | F | | F | | F | | F | |
| 72-Yr Record Snowfall | 243.9 | 9.60 | 437.0 | 17.20 | 533.6 | 21.00 | 149.9 | 5.90 | Trace | Trace | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | Trace | Trace | 165.20 | 6.50 | 533.6 | 21.00 | 1051.9 | 41.40 |
| 72-Yr Record 24-hour Snowfall | 210.9 | 8.30 | 287.1 | 11.30 | 304.9 | 12.00 | 137.2 | 5.40 | Trace | Trace | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | Trace | Trace | 165.20 | 6.50 | 304.9 | 12.00 | 304.9 | 12.00 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Days | | Days | | Days | | Days | | Days | | Days | | Days | | Days | | Days | | Days | | Days | | Days | | Days | |
| 30-Yr Avg. Days Max. Temp. ≥ 90 °F | 0.0 | | 0.0 | | 0.0 | | 0.1 | | 1.5 | | 7.7 | | 14.4 | | 12.7 | | 4.9 | | 0.1 | | 0.0 | | 0.0 | | 41.4 | |
| 2021 No. Days Max. Temp. ≥ 90 °F | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 1.0 | | 3.0 | | 11.0 | | 11.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 26.0 | |
| 30-Yr Avg. Days Min. Temp. ≤ 32 °F | 19.8 | | 15.4 | | 8.7 | | 1.8 | | 0.1 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.9 | | 10.3 | | 16.5 | | 73.5 | |
| 2021 Days Min. Temp. ≤ 32 °F | 22 | | 17.0 | | 8.0 | | 6.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 21.0 | | 12.0 | | 86.0 | |
| 30-Yr Avg. Days Max. Temp. ≤ 32 °F | 2.6 | | 0.8 | | 0.1 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.8 | | 4.3 | |
| 2021 Days Max. Temp. ≤ 32 °F | 1.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 1.0 | |
| 30-Yr Avg. Days Precip. ≥ 0.01 in. | 11.8 | | 11.6 | | 12.4 | | 11.1 | | 11.5 | | 11.4 | | 12.3 | | 9.8 | | 8.1 | | 8.3 | | 9.2 | | 12.2 | | 129.7 | |
| 2021 Days Precip. ≥ 0.01 in. | 11.0 | | 15.0 | | 12.0 | | 8.0 | | 5.0 | | 10.0 | | 11.0 | | 15.0 | | 7.0 | | 15.0 | | 6.0 | | 11.0 | | 126.0 | |
| 30-Yr Avg. Days Precip. ≥ 1.00 in. | 1.7 | | 1.4 | | 1.4 | | 1.5 | | 1.1 | | 1.2 | | 1.6 | | 0.9 | | 1.2 | | 1.0 | | 1.7 | | 1.7 | | 16.4 | |
| 2021 Days Precip. ≥ 1.00 in. | 0.0 | | 1.0 | | 6.0 | | 0.0 | | 2.0 | | 2.0 | | 0.0 | | 4.0 | | 0.0 | | 2.0 | | 0.0 | | 1.0 | | 18.0 | |

- 1948-1964 CHEYENNE HALL Area; 1965-1999 NOAA-ATDD; 1999-2014 KOQT ASOS; 2015-2021 ORNL
- Data table obtained from (ORNL n.d.)

**Table 3-11 Relative Humidity Summary for ORNL Tower "C" in % (1998-2013)**

| Month | Avg Daily Maximum | Avg Daily Minimum | Monthly Avg |
|---|---|---|---|
| January | 91.7 | 50.7 | 73.1 |
| February | 85.6 | 43.7 | 65.6 |
| March | 89.9 | 41.5 | 65.6 |
| April | 91.1 | 39.4 | 65.1 |
| May | 98.0 | 47.1 | 75.0 |
| June | 96.5 | 47.8 | 75.3 |
| July | 98.7 | 52.6 | 79.9 |
| August | 98.1 | 50.1 | 78.2 |
| September | 96.2 | 47.7 | 77.0 |
| October | 97.9 | 47.6 | 78.0 |
| November | 92.8 | 45.3 | 72.2 |
| December | 93.8 | 53.9 | 76.6 |
| | | | |
| Annual | 94.2 | 47.3 | 73.5 |

**Table 3-12 ORNL Tower "D" (1000 Area) 15-meter Relative Humidity (%) for 2015-2021**

| **MAXIMUM** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
| 2015 | 97.3 | 97.3 | 98.6 | 98.8 | 98.9 | 98.8 | 99.1 | 98.9 | 98.7 | 98.2 | 98.5 | 98.7 | 98.5 |
| 2016 | 97.9 | 98.5 | 98.8 | 100 | 100 | 99.4 | 99.5 | 99.6 | 99.5 | 98.3 | 99.7 | 100 | 99.3 |
| 2017 | 99.8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 2018 | 100 | 100 | 100 | 100 | 98.9 | 98.8 | 98.4 | 99 | 99.1 | 99.9 | 99.2 | 99.2 | 99.4 |
| 2019 | 99.3 | 99.4 | 99.4 | 98.5 | 98.9 | 99.3 | 99.3 | 99.2 | 97.7 | 99.2 | 99.8 | 99.2 | 99.1 |
| 2020 | 99.2 | 99.4 | 100 | 99.6 | 100 | 99.9 | 99.8 | 100 | 99.9 | 100 | 99.6 | 100 | 99.8 |
| 2021 | 100 | 100 | 99.4 | 99.7 | 99.2 | 100 | 100 | 100 | 100 | 100 | 99.8 | 100 | 99.8 |
| Average | 99.1 | 99.2 | 99.5 | 99.5 | 99.4 | 99.5 | 99.4 | 99.5 | 99.3 | 99.4 | 99.5 | 99.6 | 99.4 |
| | | | | | | | | | | | | | |
| **MINIMUM** | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
| 2015 | 19.8 | 16.4 | 13 | 14.6 | 25.8 | 36.7 | 36.9 | 34.3 | 38.3 | 19.1 | 8.7 | 30.1 | 24.5 |
| 2016 | 20.1 | 18.9 | 9.1 | 14.9 | 26.4 | 26.1 | 36.9 | 32.6 | 24.4 | 21.2 | 20.5 | 22.5 | 22.8 |
| 2017 | 20 | 15.6 | 12.6 | 14.2 | 23.8 | 31.5 | 22.3 | 35.7 | 31.2 | 32.2 | 20.9 | 19.1 | 23.3 |
| 2018 | 16.7 | 26 | 13.5 | 14.2 | 26.4 | 27.6 | 30 | 41.1 | 40.8 | 31.4 | 33.7 | 28.7 | 27.5 |
| 2019 | 18.8 | 18.9 | 12.6 | 21.9 | 29.1 | 29.5 | 31.1 | 35.6 | 26.4 | 23.5 | 23.5 | 22.5 | 24.5 |
| 2020 | 22.7 | 17.8 | 19.9 | 15 | 24.3 | 28.1 | 30.5 | 36.6 | 35.3 | 28.4 | 18 | 30.6 | 25.6 |
| 2021 | 22.9 | 16.2 | 11.9 | 17 | 16.4 | 29.5 | 35.9 | 43.3 | 34.8 | 33.1 | 21.1 | 23.5 | 25.5 |
| Average | 20.1 | 18.5 | 13.2 | 16 | 24.6 | 29.9 | 31.9 | 37 | 33 | 27 | 20.9 | 25.3 | 24.8 |
| | | | | | | | | | | | | | |

| AVERAGE | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
| 2015 | 64.6 | 61.9 | 67.2 | 66.2 | 68.3 | 76 | 81.4 | 77.2 | 77.7 | 75.7 | 70 | 79.3 | 72.1 |
| 2016 | 66 | 65.4 | 61.4 | 55.5 | 71.1 | 70.5 | 76.7 | 76.1 | 65.3 | 62.9 | 61.2 | 71.9 | 67 |
| 2017 | 74.8 | 63.4 | 55.2 | 65.6 | 73.4 | 76 | 79.9 | 80 | 80.2 | 79.8 | 75.1 | 69 | 72.7 |
| 2018 | 64.6 | 80.5 | 62.7 | 63.8 | 75.9 | 78 | 78.2 | 82.5 | 83.4 | 80.5 | 79.6 | 78 | 75.6 |
| 2019 | 71 | 73.6 | 57.3 | 64.3 | 72.7 | 78.1 | 80.7 | 78.4 | 72.5 | 77.3 | 73.1 | 76.2 | 72.9 |
| 2020 | 72.1 | 75.2 | 71.5 | 64.9 | 74.3 | 76.6 | 76.5 | 82.8 | 80.9 | 81.7 | 70.1 | 78.4 | 75.4 |
| 2021 | 74.3 | 74.4 | 60.7 | 60.4 | 68.5 | 76.9 | 80.4 | 83.4 | 82.9 | 86.6 | 69.6 | 78.2 | 74.7 |
| Average | 69.6 | 70.6 | 62.3 | 63 | 72 | 76 | 79.1 | 80.1 | 77.6 | 77.8 | 71.2 | 75.9 | 72.9 |

### 3.6.1.3 Wind

As shown in Figure 3-41, eleven meteorological towers are situated on the ORNL property. These towers more than adequately provide coverage for the Site. Wind data was obtained from the ORR Meteorology web page for these towers (ORNL n.d.). Not all towers had the same amount of data, but the overall composite of data provides significant coverage. These same towers were utilized to obtain the Wind Rose data that supports release / dispersion calculations. Figure 3-45 provides a summary of the wind data depicted in Table 3-13. It is noted that Tower S has the highest monthly/annual wind speed, followed by Tower K (at 60 m instrumentation elevation) and Tower F. A review of the actual elevation of the tower does provide insights. Tower S is located at ~1153 ft AMSL with its instrumentation located at 10/15 m above ground level (AGL). Tower K is located at ~795 ft AMSL with its one set of instrumentation at 60 m AGL. Tower F is located at ~1147 ft AMSL with its instrumentation located at 10 m AGL. Tower Y is located at ~954 ft AMSL with its instrumentation located at 15 m AGL. Tower M is located at ~770 ft AMSL with its instrumentation located at 10/15 m AGL. All other towers lie at elevations between these towers, so a correlation can be drawn with regards to the wind speed. The trend for the monthly/annual wind speed for all towers is thus very consistent. Peak wind speed and wind gust data for each of the towers is denoted in Table 3-9.

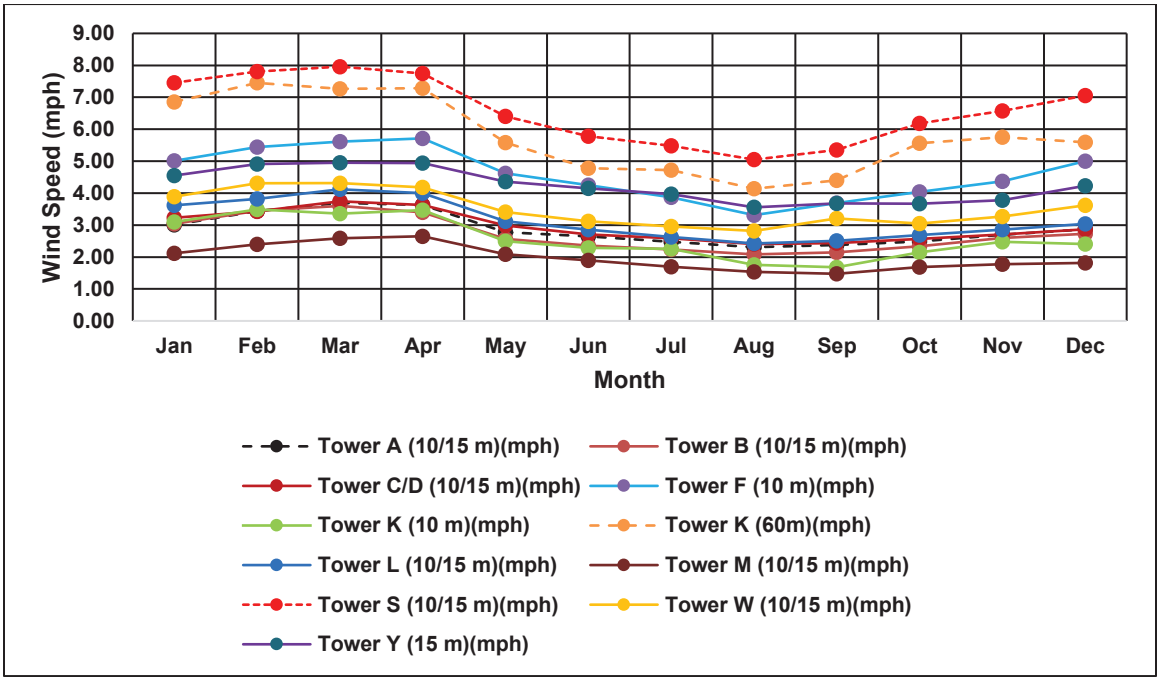



**Figure 3-45 Monthly Wind Averages (mph)**

Figure 3-46 through Figure 3-67, provide Wind Rose data for each of the ORNL Met Towers listed in Table 3-9. These wind roses clearly display the channeling effect of the mountains that surround the Site. Figure 3-68 through Figure 3-80 provide Wind Rose data for each of the surrounding airports listed in Table 3-9. Again, these wind roses show the channeling effects of the mountains that surround the Site, but to a lesser degree (due to their distance from the site and due to the mountain terrain variations).

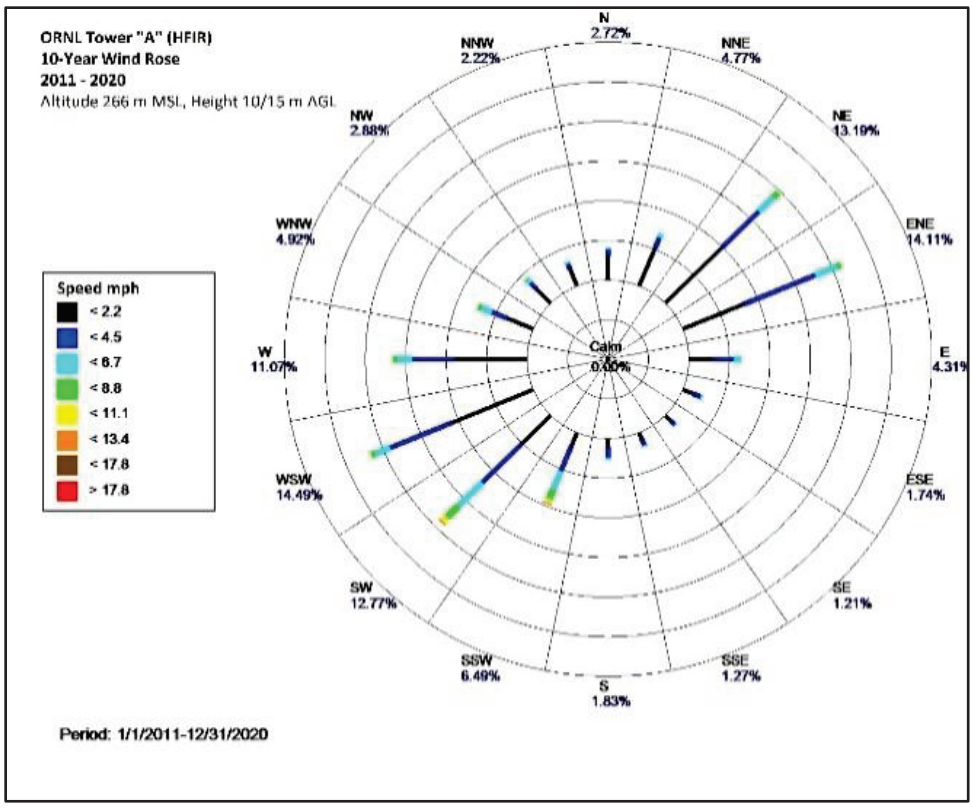



**Figure 3-46 Tower A (10/15 m) 10-yr Wind Rose Data**

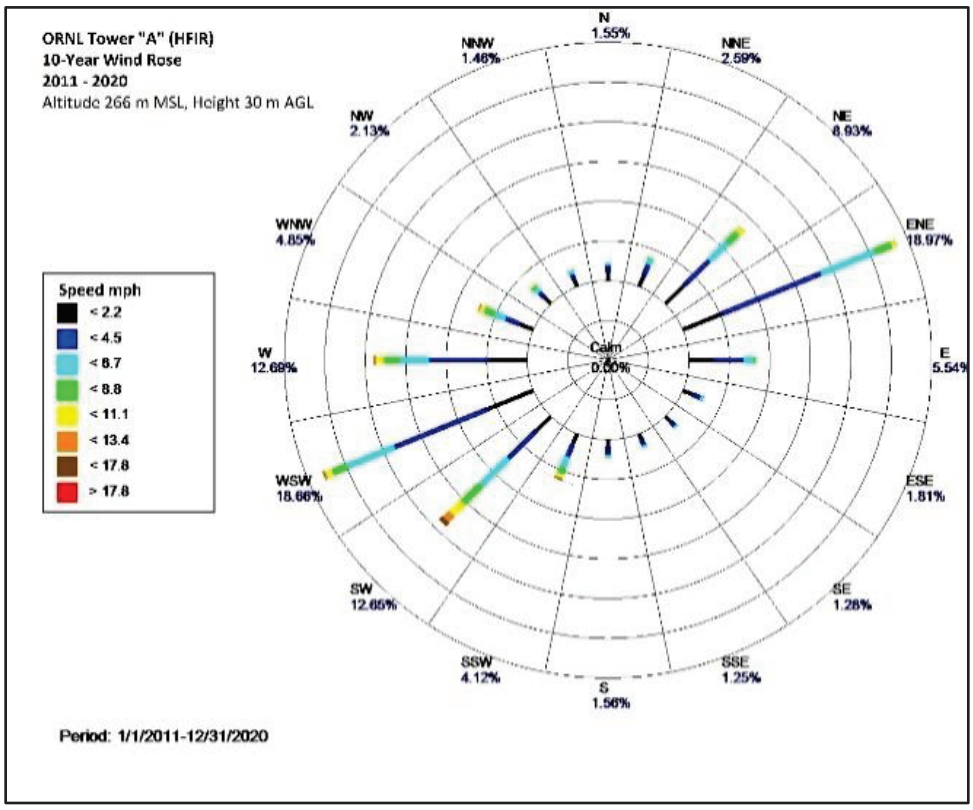



**Figure 3-47 Tower A (30 m) 10-yr Wind Rose Data**

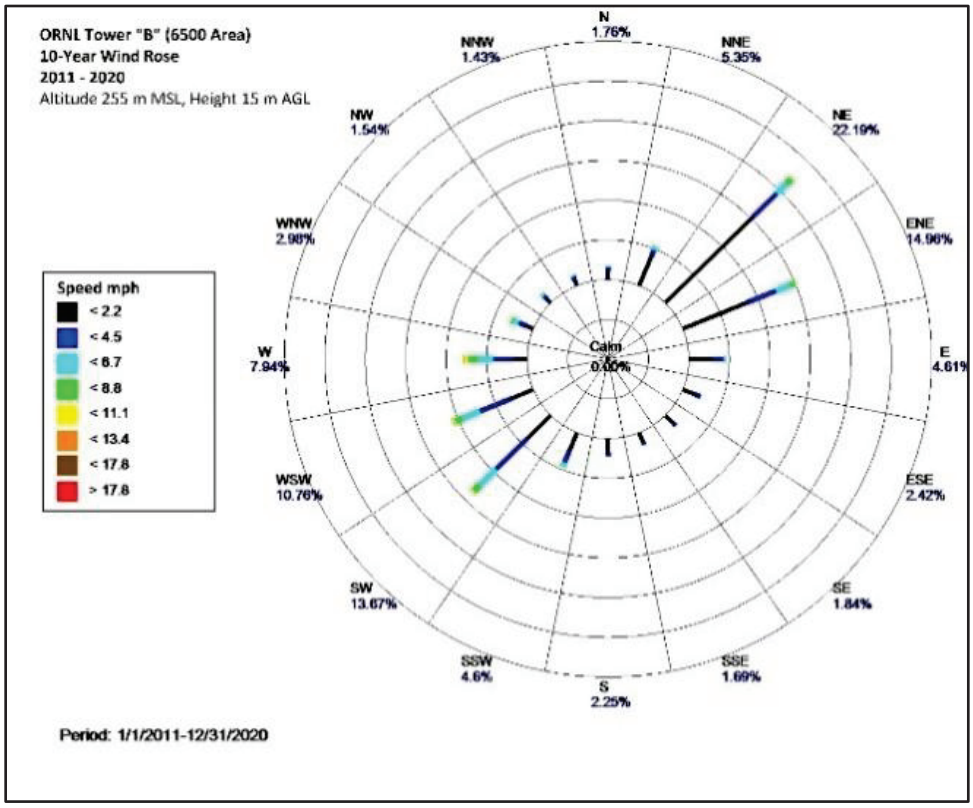



**Figure 3-48 Tower B (15 m) 10-yr Wind Rose Data**

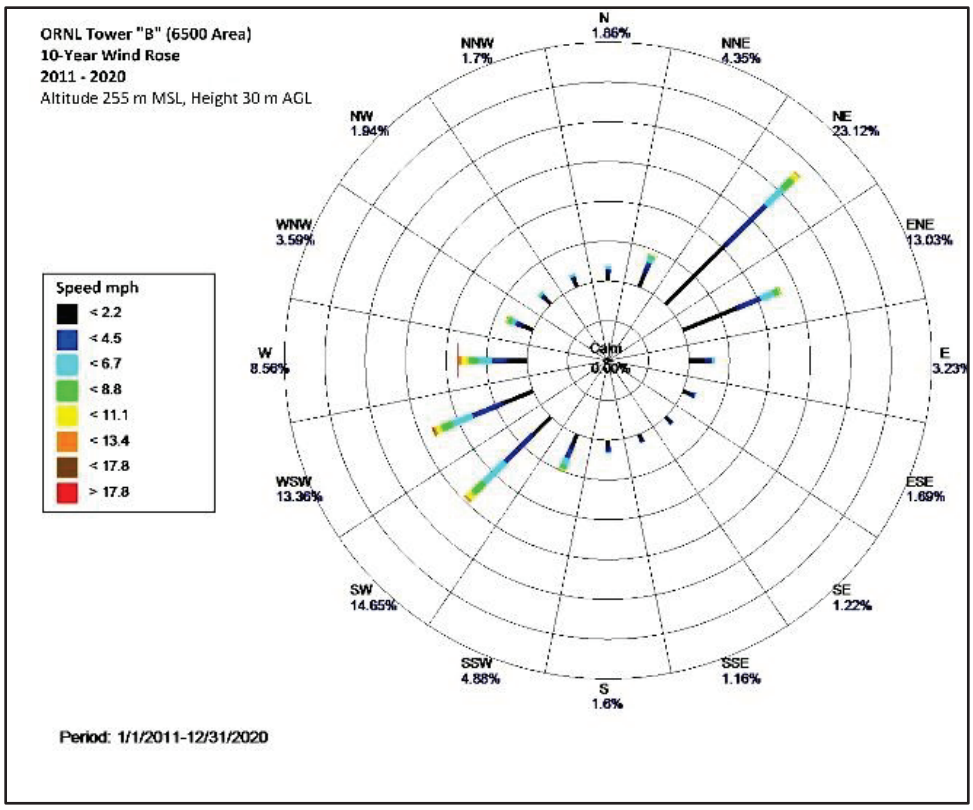



**Figure 3-49 Tower B (30 m) 10-yr Wind Rose Data**

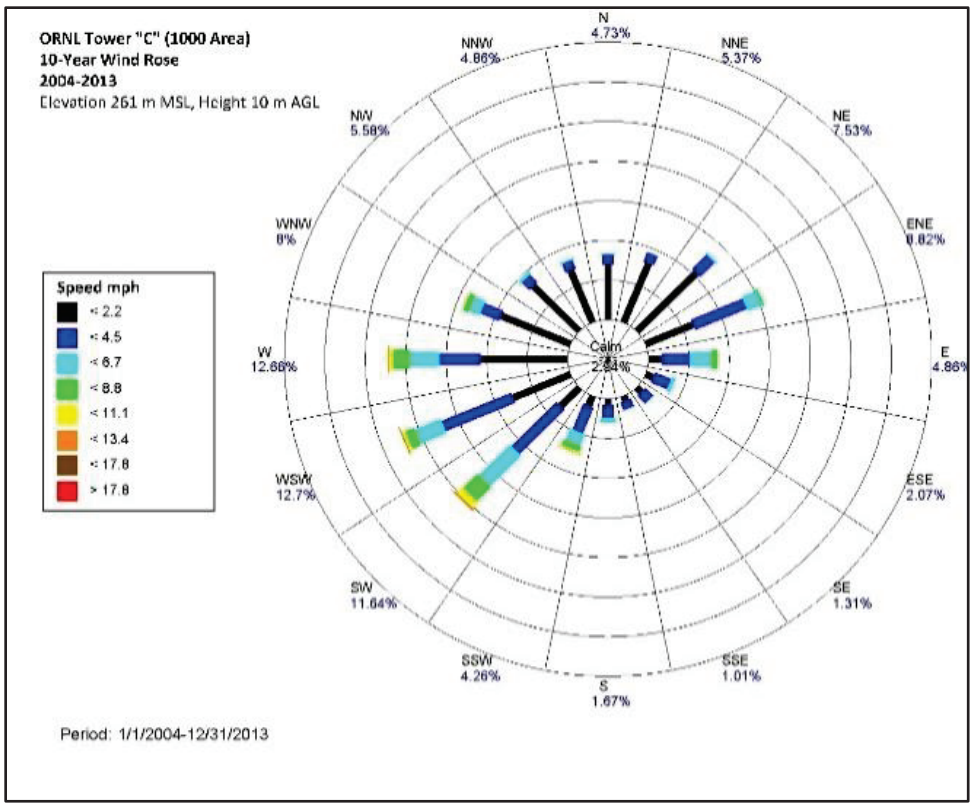



**Figure 3-50 Tower C (10 m) 10-yr Wind Rose Data**

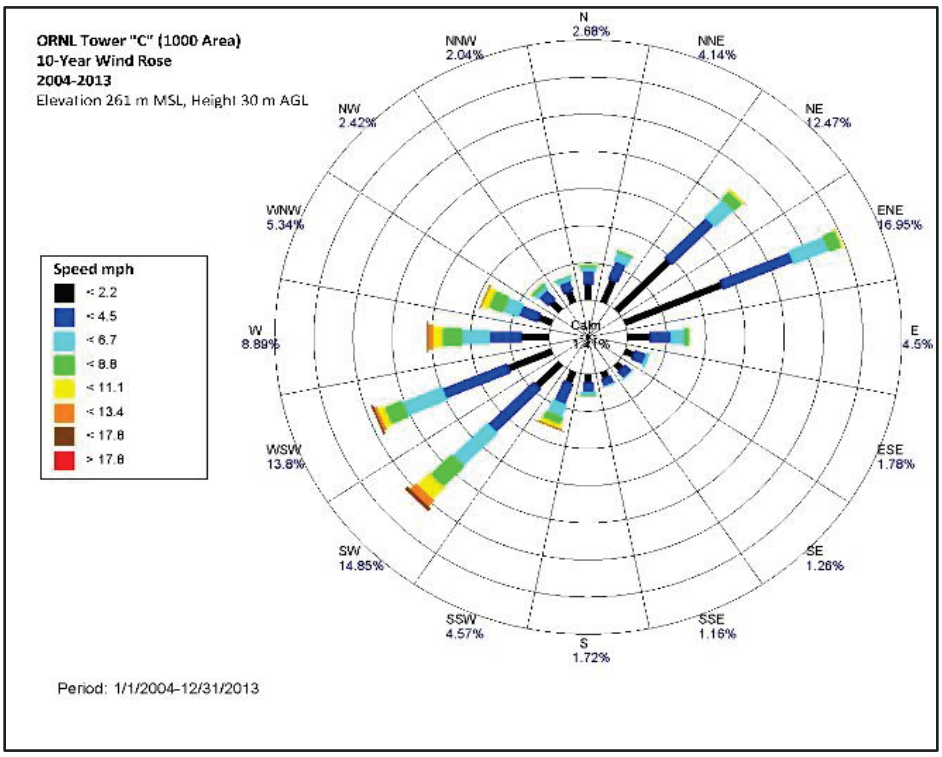



**Figure 3-51 Tower C (30 m) 10-yr Wind Rose Data**

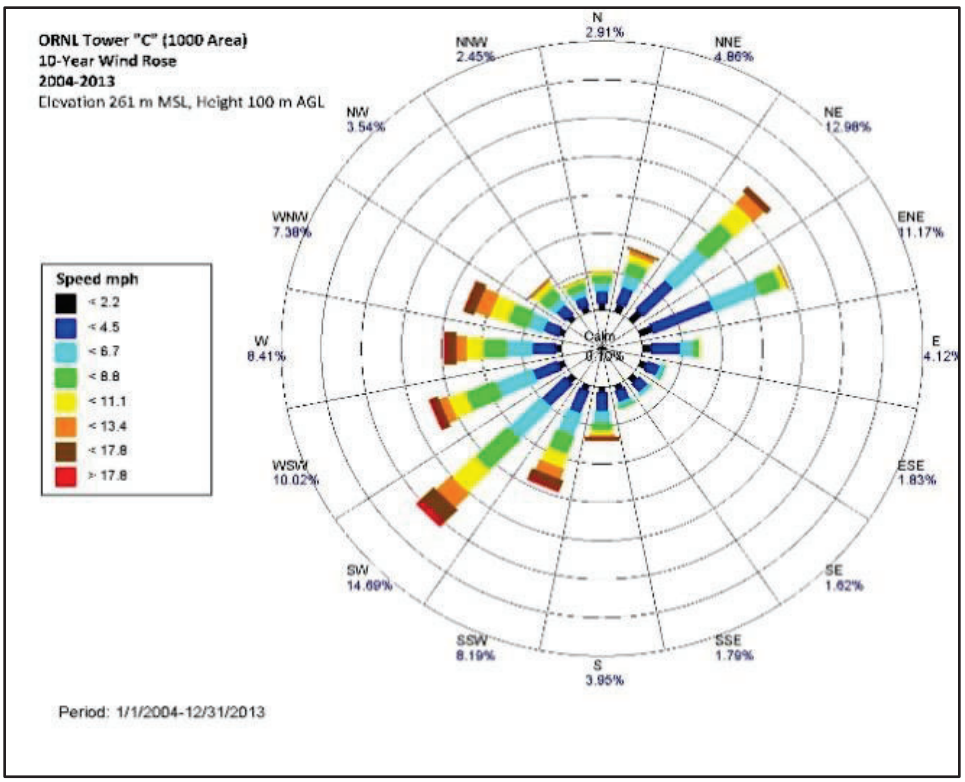



**Figure 3-52 Tower C (100 m) 10-yr Wind Rose Data**

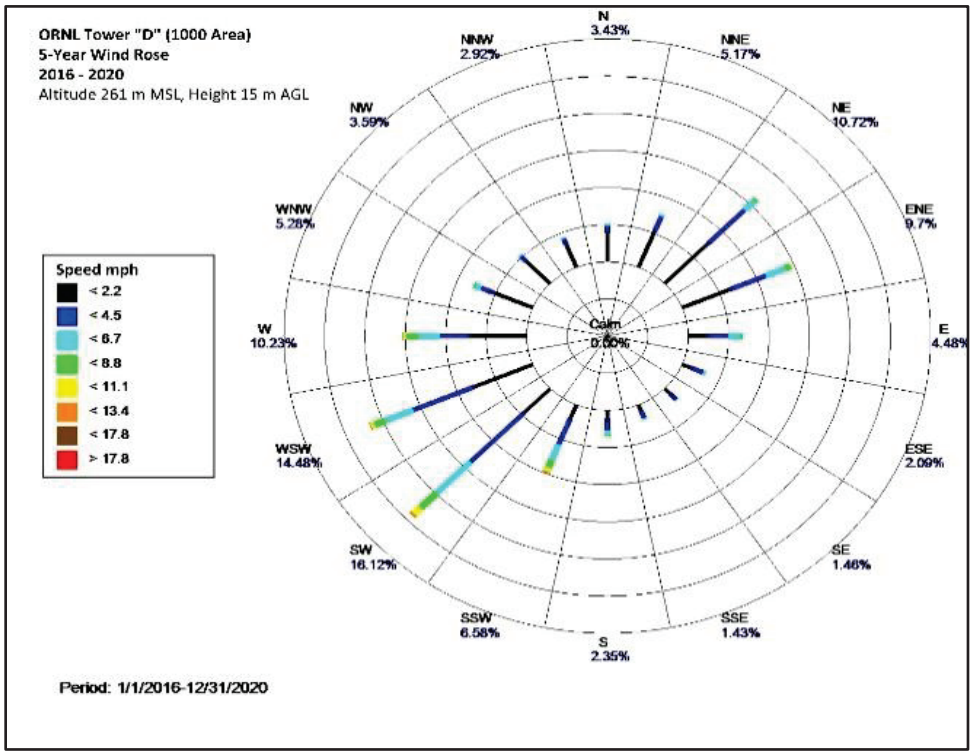



**Figure 3-53 Tower D (15 m) 5-yr Wind Rose Data**

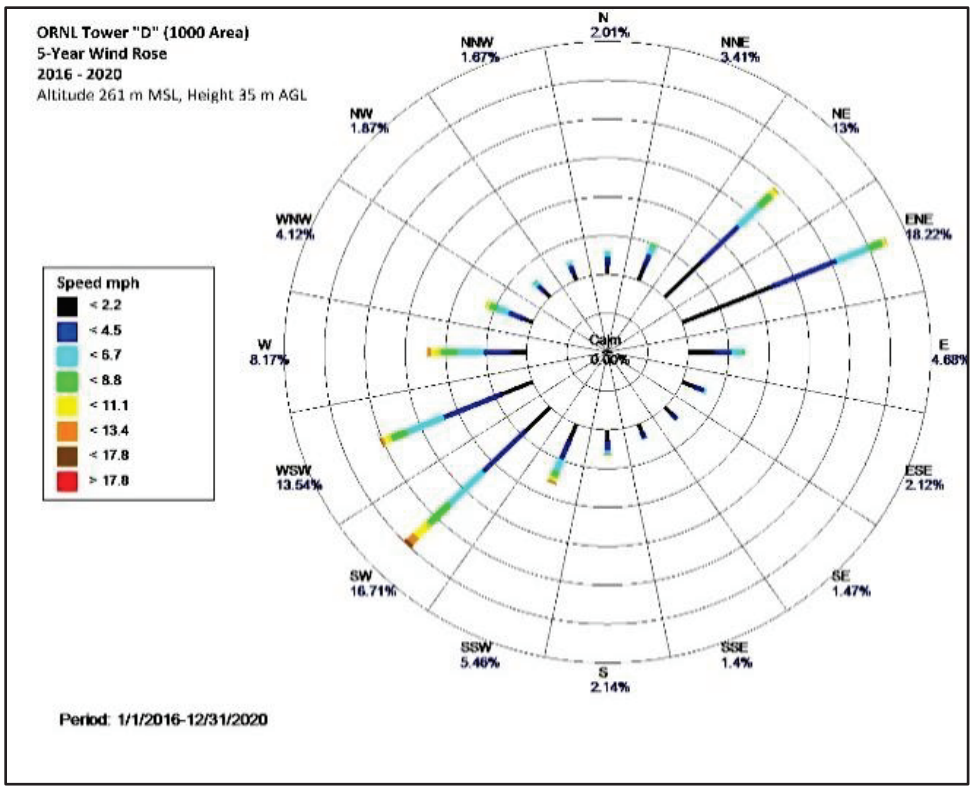



**Figure 3-54 Tower D (35 m) 5-yr Wind Rose Data**

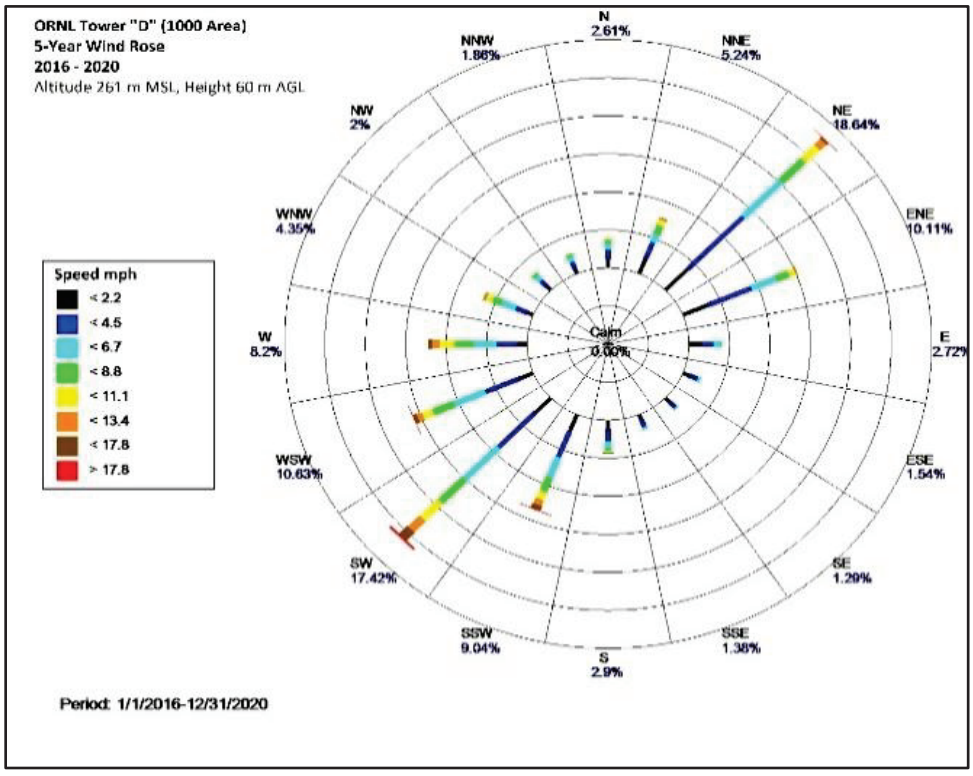



**Figure 3-55 Tower D (60 m) 5-yr Wind Rose Data**

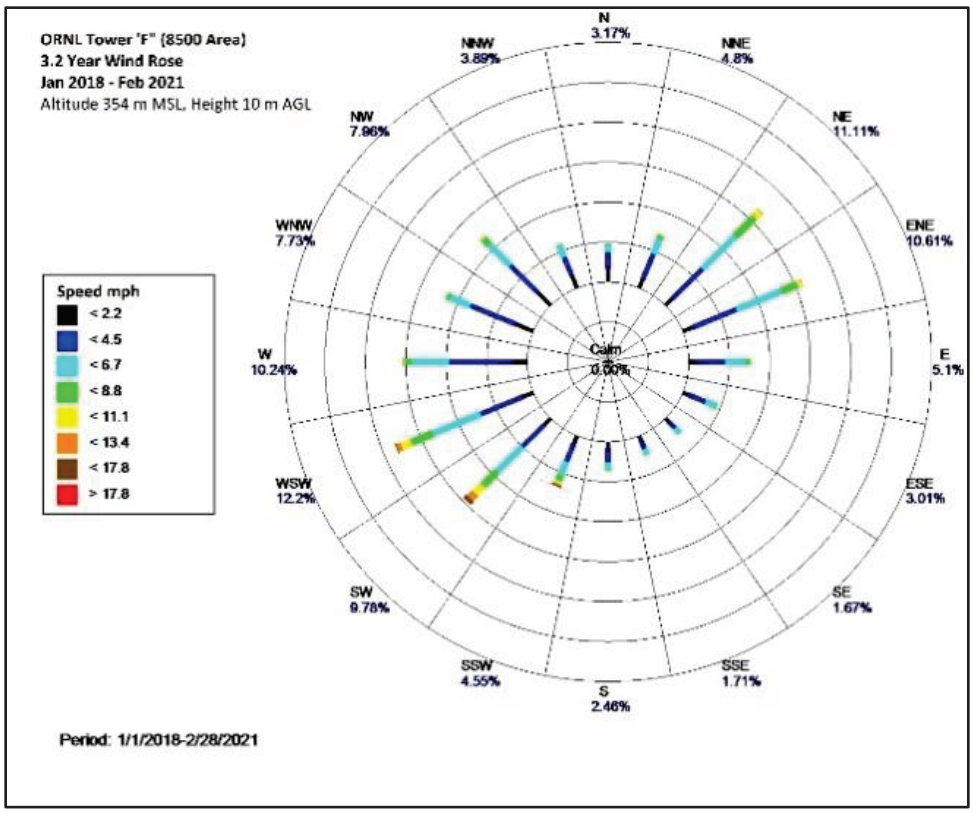



**Figure 3-56 Tower F (10 m) 3.2-yr Wind Rose Data**

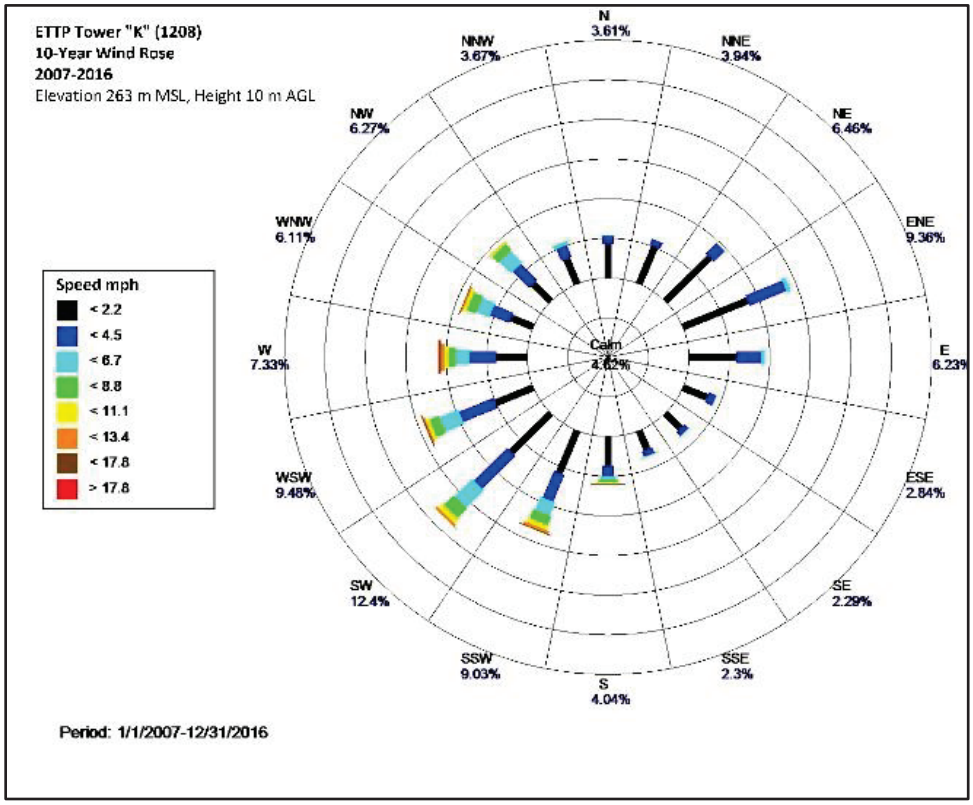



**Figure 3-57 Tower K (10 m) 10-yr Wind Rose Data**

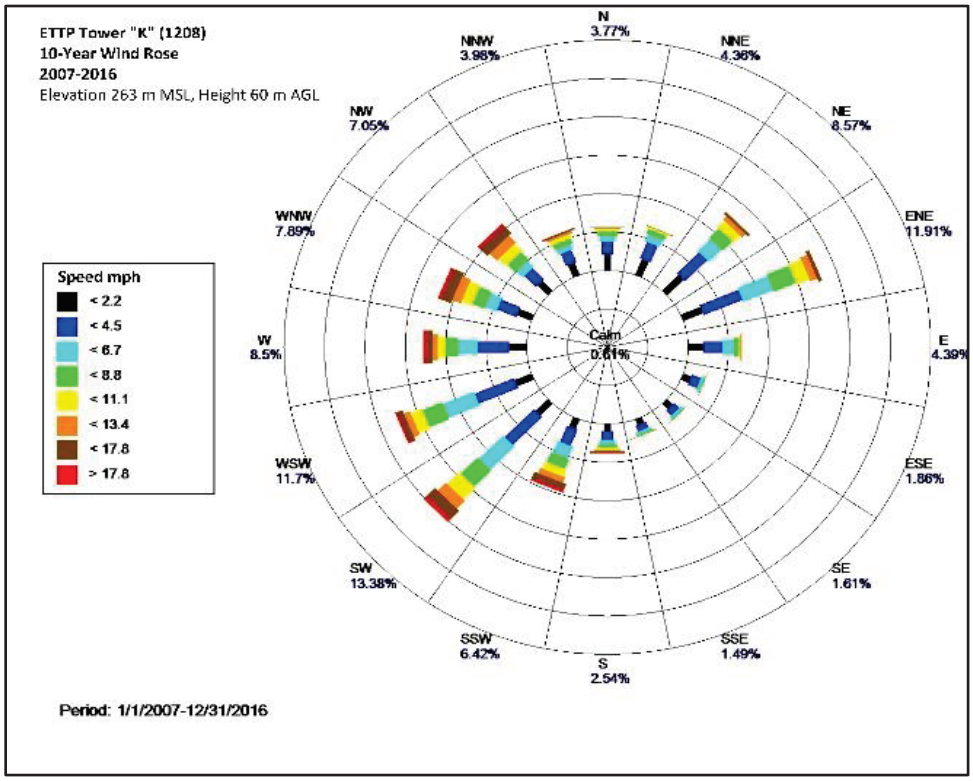



**Figure 3-58 Tower K (60 m) 10-yr Wind Rose Data**

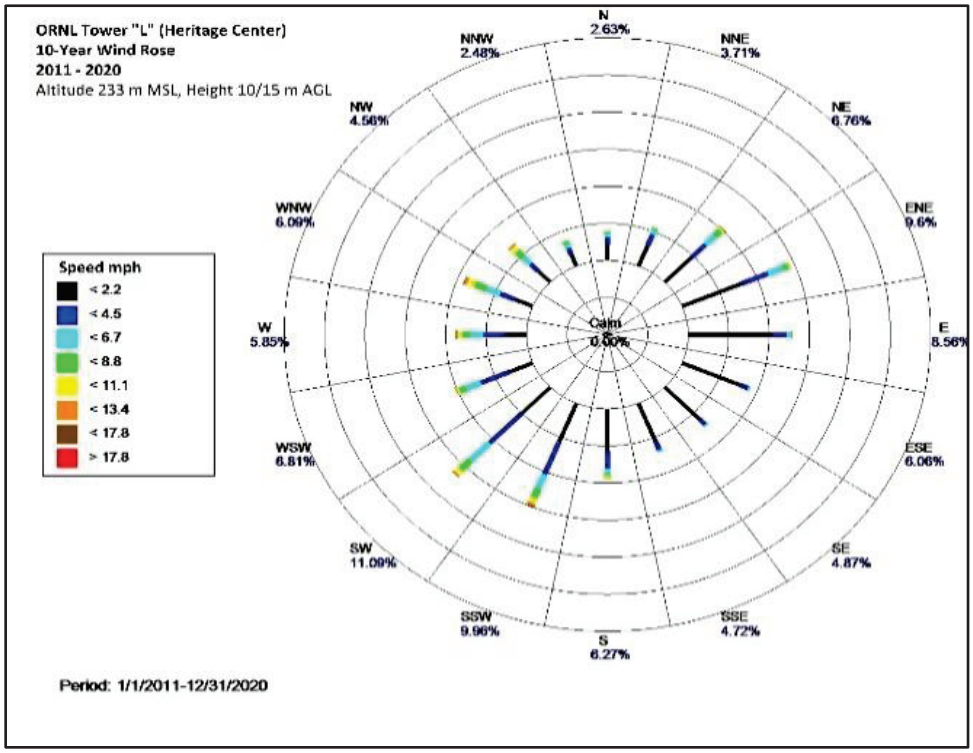



**Figure 3-59 Tower L (10/15 m) 10-yr Wind Rose Data**

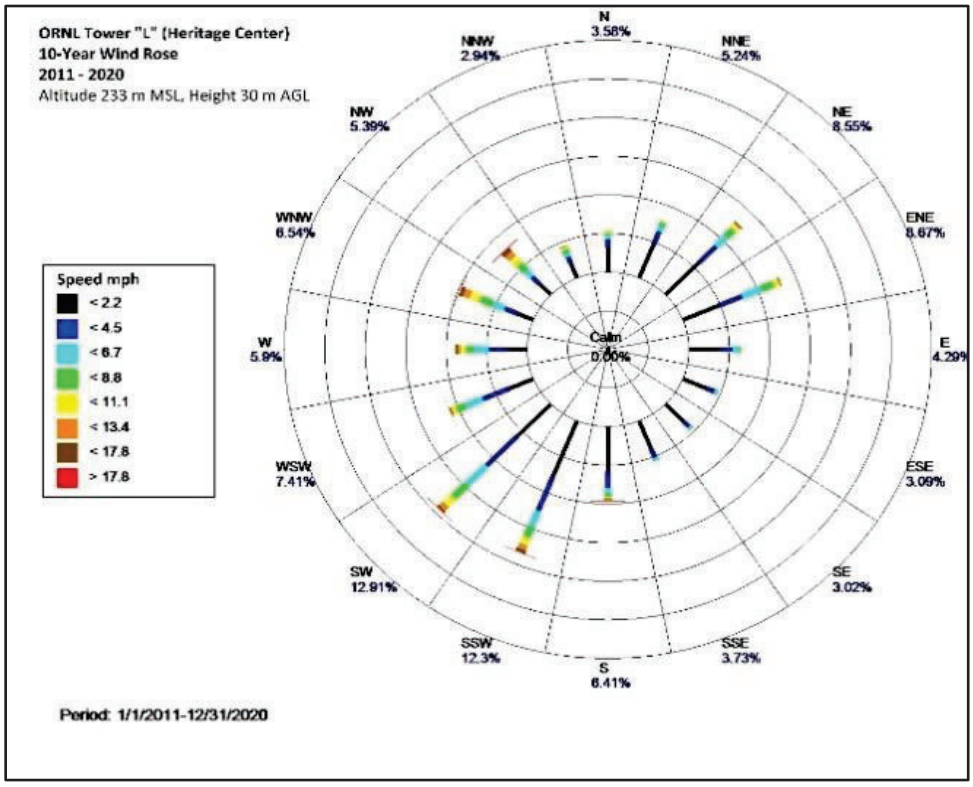



**Figure 3-60 Tower L (30 m) 10-yr Wind Rose Data**

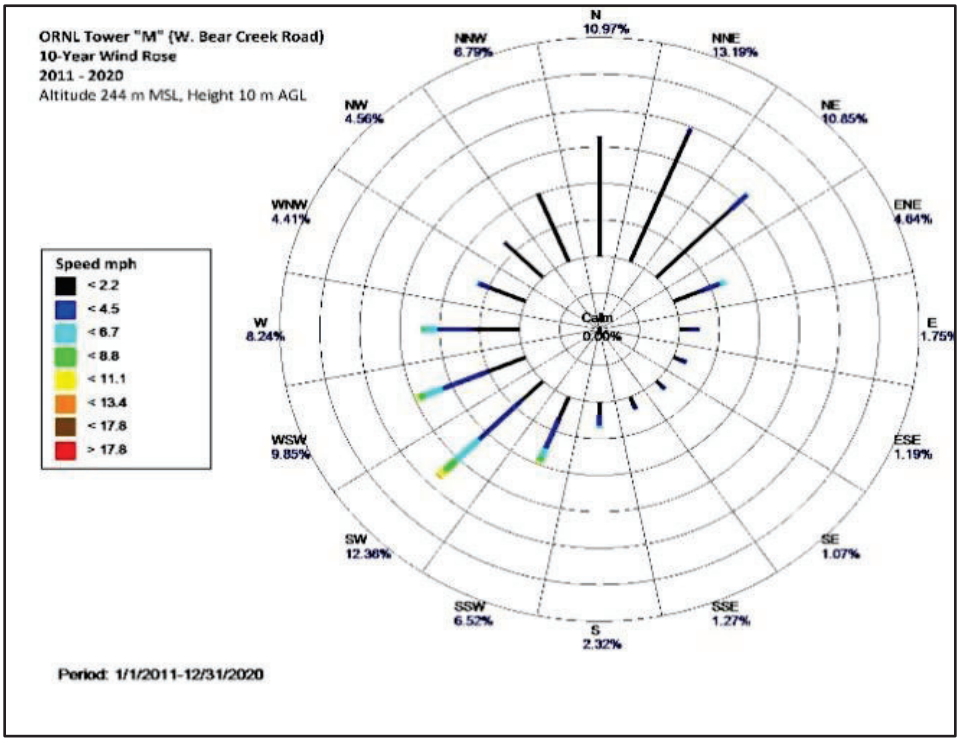



**Figure 3-61 Tower M (10 m) 10-yr Wind Rose Data**

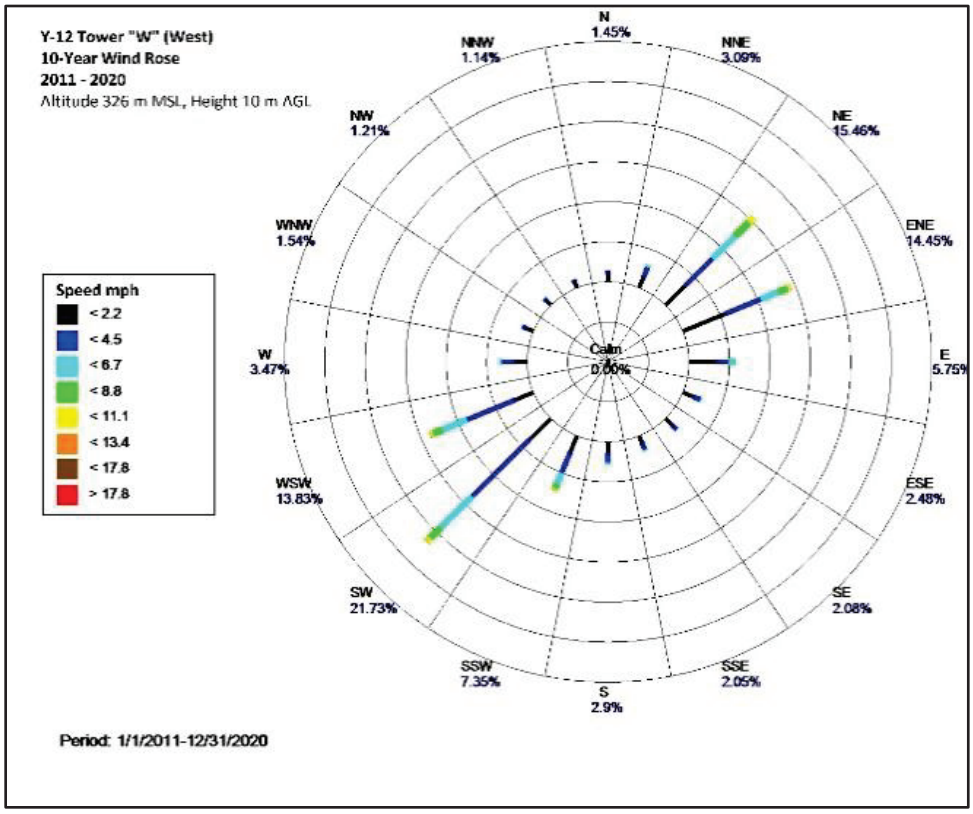



**Figure 3-62 Tower W (10 m) 10-yr Wind Rose Data**

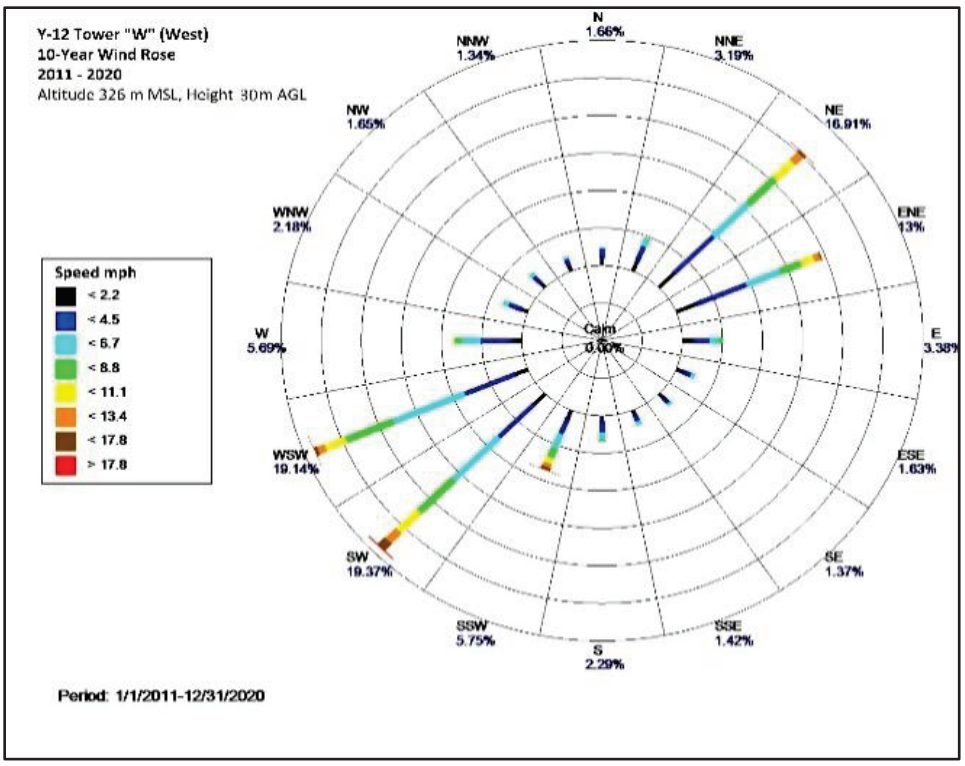



**Figure 3-63 Tower W (30 m) 10-yr Wind Rose Data**

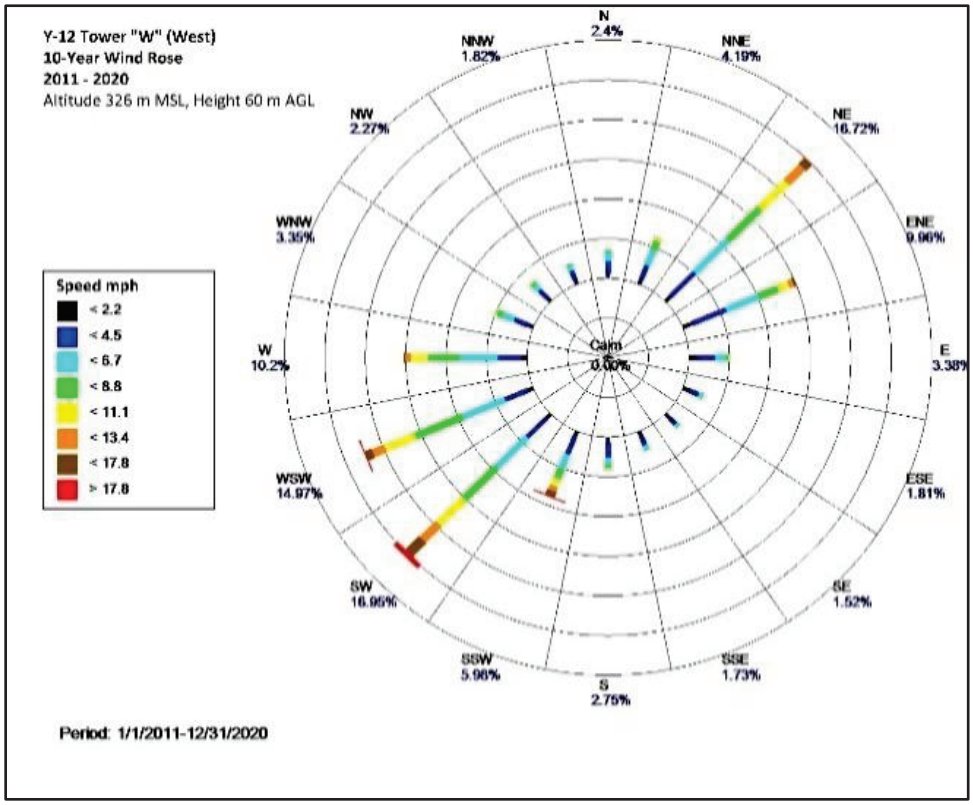



**Figure 3-64 Tower W (60 m) 10-yr Wind Rose Data**

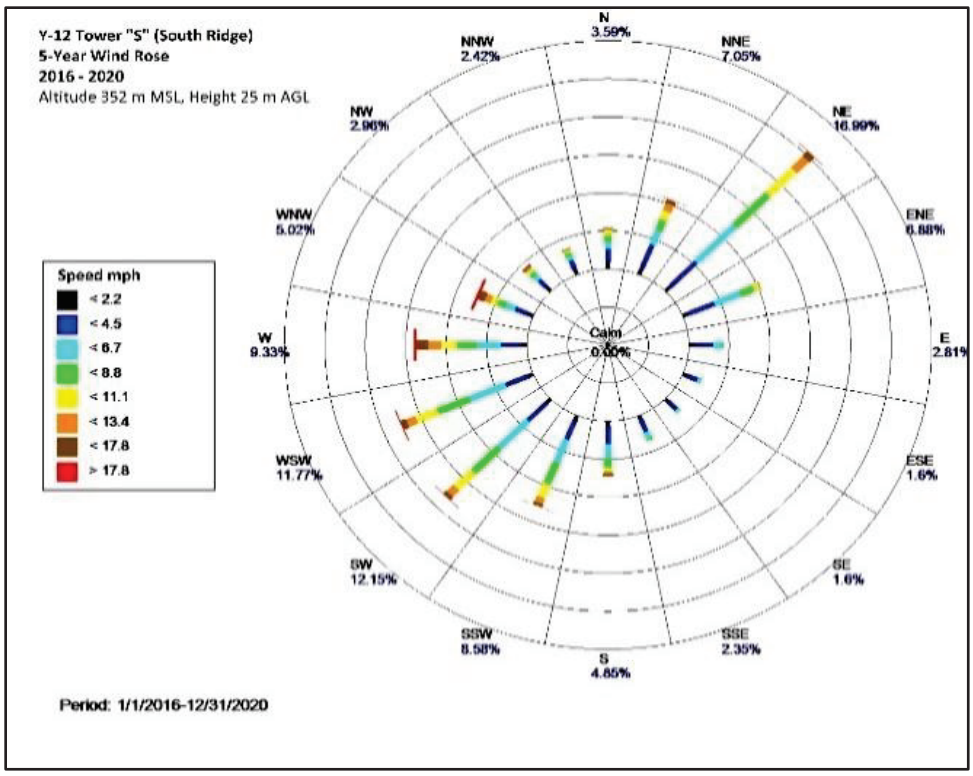



**Figure 3-65 Tower S (25 m) 5-yr Wind Rose Data**

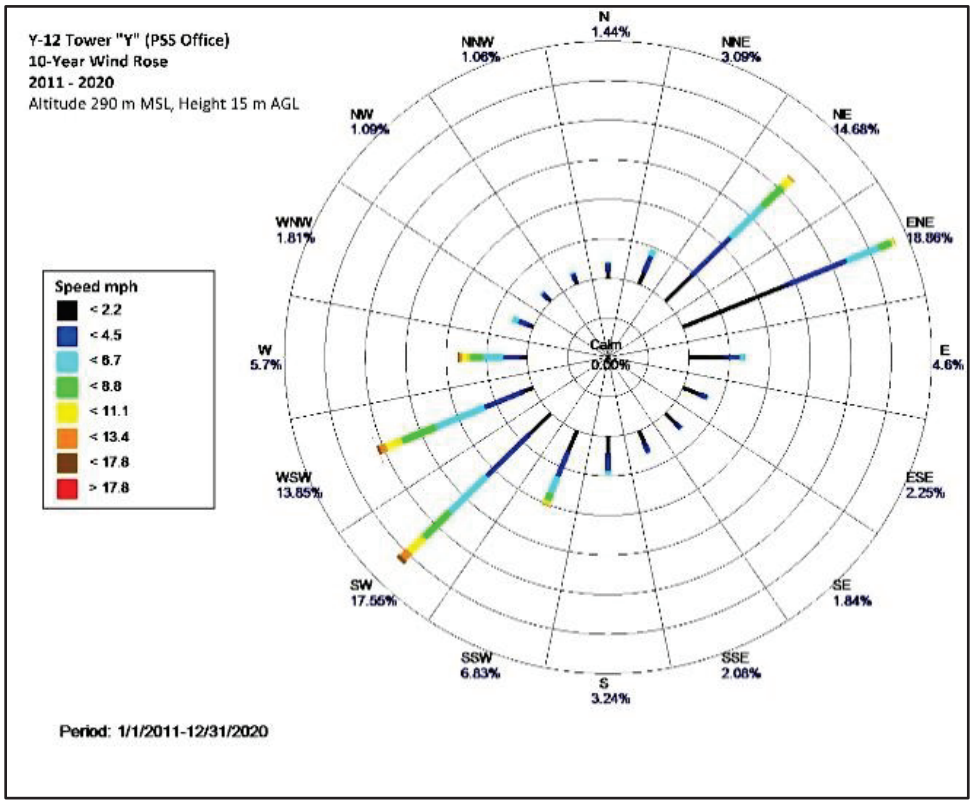



**Figure 3-66 Tower Y (15 m) 10-yr Wind Rose Data**

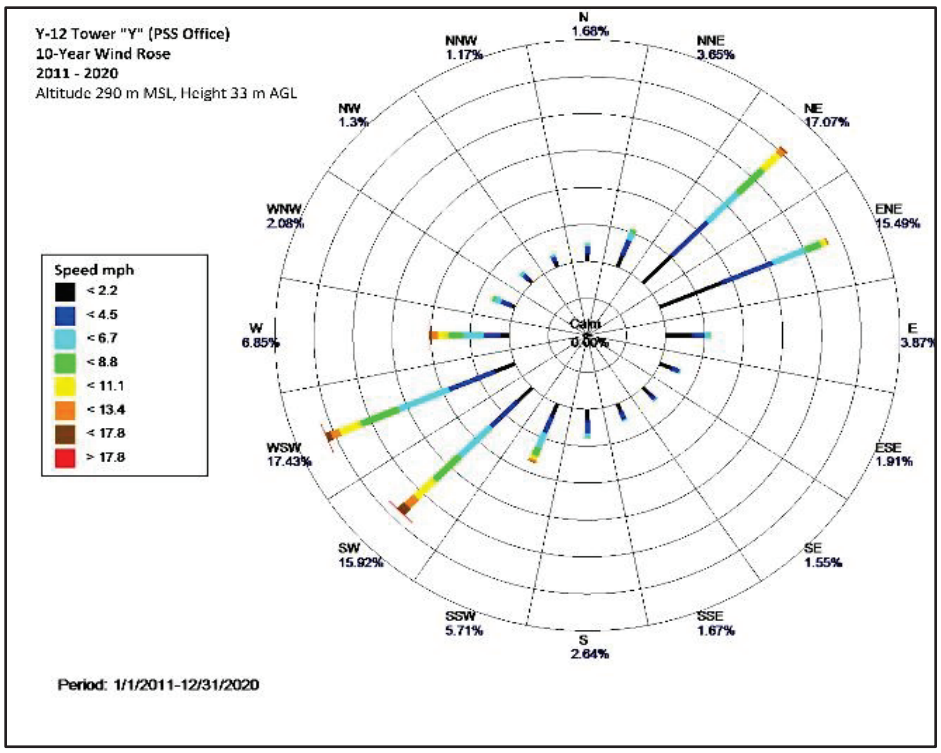



**Figure 3-67 Tower Y (33 m) 10-yr Wind Rose Data**

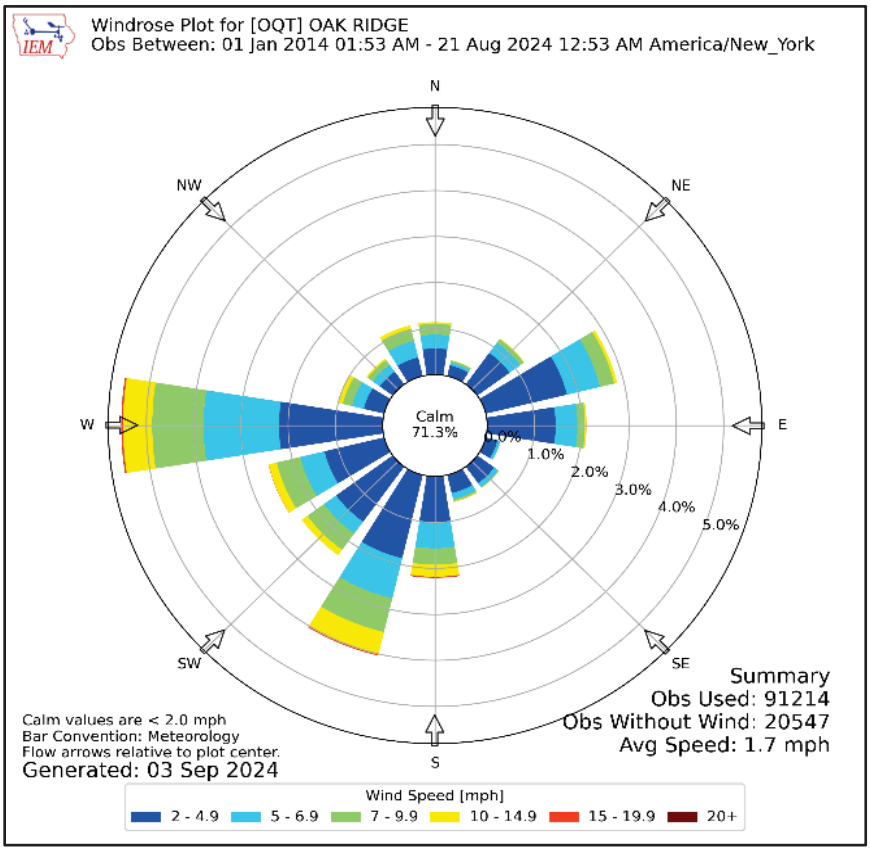



**Figure 3-68 Oak Ridge Met (OQT), 10-yr Wind Rose Data**

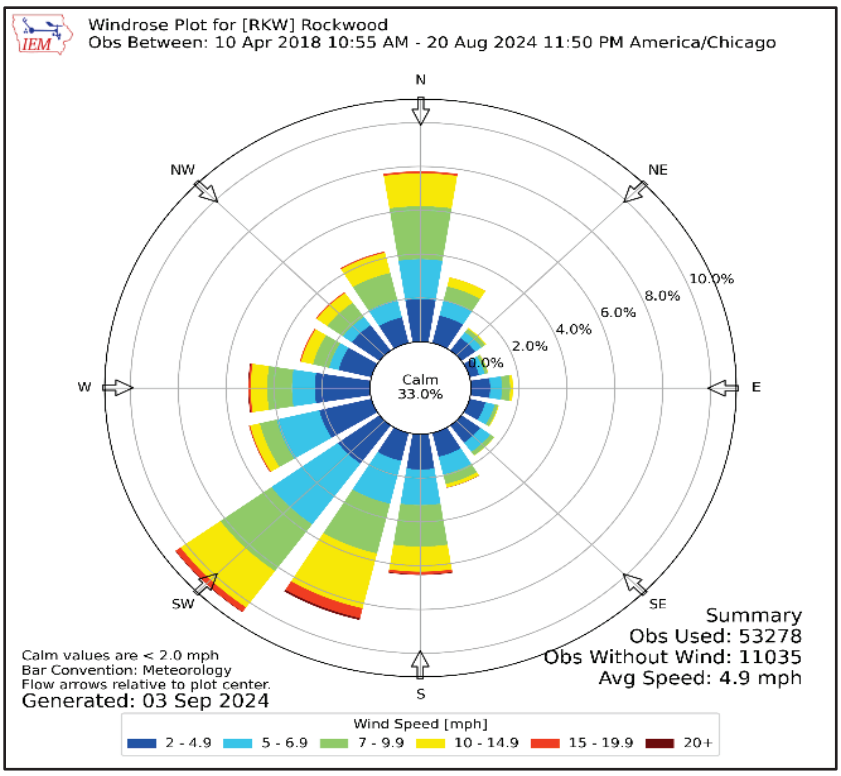



**Figure 3-69 Rockwood (KRKW), 6-yr Wind Rose Data**

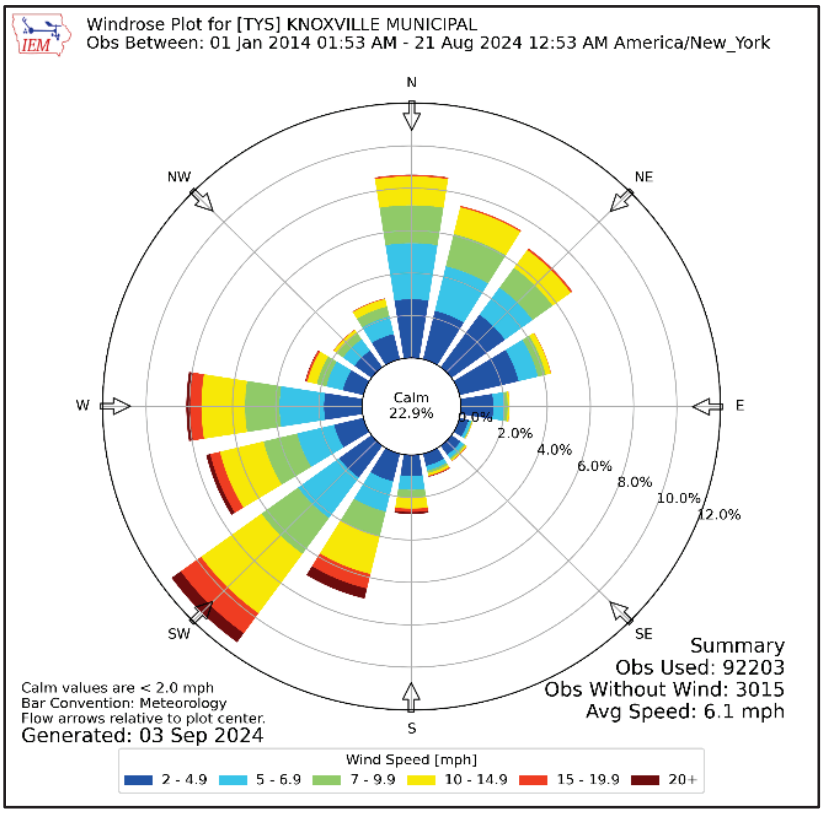



**Figure 3-70 Knoxville Municipal (KTYS), 10-yr Wind Rose Data**

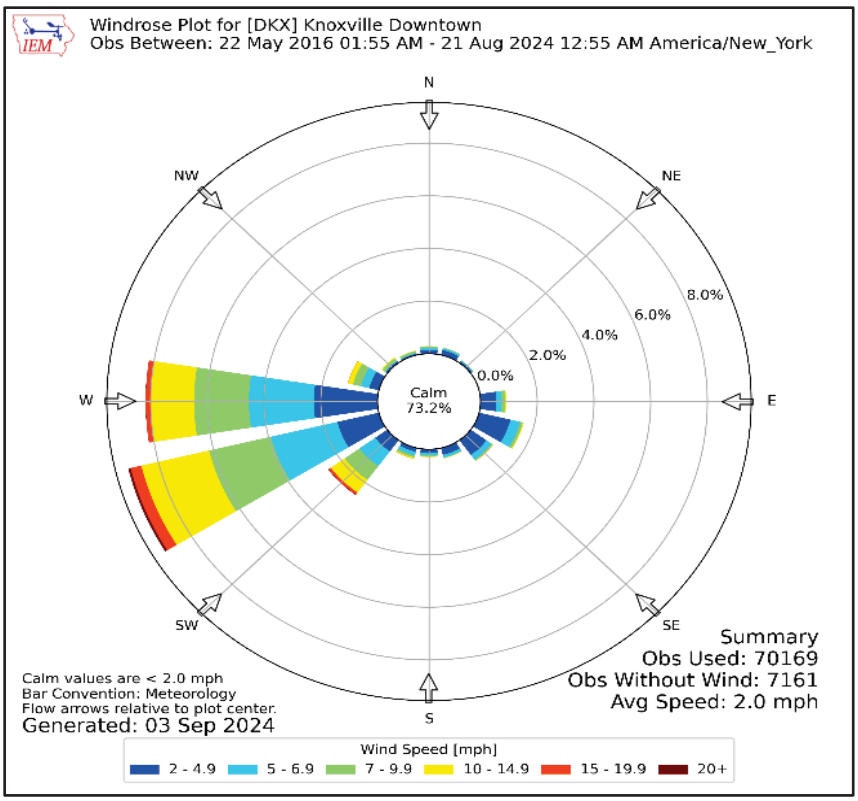



**Figure 3-71 Knoxville Downtown (KDKX), 10-yr Wind Rose Data**

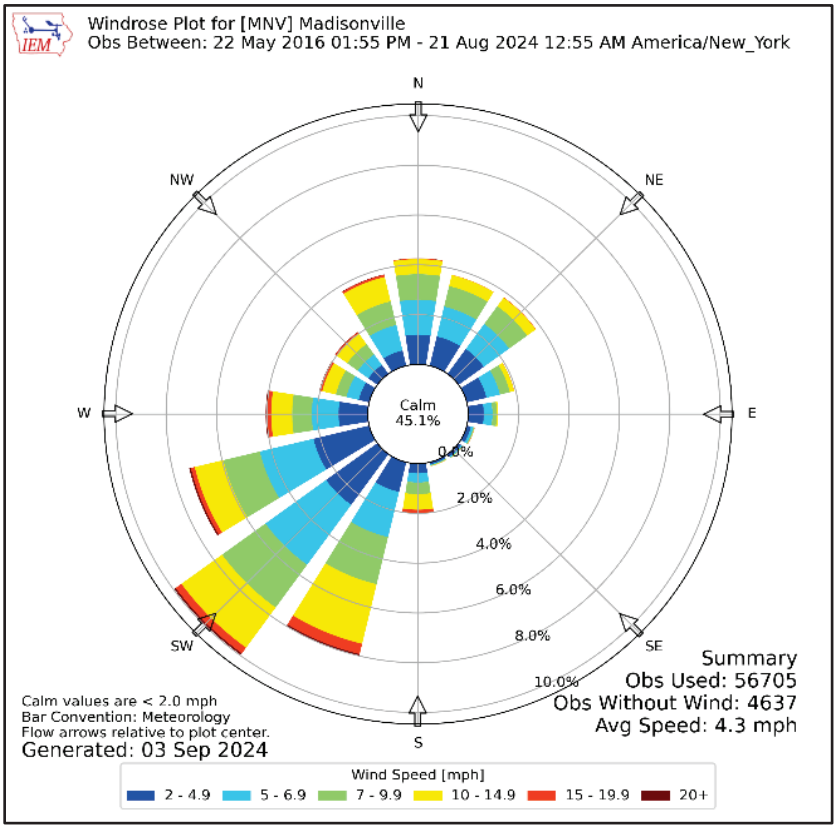



**Figure 3-72 Madisonville (Monroe County)(KMNV), 8-yr Wind Rose Data**

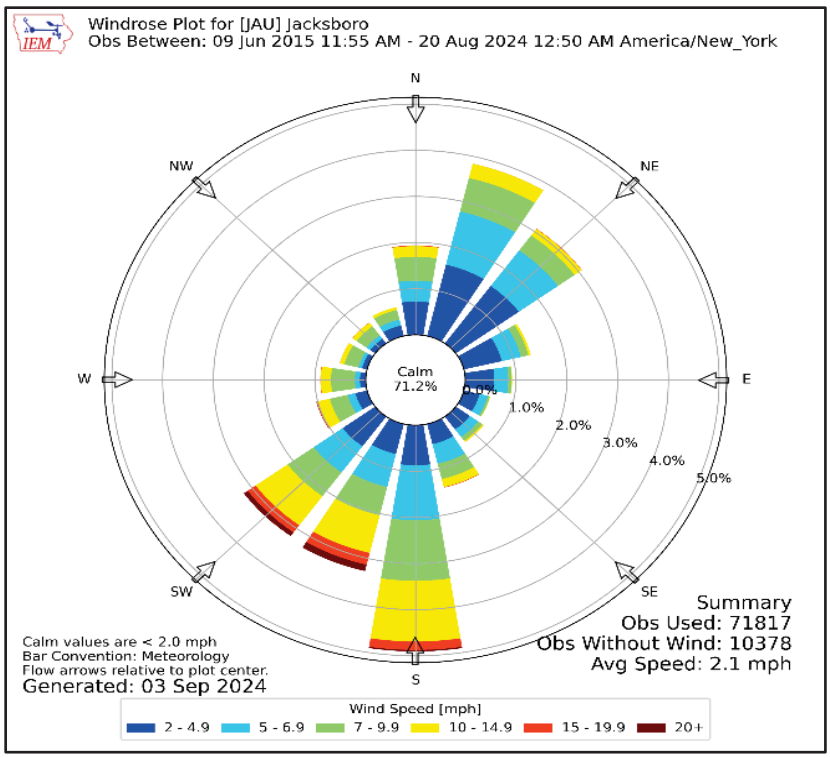



**Figure 3-73 Jacksboro (Colonel Tommy G Stiner)(KJAU), 9-yr Wind Rose Data**

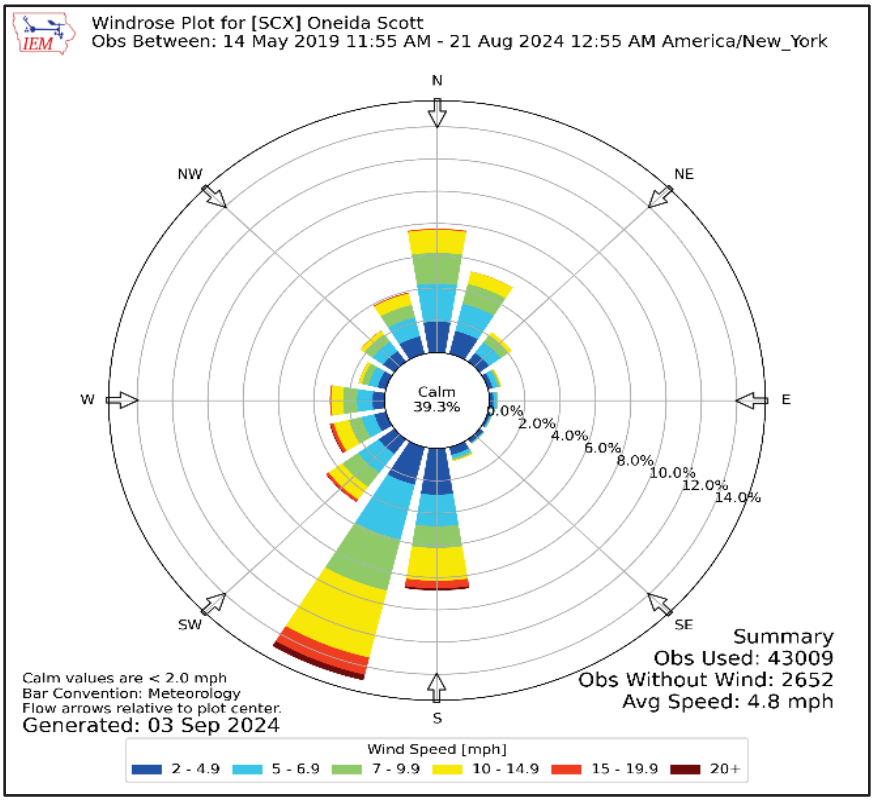



**Figure 3-74 Oneida Scott (KSCX), 5-yr Wind Rose Data**

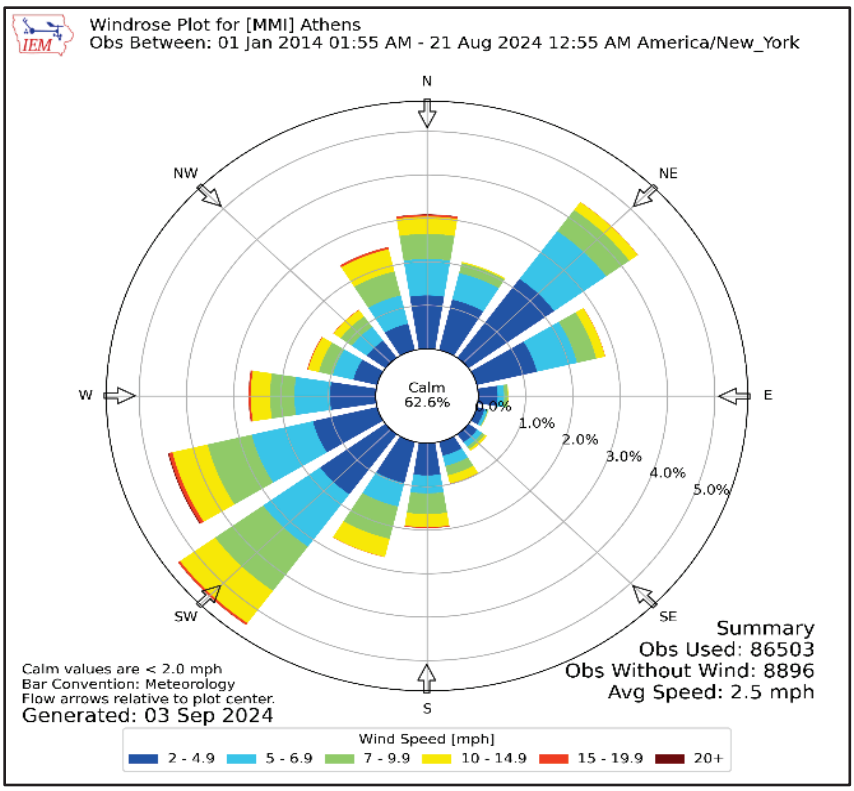



**Figure 3-75 Athens (McMinn County)(KMMI), 10-yr Wind Rose Data**

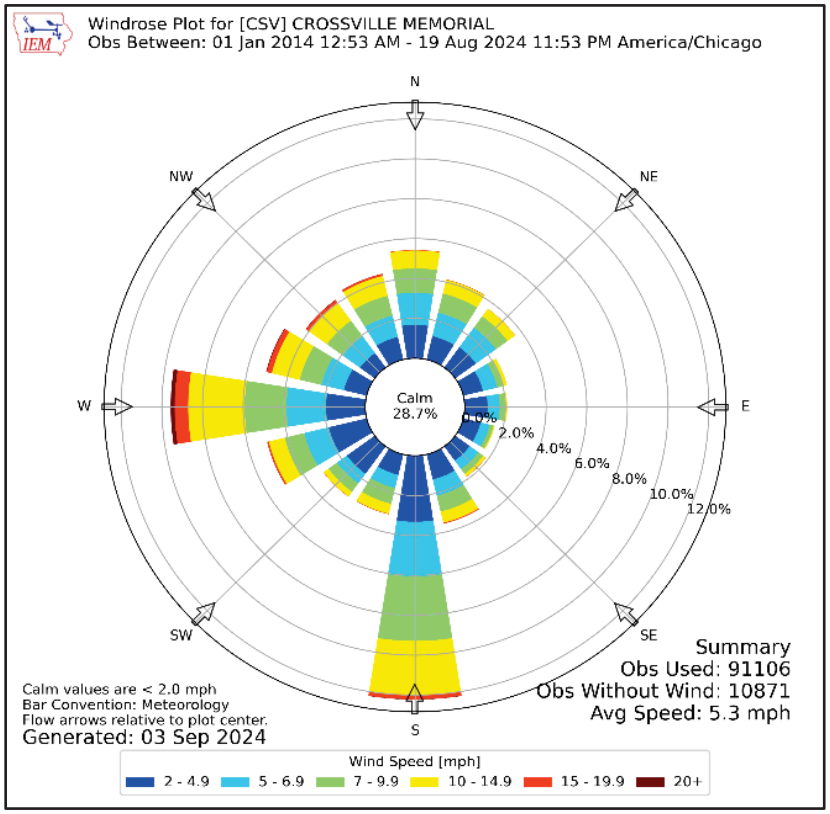



**Figure 3-76 Crossville Memorial (KCSV), 10-yr Wind Rose Data**

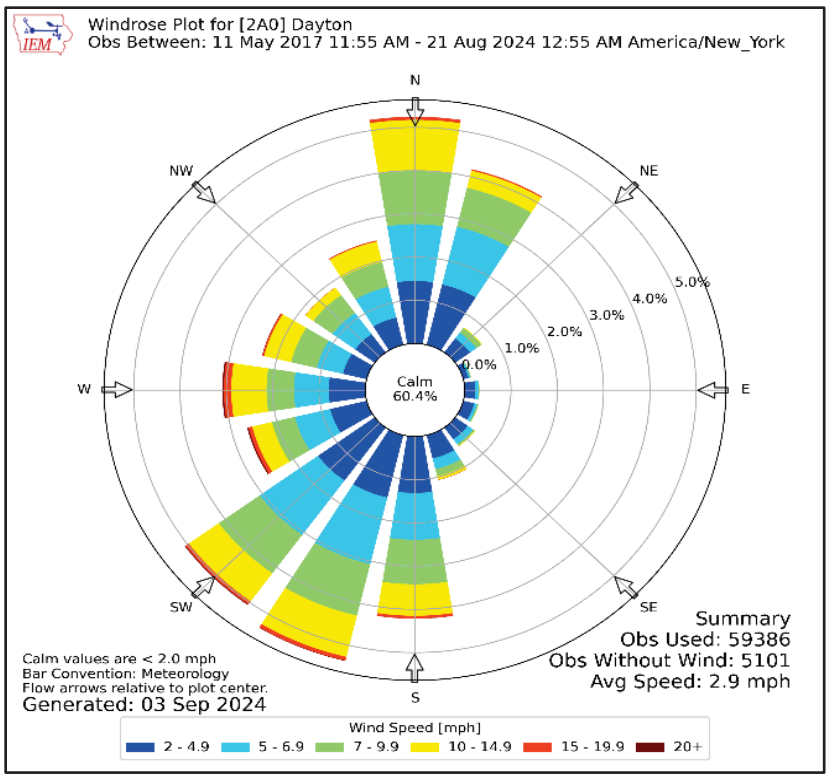



**Figure 3-77 Dayton (Mark Anton) (2A0), 7-yr Wind Rose Data**

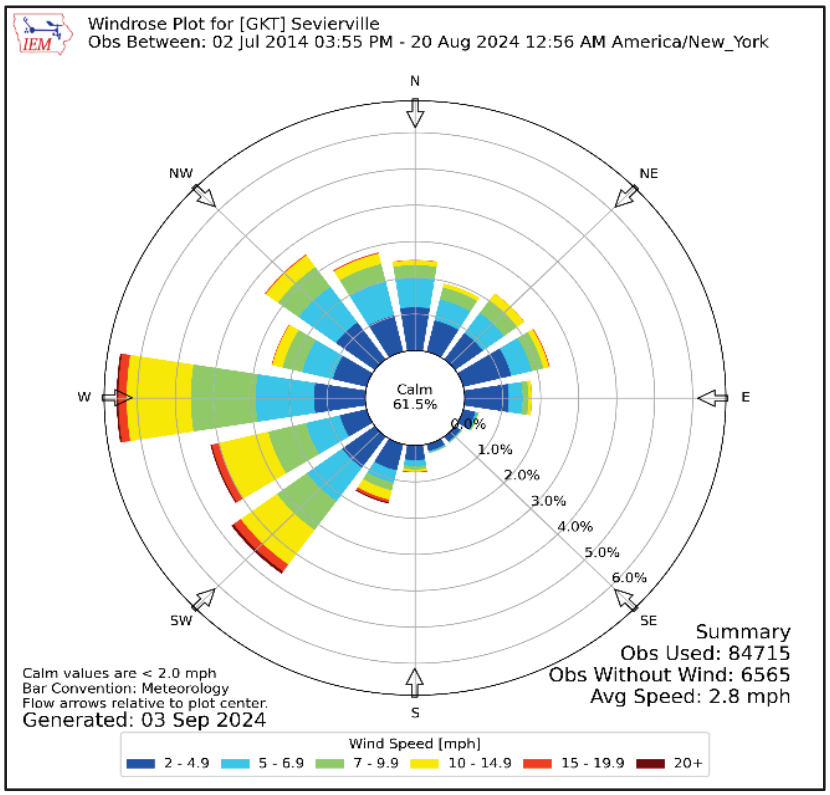



**Figure 3-78 Sevierville (Gatlin-Pigeon Forge)(KGKT), 10-yr Wind Rose Data**

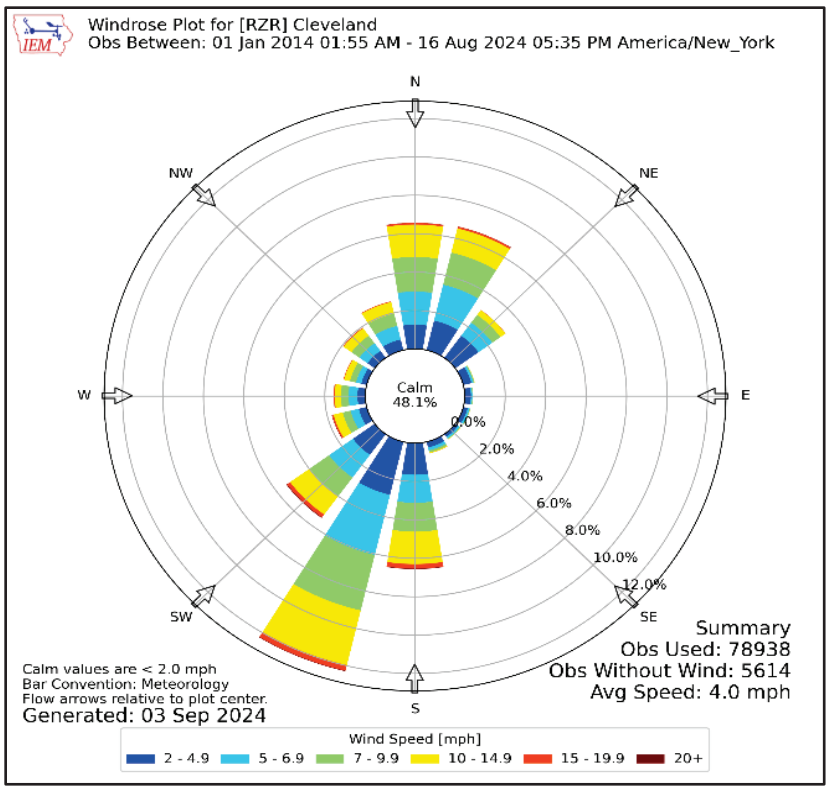



**Figure 3-79 Cleveland (KRZR), 10-yr Wind Rose Data**

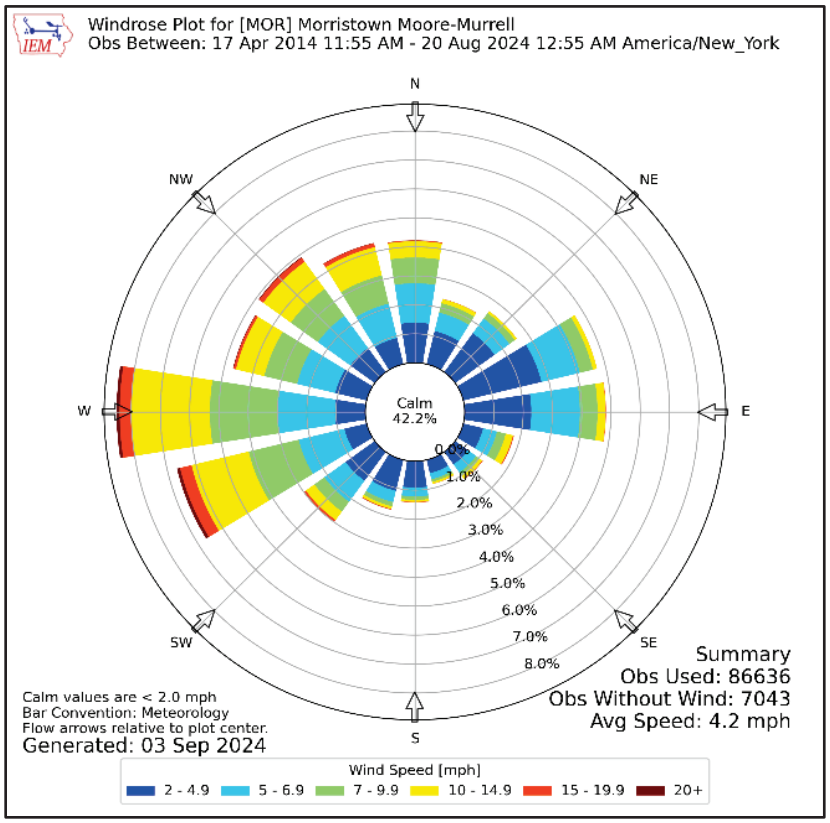



**Figure 3-80 Morristown Moore-Murrell (KMOR), 10-yr Wind Rose Data**

## Table 3-13 ORNL Meteorological Towers Monthly Wind Averages

| Tower | Instrument Level (M) | Period of Record | Unit | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tower A | 10/15 | 2011-2021 | mph | 3.01 | 3.44 | 3.70 | 3.63 | 2.78 | 2.65 | 2.48 | 2.31 | 2.37 | 2.48 | 2.70 | 2.87 | 2.87 |
| Tower B | 10/15 | 2011-2021 | mph | 3.03 | 3.45 | 3.60 | 3.40 | 2.57 | 2.36 | 2.23 | 2.08 | 2.14 | 2.34 | 2.60 | 2.73 | 2.71 |
| Tower C/D | 10/15 | 2014-2022 | mph | 3.23 | 3.42 | 3.74 | 3.63 | 2.98 | 2.71 | 2.58 | 2.40 | 2.44 | 2.57 | 2.70 | 2.87 | 2.94 |
| Tower F | 10 | 2017-2021 | mph | 5.01 | 5.44 | 5.61 | 5.71 | 4.62 | 4.25 | 3.87 | 3.31 | 3.69 | 4.04 | 4.37 | 5.00 | 4.58 |
| Tower K | 10 | 2014-2016 | mph | 3.10 | 3.49 | 3.36 | 3.47 | 2.49 | 2.29 | 2.25 | 1.76 | 1.68 | 2.14 | 2.48 | 2.41 | 2.58 |
| Tower K | 60 | 2014-2016 | mph | 6.86 | 7.45 | 7.26 | 7.29 | 5.58 | 4.78 | 4.72 | 4.14 | 4.40 | 5.56 | 5.76 | 5.59 | 5.78 |
| Tower L | 10/15 | 2014-2020 | mph | 3.61 | 3.82 | 4.12 | 4.00 | 3.12 | 2.86 | 2.62 | 2.42 | 2.51 | 2.69 | 2.86 | 3.04 | 3.14 |
| Tower M | 10/15 | 2014-2020 | mph | 2.12 | 2.40 | 2.58 | 2.65 | 2.09 | 1.89 | 1.70 | 1.53 | 1.47 | 1.69 | 1.77 | 1.81 | 1.98 |
| Tower S | 10/15 | 2014-2021 | mph | 7.45 | 7.80 | 7.96 | 7.75 | 6.41 | 5.78 | 5.48 | 5.05 | 5.35 | 6.19 | 6.57 | 7.06 | 6.57 |
| Tower W | 10/15 | 2014-2021 | mph | 3.89 | 4.31 | 4.31 | 4.18 | 3.41 | 3.12 | 2.95 | 2.82 | 3.21 | 3.04 | 3.26 | 3.62 | 3.51 |
| Tower Y | 15 | 2014-2021 | mph | 4.55 | 4.91 | 4.95 | 4.94 | 4.36 | 4.15 | 3.97 | 3.56 | 3.68 | 3.66 | 3.78 | 4.23 | 4.23 |

### 3.6.1.4 Atmospheric Stability

Atmospheric stability is a key factor to understand the potential toxic releases from the Facility (i.e., release / dispersion calculations).

The vertical thermal structure of the lower atmosphere is a key component in determining the efficiency of the dispersion of effluents into the atmosphere. The atmosphere is said to be stable when warmer air overlies cooler air so that vertical motions are damped. During the day, rising currents of air heated at the surface mix vertically. It follows that the dispersion of an effluent will be most efficient within the thermally well-mixed portion of the atmosphere. This well-mixed portion of the atmosphere is known as the mixing depth and is defined as that portion of the atmosphere next to the surface through which airborne material can freely diffuse. The mixing depth is bounded above by an inversion layer where air temperature increases with height or where the rate of temperature decrease with height is less than in the air below. The depth of the mixed layer is determined by the heat energy exchange between the air and the ground, and is influenced by cloud cover, time of day, and season.

The following discussion was obtained from ORNL/TM-2023-2948, Section 3.1.2 (ORNL 2023).

Thermally driven winds are common in areas of significant complex terrain, occurring as a result of pressure and temperature differences caused by varied surface-air energy exchange at similar altitudes along a valley's axis, sidewalls, and slopes. Thermal flows operate most effectively when synoptic winds are light and when thermal differences are exacerbated by clear skies and/or relatively low humidity, refer to Figure 3-40. Oak Ridge's ridge-and-valley terrain may enhance or inhibit such air flow, depending on the ambient stability, mixing depth, and synoptic weather. A 1998 report by Richard Eckman suggested that the presence of daytime up-valley winds and night-time down-valley (drainage) flows within the Oak Ridge area tended to reverse at about 0900 to 1100 and from about 1700 to 1900 local time (R. M. Eckman 1998). The terrain-following nature of drainage winds suggests greater impact from ridge-and-valley corrugations than for their daytime counterparts, which tend to be accompanied by upward air motions, weaker stability, and deep mixing depth. A 2011 report from Kevin Birdwell identified both up- and down-valley thermally dominated winds for the Central Great Valley including the ORR in all seasons (Birdwell 2011). However, thermally-driven winds strongly favor summer and fall (19% and 12% seasonal frequencies for 2009/2010), with somewhat less frequent occurrence during winter and spring. Rare occurrence of mountain-valley breezes was also identified during fall (Cumberland Mountains Breeze), usually represented by a daytime "up–mountain" flow from the southeast.

Wind speeds tend to be lower in local valley bottoms due to the wind blockage created by the local ridge corrugations (about 262-492 ft high). However, temperature inversions that frequently form within local valleys between the ridges occasionally create conditions that result in wind speed accelerations during inversion breakup. These accelerations typically occur during late morning hours as near-surface atmospheric instability increases. Wind accelerations may also occur as strong synoptic low-pressure systems abruptly change the vertical stability of the Great Valley atmosphere. This latter type of wind acceleration occurs more frequently during cool months (November-April) when cold air drainage is prevalent, and the frequency of synoptic systems is greatest. During periods of low wind speed, a significant terrain effect is the reduction of the dispersion of emissions into the atmosphere. However, the effect is partially mitigated by tall stacks, terrain complexity, temperature, and moisture.

Topographic variation also influences patterns of temperature and precipitation over the region. Cooler temperatures and greater precipitation generally occur over the nearby Cumberland Mountains and Plateau. Severe storms that cross the region are significantly affected by the Crab Orchard and Cumberland Mountains as well as the Cumberland Plateau as the storms cross the ORR and Great Valley of Eastern Tennessee, which include the Site. Storms that cross from west-to-east typically weaken upon descent from these topographic barriers before reaching the ORR. However, when upper-level winds are from the northwest with respect to Oak Ridge, topographic enhancement of local storms, resulting from mountain wave enhancement by the Cumberland Mountains occasionally occurs. This effect has been observed to slightly increase thunderstorm incidence over the ORR during fall.

Local topography (ridge-and-valley) generally induces a slightly enhanced diurnal temperature range (by 1 to 3 °C) within local valleys compared to nearby ridge tops (Figure 3-81). The effects are more pronounced during clear weather under light winds. Such conditions allow cold air to more efficiently drain into and through local valleys. Stronger temperature inversions may result, sometimes accompanied by fog or high humidity. These conditions may be exacerbated after major precipitation events. During daytime hours, relatively higher wind speed at ridge top locations efficiently mixes the near-surface atmosphere, resulting in slightly lower maximum temperatures (by 1-2 °C), especially on sunny days (Eckman, Dobosy and Pendergrass 1992).

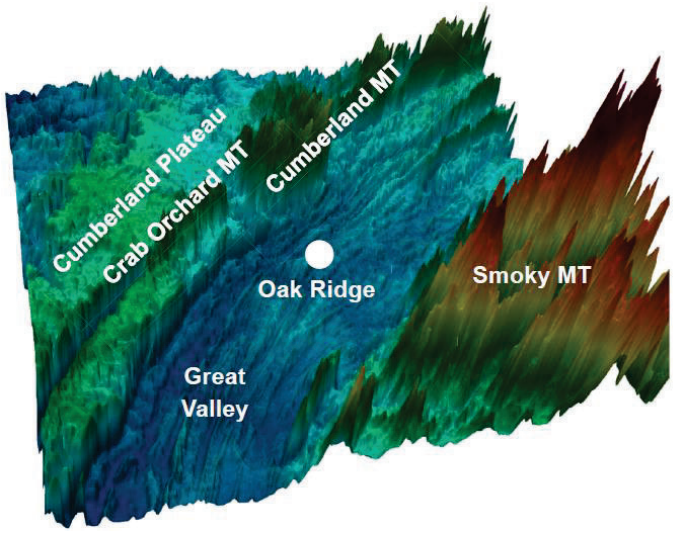



**Figure 3-81: Valley and mountain ranges surrounding Oak Ridge and the Oak Ridge Reservation (ORNL 2023)**

The seasonal and annual mixing depths for mornings and afternoons for the ORR inclusive of the Site is shown in Table 3-14 and Table 3-15. The data indicate that the mixing depth is the shallowest in the early morning before 0700 or evening after 2100, and during the winter months, resulting in limited vertical dispersion. The mixing depth is greatest during summer (May through August) and late afternoon (1400-1700), which enhances vertical dispersion during that portion of the day and year. Solar radiation, wind speed (which influences mechanical turbulence), and surface characteristics (which affect thermal and mechanical mixing) also substantially influence the mixing depth.

**Table 3-14 Average Monthly and Annual Mixing Depth in meters for ORNL Tower "C/D" for 2003-2012, 2013 to 2022 individually, and for the last 20 years**

| Year | 2003-2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 20-Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Month** | | | | | | | | | | | | |
| Jan | 430 | 431 | 687 | 550 | 517 | 613 | 598 | 512 | 572 | 482 | 495 | 476 |
| Feb | 478 | 496 | 721 | 604 | 707 | 690 | 652 | 611 | 536 | 518 | 534 | 530 |
| Mar | 600 | 581 | 839 | 642 | 771 | 833 | 806 | 790 | 609 | 582 | 657 | 644 |
| Apr | 688 | 639 | 1050 | 899 | 1049 | 1070 | 868 | 933 | 812 | 764 | 766 | 767 |
| May | 729 | 662 | 1137 | 1202 | 1090 | 1037 | 1168 | 1091 | 872 | 752 | 745 | 828 |
| Jun | 791 | 654 | 1218 | 1281 | 1263 | 1152 | 1232 | 986 | 848 | 747 | 761 | 880 |
| Jul | 768 | 636 | 1074 | 967 | 1256 | 1268 | 1198 | 1135 | 772 | 1051 | 952 | 873 |
| Aug | 784 | 908 | 1001 | 989 | 1210 | 1221 | 1100 | 1086 | 814 | 939 | 984 | 881 |
| Sep | 674 | 821 | 932 | 908 | 1187 | 1018 | 1041 | 1058 | 630 | 679 | 603 | 760 |
| Oct | 538 | 615 | 768 | 625 | 847 | 732 | 722 | 644 | 585 | 553 | 530 | 588 |
| Nov | 429 | 667 | 646 | 513 | 614 | 576 | 607 | 554 | 551 | 502 | 477 | 486 |
| Dec | 392 | 597 | 547 | 553 | 530 | 572 | 567 | 591 | 517 | 492 | 403 | 450 |
| | | | | | | | | | | | | |
| Annual | 608 | 642 | 885 | 811 | 920 | 899 | 880 | 833 | 677 | 672 | 659 | 680 |

Notes:

The minimum mixing depth is highlighted green, and the maximum mixing depth is highlighted orange

Source: (ORNL n.d.)

**Table 3-15 Average Annual Mixing Depth by hour of day in meters for ORNL Tower "C/D" for 1998-2012, 2013 to 2022 individually, and for the last 25 years**

| Year | 1998-2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 25-Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hour | | | | | | | | | | | | |
| 0100 | 309 | 331 | 399 | 302 | 321 | 475 | 468 | 424 | 391 | 342 | 333 | 337 |
| 0200 | 275 | 335 | 382 | 302 | 309 | 468 | 479 | 414 | 390 | 343 | 339 | 315 |
| 0300 | 267 | 342 | 387 | 313 | 317 | 474 | 473 | 402 | 387 | 347 | 332 | 311 |
| 0400 | 265 | 350 | 381 | 293 | 307 | 459 | 471 | 387 | 372 | 347 | 329 | 307 |
| 0500 | 266 | 347 | 393 | 298 | 307 | 455 | 473 | 383 | 362 | 337 | 326 | 307 |
| 0600 | 269 | 337 | 378 | 299 | 325 | 446 | 457 | 380 | 364 | 319 | 318 | 306 |
| 0700 | 276 | 339 | 398 | 319 | 362 | 435 | 434 | 418 | 360 | 315 | 313 | 313 |
| 0800 | 413 | 358 | 440 | 338 | 481 | 447 | 445 | 538 | 376 | 341 | 338 | 412 |
| 0900 | 549 | 430 | 543 | 408 | 902 | 519 | 490 | 1067 | 447 | 399 | 435 | 555 |
| 1000 | 717 | 581 | 853 | 726 | 1363 | 859 | 708 | 1418 | 642 | 680 | 692 | 771 |
| 1100 | 882 | 743 | 1203 | 1137 | 1603 | 1209 | 1158 | 1539 | 925 | 1043 | 987 | 991 |
| 1200 | 1044 | 980 | 1418 | 1447 | 1768 | 1519 | 1430 | 1725 | 1168 | 1235 | 1187 | 1181 |
| 1300 | 1151 | 1153 | 1537 | 1534 | 1942 | 1650 | 1672 | 1813 | 1287 | 1341 | 1271 | 1298 |
| 1400 | 1212 | 1276 | 1648 | 1665 | 2006 | 1829 | 1787 | 1897 | 1373 | 1442 | 1430 | 1381 |
| 1500 | 1255 | 1344 | 1706 | 1758 | 2081 | 1845 | 1871 | 1845 | 1418 | 1523 | 1529 | 1430 |
| 1600 | 1282 | 1356 | 1779 | 1820 | 2119 | 1926 | 1887 | 1695 | 1397 | 1542 | 1494 | 1450 |
| 1700 | 1032 | 1299 | 1871 | 1824 | 1986 | 1837 | 1903 | 782 | 1234 | 1387 | 1286 | 1236 |
| 1800 | 904 | 1043 | 1733 | 1676 | 1351 | 1726 | 1547 | 454 | 911 | 846 | 858 | 1028 |
| 1900 | 699 | 676 | 1363 | 1154 | 564 | 858 | 684 | 406 | 553 | 396 | 396 | 701 |
| 2000 | 497 | 422 | 762 | 628 | 336 | 461 | 443 | 399 | 394 | 339 | 319 | 479 |

| Year | 1998-2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 25-Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2100 | 436 | 327 | 456 | 332 | 358 | 435 | 448 | 386 | 378 | 328 | 329 | 413 |
| 2200 | 423 | 314 | 425 | 321 | 319 | 442 | 466 | 409 | 394 | 331 | 328 | 404 |
| 2300 | 402 | 326 | 400 | 309 | 311 | 455 | 457 | 405 | 384 | 330 | 337 | 390 |
| 2400 | 350 | 319 | 382 | 316 | 327 | 446 | 468 | 412 | 374 | 325 | 343 | 359 |
| | | | | | | | | | | | | |
| All | 489 | 493 | 649 | 568 | 580 | 623 | 604 | 570 | 542 | 497 | 475 | 518 |

Notes:
The minimum mixing depth is highlighted green, and the maximum mixing depth is highlighted orange
Source: (ORNL n.d.)

The following discussion was obtained from ORNL/TM-2023-2948, Section 3.4.6 (ORNL 2023).

Over relatively flat terrain, fluctuations in horizontal wind direction (sigma-theta) typically yield a more robust means of determining stability. However, existing site limitations render the sigma-theta method inconsistent over the ORR's complex terrain. Delta vertical temperature data from towers that have vertical temperature data separated by at least 50 meters are preferred. Delta temperature values for the ORR derived from separations less than 50 meters tend to yield stability data that slightly exaggerates very stable and very unstable measurements. Consequently, only ORNL Tower "D" and Tower "W" are ideally suited to provide stability measurements based on delta temperature measurements. Tower D is used based on its proximity to the Site, approximately 2.5 miles.

Stability calculations using the standard "SRDT" (Solar Radiation Delta Temperature) method have been traditionally used for the ORR from 2001 to the mid-2010s. On-site ORR comparison with other methods has yielded a more realistic measure of stability variation using SRDT within the corrugated terrain of the ORR compared to the sigma theta and most other stability classification methods. However, beginning in the mid-2010s, most ORR meteorological towers began using 3-dimensional sonic wind monitors that allow for calculation of vertical wind speed and standard deviation. Also, stability research at Savannah River Site in South Carolina has shown promise for the use of sigma phi classification based on such measurements (Hunter 2012). Consequently, vertical wind speed values are now routinely measured along with their associated standard deviations for most ORR meteorological sites, allowing for the estimation of stability from the sigma phi method (which seems somewhat less influenced by local terrain relative to the sigma theta method). Since then, the SRDT and sigma phi methods have both been used to calculate stability on the ORR . The Sigma Phi measurements have been standardized by the historical SRDT measurements for each meteorological site to help account for site specific terrain influences.

Stability A (unstable) conditions at many of the ORR sites show a strong preference for winds from the south half of the compass. Stability D conditions (neutral) which also tend to correspond to higher wind speeds show a significant preference for winds from the west and west-northwest. During very stable conditions (F and G stability), winds show a preference for light winds from north and northeasterly directions (likely down valley “cold air” drainage flow).

Thus, stability class, using the vertical temperature difference (ΔT) method as specified in Table 1 of Regulatory Guide 1.23, Revision 1, is used. This method is preferred because it is an effective indicator for the worst-case stability conditions (e.g., Pasquill stability classes E, F and G). Furthermore, models endorsed by the NRC to predict radioactive release concentrations are based on field studies that used vertical temperature differences to classify atmospheric stability. Table 3-16 through Table 3-31 list the Stability Classes based on the compass directions for Tower D at 15 m and 60 m AGL for years 2014 through 2021.

Based on wind data from Tower D at the 49 ft AGL (Table 3-32), the most stable classes, E, F and G, occur annually 10.5%, 23.7% and 12.2% of the time, respectively. The least stable classes, A, B, and C, occur annually 7.1%, 11.6% and 9.1% of the time, respectfully. The neutral stable class occurs annually 25.9% of the time.

Pressure-driven channeling, in its simplest essence, is the redirection of synoptically induced wind flow through a valley channel. The direction of the valley wind flow is determined by the portion of the pressure gradient that is superimposed on the along-valley axis. This process is affected by Coriolis forces, a leftward deflection of winds (in the Northern Hemisphere). Birdwell showed that pressure-driven channeling plays a significant role within the ORR with regard to sudden wind reversals, (turning greater than 135°) during all seasons except summer (Birdwell 2011). The pattern is often associated with the passage of strong synoptic low-pressure systems. Winds driven by such processes usually shift from down-valley (from east-northeast) to up-valley (from west-southwest) or conversely as synoptic-induced flow shifts across the axis of the Great Valley of Eastern Tennessee. Because the processes involved in pressure-driven flow primarily affect horizontal air motion, the presence of a near-surface or moderately deep temperature inversion enhances this flow pattern. Weak vertical air motion and momentum associated with such inversions allow air layers to easily slide over each other (R. M. Eckman 1998). Pressure-driven dominated winds represent up to 20% of all winds over the ORR during fall, winter, and spring. Most pressure-driven wind events are associated with wind blockage created by the Great Smoky Mountains (37 miles) to the southeast of the ORR, refer to Figure 3-44.

Winds on the ORR were analyzed for consistency of flow duration with respect to physical wind mechanism. Although the resulting values varied significantly with respect to season and specific synoptic weather circumstances, forced channeled flows were generally the longest-lived wind patterns (8-12 hours and 6-9 hours for up- and down-valley forced channeling, respectively). Westerly to northerly vertically coupled winds were moderately persistent with average durations of 4 to 8 hours; however, most other wind patterns, including other infrequent vertically coupled wind classes, pressure-driven winds, and thermally-driven patterns, exhibited average durations ranging from 1 to 6 hours. Tables of maximum persistence of wind flow patterns can be found in Appendix C-2 of Birdwell (Birdwell 2011). For the purposes of wind shift criteria, major wind shifts were defined as > 90°.

**Table 3-16 Tower D, 2014, 15 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0656 | 0.0295 | 0.0379 | 0.0210 | 0.0255 | 0.0271 | 0.0154 |
| **NNW** | 0.0457 | 0.0186 | 0.0071 | 0.0122 | 0.0234 | 0.0135 | 0.0033 |
| **NW** | 0.0410 | 0.0142 | 0.0036 | 0.0093 | 0.0191 | 0.0088 | 0.0033 |
| **WNW** | 0.0714 | 0.0251 | 0.0095 | 0.0109 | 0.0128 | 0.0115 | 0.0022 |
| **W** | 0.0984 | 0.0306 | 0.0142 | 0.0210 | 0.0277 | 0.0217 | 0.0071 |
| **WSW** | 0.1019 | 0.1037 | 0.0829 | 0.0711 | 0.0553 | 0.1056 | 0.0943 |
| **SW** | 0.0609 | 0.0972 | 0.1481 | 0.1801 | 0.1128 | 0.2295 | 0.3423 |
| **SSW** | 0.0422 | 0.0382 | 0.0462 | 0.0652 | 0.1149 | 0.0975 | 0.0565 |
| **S** | 0.0422 | 0.0295 | 0.0320 | 0.0354 | 0.0277 | 0.0440 | 0.0165 |
| **SSE** | 0.0304 | 0.0404 | 0.0237 | 0.0295 | 0.0383 | 0.0122 | 0.0055 |
| **SE** | 0.0422 | 0.0513 | 0.0130 | 0.0307 | 0.0426 | 0.0115 | 0.0044 |
| **ESE** | 0.0375 | 0.0775 | 0.0450 | 0.0526 | 0.0511 | 0.0237 | 0.0044 |
| **E** | 0.0351 | 0.0742 | 0.1244 | 0.0947 | 0.1213 | 0.0440 | 0.0176 |
| **ENE** | 0.0691 | 0.0950 | 0.0972 | 0.0997 | 0.0894 | 0.1219 | 0.1135 |
| **NE** | 0.1101 | 0.1758 | 0.2168 | 0.1818 | 0.1213 | 0.1341 | 0.2276 |
| **NNE** | 0.1066 | 0.0993 | 0.0983 | 0.0846 | 0.1170 | 0.0934 | 0.0861 |
| **TOTAL** | **0.0975** | **0.1046** | **0.0963** | **0.2712** | **0.0537** | **0.1686** | **0.2081** |

**Table 3-17 Tower D, 2014, 60 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0693 | 0.0360 | 0.0131 | 0.0132 | 0.0343 | 0.0201 | 0.0284 |
| **NNW** | 0.0300 | 0.0264 | 0.0019 | 0.0078 | 0.0128 | 0.0146 | 0.0284 |
| **NW** | 0.0346 | 0.0240 | 0.0019 | 0.0072 | 0.0128 | 0.0177 | 0.0117 |
| **WNW** | 0.0508 | 0.0304 | 0.0056 | 0.0108 | 0.0186 | 0.0222 | 0.0200 |
| **W** | 0.0878 | 0.0785 | 0.0281 | 0.0210 | 0.0264 | 0.0364 | 0.0167 |
| **WSW** | 0.0924 | 0.1409 | 0.1295 | 0.1118 | 0.1106 | 0.2119 | 0.0735 |
| **SW** | 0.0762 | 0.0745 | 0.0600 | 0.0950 | 0.1449 | 0.1186 | 0.1102 |
| **SSW** | 0.0254 | 0.0336 | 0.0019 | 0.0319 | 0.0678 | 0.0531 | 0.0401 |
| **S** | 0.0254 | 0.0168 | 0.0056 | 0.0222 | 0.0371 | 0.0232 | 0.0301 |
| **SSE** | 0.0115 | 0.0160 | 0.0000 | 0.0192 | 0.0450 | 0.0180 | 0.0250 |
| **SE** | 0.0115 | 0.0160 | 0.0225 | 0.0271 | 0.0578 | 0.0187 | 0.0267 |
| **ESE** | 0.0346 | 0.0272 | 0.0919 | 0.1004 | 0.0792 | 0.0343 | 0.0284 |
| **E** | 0.0416 | 0.0360 | 0.0844 | 0.1064 | 0.0928 | 0.0576 | 0.0835 |
| **ENE** | 0.0831 | 0.0881 | 0.1370 | 0.1317 | 0.0842 | 0.1315 | 0.2204 |
| **NE** | 0.2217 | 0.2650 | 0.3527 | 0.2044 | 0.1049 | 0.1540 | 0.1937 |
| **NNE** | 0.1039 | 0.0905 | 0.0638 | 0.0896 | 0.0707 | 0.0680 | 0.0634 |
| **TOTAL** | **0.0494** | **0.1426** | **0.0608** | **0.1898** | **0.1599** | **0.3291** | **0.0684** |

**Table 3-18 Tower D, 2015, 15 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0569 | 0.0459 | 0.0233 | 0.0069 | 0.0079 | 0.0000 | 0.0094 |
| **NNW** | 0.0741 | 0.0236 | 0.0110 | 0.0041 | 0.0022 | 0.0000 | 0.0157 |
| **NW** | 0.0828 | 0.0372 | 0.0123 | 0.0063 | 0.0034 | 0.0010 | 0.0125 |
| **WNW** | 0.1086 | 0.0459 | 0.0317 | 0.0091 | 0.0056 | 0.0020 | 0.0188 |
| **W** | 0.0862 | 0.0993 | 0.1075 | 0.0363 | 0.0146 | 0.0132 | 0.0658 |
| **WSW** | 0.0793 | 0.1365 | 0.1276 | 0.0957 | 0.1033 | 0.0458 | 0.1379 |
| **SW** | 0.0586 | 0.1278 | 0.0395 | 0.1383 | 0.1302 | 0.0610 | 0.0878 |
| **SSW** | 0.0431 | 0.0261 | 0.0084 | 0.0544 | 0.0763 | 0.0631 | 0.0313 |
| **S** | 0.0293 | 0.0310 | 0.0110 | 0.0300 | 0.0550 | 0.0458 | 0.0219 |
| **SSE** | 0.0362 | 0.0248 | 0.0110 | 0.0338 | 0.0606 | 0.0448 | 0.0219 |
| **SE** | 0.0224 | 0.0310 | 0.0091 | 0.0297 | 0.0763 | 0.0702 | 0.0345 |
| **ESE** | 0.0362 | 0.0571 | 0.0330 | 0.0440 | 0.0696 | 0.0977 | 0.0502 |
| **E** | 0.0466 | 0.0707 | 0.1120 | 0.1160 | 0.1302 | 0.1851 | 0.0752 |
| **ENE** | 0.0500 | 0.0670 | 0.1373 | 0.1806 | 0.1874 | 0.2940 | 0.2476 |
| **NE** | 0.0845 | 0.1005 | 0.2286 | 0.1748 | 0.0707 | 0.0732 | 0.1473 |
| **NNE** | 0.1052 | 0.0757 | 0.0965 | 0.0401 | 0.0067 | 0.0031 | 0.0219 |
| **TOTAL** | **0.0662** | **0.0920** | **0.1763** | **0.4153** | **0.1017** | **0.1122** | **0.0364** |

**Table 3-19 Tower D, 2015, 60 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0414 | 0.0422 | 0.0220 | 0.0173 | 0.0168 | 0.0203 | 0.0094 |
| **NNW** | 0.0397 | 0.0273 | 0.0104 | 0.0074 | 0.0135 | 0.0102 | 0.0125 |
| **NW** | 0.0466 | 0.0174 | 0.0045 | 0.0060 | 0.0079 | 0.0112 | 0.0031 |
| **WNW** | 0.0741 | 0.0149 | 0.0136 | 0.0121 | 0.0079 | 0.0153 | 0.0031 |
| **W** | 0.0741 | 0.0509 | 0.0337 | 0.0236 | 0.0258 | 0.0305 | 0.0031 |
| **WSW** | 0.0845 | 0.1104 | 0.1561 | 0.1165 | 0.1717 | 0.1445 | 0.1066 |
| **SW** | 0.1224 | 0.2208 | 0.1120 | 0.1745 | 0.2009 | 0.1617 | 0.1818 |
| **SSW** | 0.0621 | 0.0533 | 0.0097 | 0.0550 | 0.0393 | 0.0397 | 0.0157 |
| **S** | 0.0603 | 0.0372 | 0.0142 | 0.0305 | 0.0236 | 0.0163 | 0.0157 |
| **SSE** | 0.0397 | 0.0298 | 0.0110 | 0.0267 | 0.0157 | 0.0102 | 0.0188 |
| **SE** | 0.0276 | 0.0409 | 0.0162 | 0.0258 | 0.0146 | 0.0081 | 0.0125 |
| **ESE** | 0.0603 | 0.0757 | 0.0667 | 0.0607 | 0.0191 | 0.0163 | 0.0157 |
| **E** | 0.0379 | 0.0571 | 0.1056 | 0.1023 | 0.0797 | 0.0590 | 0.0721 |
| **ENE** | 0.0500 | 0.0744 | 0.1114 | 0.1190 | 0.1403 | 0.1760 | 0.2790 |
| **NE** | 0.1103 | 0.0918 | 0.2364 | 0.1636 | 0.1504 | 0.2085 | 0.2038 |
| **NNE** | 0.0690 | 0.0558 | 0.0764 | 0.0588 | 0.0730 | 0.0722 | 0.0470 |
| **TOTAL** | **0.0662** | **0.0920** | **0.1763** | **0.4153** | **0.1017** | **0.1122** | **0.0364** |

**Table 3-20 Tower D, 2016, 15 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0564 | 0.0530 | 0.0155 | 0.0141 | 0.0161 | 0.0021 | 0.0156 |
| **NNW** | 0.0364 | 0.0435 | 0.0019 | 0.0077 | 0.0105 | 0.0011 | 0.0084 |
| **NW** | 0.0527 | 0.0475 | 0.0000 | 0.0032 | 0.0048 | 0.0018 | 0.0156 |
| **WNW** | 0.0836 | 0.0514 | 0.0058 | 0.0083 | 0.0161 | 0.0018 | 0.0252 |
| **W** | 0.0836 | 0.1179 | 0.0775 | 0.0423 | 0.0297 | 0.0156 | 0.0600 |
| **WSW** | 0.0673 | 0.1108 | 0.1085 | 0.1039 | 0.1053 | 0.0962 | 0.2005 |
| **SW** | 0.0455 | 0.0380 | 0.0213 | 0.0956 | 0.1286 | 0.1338 | 0.0864 |
| **SSW** | 0.0200 | 0.0095 | 0.0194 | 0.0250 | 0.0514 | 0.0721 | 0.0468 |
| **S** | 0.0200 | 0.0190 | 0.0097 | 0.0141 | 0.0322 | 0.0554 | 0.0180 |
| **SSE** | 0.0182 | 0.0134 | 0.0019 | 0.0148 | 0.0305 | 0.0586 | 0.0192 |
| **SE** | 0.0218 | 0.0103 | 0.0039 | 0.0135 | 0.0523 | 0.0671 | 0.0360 |
| **ESE** | 0.0200 | 0.0285 | 0.0543 | 0.0436 | 0.0804 | 0.0927 | 0.0528 |
| **E** | 0.0691 | 0.0530 | 0.1415 | 0.1597 | 0.1069 | 0.1374 | 0.0948 |
| **ENE** | 0.0836 | 0.0799 | 0.1473 | 0.1963 | 0.1479 | 0.1881 | 0.1885 |
| **NE** | 0.1800 | 0.2025 | 0.2946 | 0.1899 | 0.1407 | 0.0699 | 0.1044 |
| **NNE** | 0.1418 | 0.1218 | 0.0969 | 0.0680 | 0.0466 | 0.0064 | 0.0276 |
| **TOTAL** | **0.0628** | **0.1443** | **0.0589** | **0.1780** | **0.1420** | **0.3216** | **0.0951** |

**Table 3-21 Tower D, 2016, 60 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0564 | 0.0340 | 0.0097 | 0.0199 | 0.0193 | 0.0309 | 0.0132 |
| **NNW** | 0.0218 | 0.0253 | 0.0019 | 0.0038 | 0.0121 | 0.0167 | 0.0024 |
| **NW** | 0.0364 | 0.0206 | 0.0000 | 0.0032 | 0.0056 | 0.0110 | 0.0120 |
| **WNW** | 0.0527 | 0.0237 | 0.0000 | 0.0045 | 0.0080 | 0.0142 | 0.0072 |
| **W** | 0.0727 | 0.0506 | 0.0155 | 0.0160 | 0.0265 | 0.0298 | 0.0132 |
| **WSW** | 0.0891 | 0.1195 | 0.1047 | 0.0789 | 0.0788 | 0.1335 | 0.0720 |
| **SW** | 0.0655 | 0.1464 | 0.0775 | 0.1636 | 0.1785 | 0.2371 | 0.1957 |
| **SSW** | 0.0436 | 0.0285 | 0.0233 | 0.0468 | 0.0603 | 0.0579 | 0.0744 |
| **S** | 0.0218 | 0.0206 | 0.0213 | 0.0205 | 0.0249 | 0.0366 | 0.0288 |
| **SSE** | 0.0273 | 0.0222 | 0.0019 | 0.0135 | 0.0426 | 0.0195 | 0.0180 |
| **SE** | 0.0309 | 0.0174 | 0.0097 | 0.0141 | 0.0523 | 0.0188 | 0.0192 |
| **ESE** | 0.0400 | 0.0364 | 0.0678 | 0.0776 | 0.1021 | 0.0280 | 0.0216 |
| **E** | 0.0436 | 0.0491 | 0.1376 | 0.1533 | 0.1085 | 0.0540 | 0.0684 |
| **ENE** | 0.0782 | 0.0815 | 0.1260 | 0.1187 | 0.1101 | 0.0987 | 0.1753 |
| **NE** | 0.1709 | 0.2184 | 0.2791 | 0.1860 | 0.1085 | 0.1292 | 0.1861 |
| **NNE** | 0.1491 | 0.1060 | 0.1240 | 0.0795 | 0.0619 | 0.0841 | 0.0924 |
| **TOTAL** | **0.0628** | **0.1443** | **0.0589** | **0.1780** | **0.1420** | **0.3216** | **0.0951** |

**Table 3-22 Tower D, 2017, 15 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0911 | 0.0589 | 0.0372 | 0.0256 | 0.0315 | 0.0039 | 0.0165 |
| **NNW** | 0.0797 | 0.0375 | 0.0081 | 0.0075 | 0.0133 | 0.0025 | 0.0150 |
| **NW** | 0.0706 | 0.0339 | 0.0032 | 0.0064 | 0.0182 | 0.0018 | 0.0150 |
| **WNW** | 0.0683 | 0.0526 | 0.0081 | 0.0075 | 0.0166 | 0.0004 | 0.0135 |
| **W** | 0.1048 | 0.0999 | 0.0583 | 0.0234 | 0.0323 | 0.0078 | 0.0599 |
| **WSW** | 0.0683 | 0.1195 | 0.1197 | 0.0815 | 0.0589 | 0.0586 | 0.2246 |
| **SW** | 0.0319 | 0.0607 | 0.0405 | 0.1326 | 0.1294 | 0.1219 | 0.1257 |
| **SSW** | 0.0228 | 0.0152 | 0.0049 | 0.0335 | 0.0564 | 0.0841 | 0.0389 |
| **S** | 0.0182 | 0.0107 | 0.0032 | 0.0149 | 0.0274 | 0.0558 | 0.0240 |
| **SSE** | 0.0114 | 0.0089 | 0.0097 | 0.0101 | 0.0315 | 0.0555 | 0.0210 |
| **SE** | 0.0046 | 0.0089 | 0.0113 | 0.0128 | 0.0323 | 0.0664 | 0.0329 |
| **ESE** | 0.0205 | 0.0277 | 0.0129 | 0.0272 | 0.0415 | 0.0971 | 0.0674 |
| **E** | 0.0456 | 0.0473 | 0.1036 | 0.1044 | 0.1269 | 0.1367 | 0.0913 |
| **ENE** | 0.0433 | 0.0642 | 0.1262 | 0.1667 | 0.1459 | 0.1922 | 0.1123 |
| **NE** | 0.1503 | 0.2016 | 0.3269 | 0.2529 | 0.1766 | 0.1031 | 0.1033 |
| **NNE** | 0.1686 | 0.1525 | 0.1262 | 0.0932 | 0.0614 | 0.0124 | 0.0389 |
| **TOTAL** | **0.0501** | **0.1280** | **0.0705** | **0.2144** | **0.1377** | **0.3232** | **0.0763** |

**Table 3-23 Tower D, 2017, 60 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0706 | 0.0446 | 0.0324 | 0.0304 | 0.0439 | 0.0251 | 0.0314 |
| **NNW** | 0.0501 | 0.0116 | 0.0081 | 0.0091 | 0.0133 | 0.0134 | 0.0165 |
| **NW** | 0.0615 | 0.0178 | 0.0032 | 0.0064 | 0.0240 | 0.0110 | 0.0090 |
| **WNW** | 0.0752 | 0.0196 | 0.0065 | 0.0037 | 0.0232 | 0.0148 | 0.0150 |
| **W** | 0.0592 | 0.0437 | 0.0049 | 0.0117 | 0.0323 | 0.0244 | 0.0240 |
| **WSW** | 0.0957 | 0.1204 | 0.0955 | 0.0517 | 0.0522 | 0.0865 | 0.0584 |
| **SW** | 0.0683 | 0.1588 | 0.0971 | 0.1848 | 0.1410 | 0.2628 | 0.2141 |
| **SSW** | 0.0319 | 0.0384 | 0.0275 | 0.0570 | 0.0630 | 0.0622 | 0.0569 |
| **S** | 0.0137 | 0.0134 | 0.0049 | 0.0170 | 0.0398 | 0.0311 | 0.0359 |
| **SSE** | 0.0159 | 0.0116 | 0.0065 | 0.0154 | 0.0249 | 0.0184 | 0.0254 |
| **SE** | 0.0251 | 0.0205 | 0.0097 | 0.0170 | 0.0290 | 0.0152 | 0.0150 |
| **ESE** | 0.0228 | 0.0375 | 0.0388 | 0.0405 | 0.1003 | 0.0258 | 0.0389 |
| **E** | 0.0456 | 0.0446 | 0.0971 | 0.1166 | 0.1103 | 0.0491 | 0.0539 |
| **ENE** | 0.0501 | 0.0901 | 0.1149 | 0.1086 | 0.0788 | 0.0986 | 0.1302 |
| **NE** | 0.1731 | 0.2079 | 0.3236 | 0.2162 | 0.1343 | 0.1639 | 0.1811 |
| **NNE** | 0.1412 | 0.1195 | 0.1294 | 0.1140 | 0.0896 | 0.0978 | 0.0943 |
| **TOTAL** | **0.0501** | **0.1280** | **0.0705** | **0.2144** | **0.1377** | **0.3232** | **0.0763** |

**Table 3-24 Tower D, 2018, 15 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0726 | 0.0615 | 0.0315 | 0.0110 | 0.0236 | 0.0031 | 0.0146 |
| **NNW** | 0.0373 | 0.0312 | 0.0037 | 0.0063 | 0.0096 | 0.0017 | 0.0167 |
| **NW** | 0.0353 | 0.0422 | 0.0019 | 0.0063 | 0.0118 | 0.0003 | 0.0188 |
| **WNW** | 0.0851 | 0.0487 | 0.0074 | 0.0073 | 0.0089 | 0.0017 | 0.0251 |
| **W** | 0.0892 | 0.0983 | 0.0574 | 0.0172 | 0.0199 | 0.0062 | 0.0376 |
| **WSW** | 0.0726 | 0.1396 | 0.1444 | 0.0830 | 0.0414 | 0.0510 | 0.1837 |
| **SW** | 0.0290 | 0.0597 | 0.0519 | 0.1561 | 0.1529 | 0.1255 | 0.1294 |
| **SSW** | 0.0187 | 0.0165 | 0.0130 | 0.0334 | 0.0524 | 0.1065 | 0.0501 |
| **S** | 0.0270 | 0.0202 | 0.0185 | 0.0209 | 0.0303 | 0.0651 | 0.0334 |
| **SSE** | 0.0207 | 0.0119 | 0.0056 | 0.0141 | 0.0288 | 0.0541 | 0.0230 |
| **SE** | 0.0187 | 0.0092 | 0.0074 | 0.0125 | 0.0266 | 0.0738 | 0.0334 |
| **ESE** | 0.0353 | 0.0156 | 0.0222 | 0.0266 | 0.0414 | 0.0913 | 0.0564 |
| **E** | 0.0353 | 0.0441 | 0.1074 | 0.1263 | 0.1123 | 0.1403 | 0.0752 |
| **ENE** | 0.0851 | 0.0716 | 0.1019 | 0.1947 | 0.1817 | 0.1682 | 0.1608 |
| **NE** | 0.1680 | 0.1938 | 0.2852 | 0.2119 | 0.1839 | 0.1017 | 0.1127 |
| **NNE** | 0.1701 | 0.1359 | 0.1407 | 0.0725 | 0.0746 | 0.0093 | 0.0292 |
| **TOTAL** | **0.0550** | **0.1243** | **0.0616** | **0.2187** | **0.1546** | **0.3312** | **0.0547** |

**Table 3-25 Tower D, 2018, 60 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0560 | 0.0422 | 0.0278 | 0.0193 | 0.0465 | 0.0241 | 0.0167 |
| **NNW** | 0.0207 | 0.0248 | 0.0037 | 0.0099 | 0.0126 | 0.0134 | 0.0042 |
| **NW** | 0.0353 | 0.0202 | 0.0019 | 0.0078 | 0.0096 | 0.0100 | 0.0084 |
| **WNW** | 0.0394 | 0.0294 | 0.0056 | 0.0089 | 0.0103 | 0.0155 | 0.0063 |
| **W** | 0.0664 | 0.0441 | 0.0148 | 0.0120 | 0.0244 | 0.0255 | 0.0167 |
| **WSW** | 0.0934 | 0.1102 | 0.0870 | 0.0475 | 0.0355 | 0.1055 | 0.0397 |
| **SW** | 0.0788 | 0.1800 | 0.1315 | 0.2093 | 0.1448 | 0.2689 | 0.2443 |
| **SSW** | 0.0353 | 0.0321 | 0.0315 | 0.0449 | 0.0746 | 0.0796 | 0.0459 |
| **S** | 0.0311 | 0.0257 | 0.0185 | 0.0198 | 0.0369 | 0.0259 | 0.0271 |
| **SSE** | 0.0207 | 0.0147 | 0.0130 | 0.0141 | 0.0251 | 0.0183 | 0.0292 |
| **SE** | 0.0270 | 0.0073 | 0.0037 | 0.0172 | 0.0414 | 0.0172 | 0.0230 |
| **ESE** | 0.0353 | 0.0294 | 0.0426 | 0.0475 | 0.0694 | 0.0245 | 0.0313 |
| **E** | 0.0415 | 0.0459 | 0.1111 | 0.1717 | 0.1374 | 0.0479 | 0.0668 |
| **ENE** | 0.0809 | 0.0781 | 0.1000 | 0.1117 | 0.1123 | 0.0920 | 0.1315 |
| **NE** | 0.1909 | 0.2130 | 0.2741 | 0.1775 | 0.1278 | 0.1358 | 0.2109 |
| **NNE** | 0.1473 | 0.1028 | 0.1333 | 0.0809 | 0.0916 | 0.0958 | 0.0981 |
| **TOTAL** | **0.0550** | **0.1243** | **0.0616** | **0.2187** | **0.1546** | **0.3312** | **0.0547** |

**Table 3-26 Tower D, 2019, 15 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0620 | 0.0409 | 0.0484 | 0.0204 | 0.0024 | 0.0051 | 0.0060 |
| **NNW** | 0.0356 | 0.0257 | 0.0161 | 0.0106 | 0.0024 | 0.0015 | 0.0022 |
| **NW** | 0.0608 | 0.0269 | 0.0184 | 0.0130 | 0.0000 | 0.0007 | 0.0044 |
| **WNW** | 0.0700 | 0.0397 | 0.0300 | 0.0141 | 0.0048 | 0.0007 | 0.0077 |
| **W** | 0.0792 | 0.0864 | 0.0449 | 0.0357 | 0.0120 | 0.0051 | 0.0093 |
| **WSW** | 0.0884 | 0.0818 | 0.0991 | 0.0817 | 0.0647 | 0.0529 | 0.0982 |
| **SW** | 0.0528 | 0.0526 | 0.0703 | 0.1166 | 0.1367 | 0.1530 | 0.1602 |
| **SSW** | 0.0149 | 0.0222 | 0.0219 | 0.0495 | 0.0647 | 0.0928 | 0.0828 |
| **S** | 0.0138 | 0.0129 | 0.0196 | 0.0302 | 0.0336 | 0.0609 | 0.0598 |
| **SSE** | 0.0138 | 0.0210 | 0.0173 | 0.0247 | 0.0528 | 0.0645 | 0.0400 |
| **SE** | 0.0184 | 0.0257 | 0.0173 | 0.0353 | 0.0863 | 0.0667 | 0.0620 |
| **ESE** | 0.0207 | 0.0339 | 0.0346 | 0.0593 | 0.0624 | 0.0638 | 0.0686 |
| **E** | 0.0586 | 0.0818 | 0.1025 | 0.1190 | 0.1151 | 0.1022 | 0.1092 |
| **ENE** | 0.0758 | 0.1051 | 0.1313 | 0.1586 | 0.1799 | 0.1726 | 0.1651 |
| **NE** | 0.1917 | 0.2138 | 0.1797 | 0.1657 | 0.1511 | 0.1371 | 0.1119 |
| **NNE** | 0.1435 | 0.1297 | 0.1486 | 0.0656 | 0.0312 | 0.0203 | 0.0126 |
| **TOTAL** | **0.0994** | **0.0977** | **0.0991** | **0.2908** | **0.0476** | **0.1574** | **0.2081** |

**Table 3-27 Tower D, 2019, 60 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0471 | 0.0234 | 0.0541 | 0.0298 | 0.0312 | 0.0355 | 0.0258 |
| **NNW** | 0.0390 | 0.0222 | 0.0092 | 0.0185 | 0.0024 | 0.0080 | 0.0104 |
| **NW** | 0.0402 | 0.0152 | 0.0127 | 0.0130 | 0.0144 | 0.0138 | 0.0082 |
| **WNW** | 0.0448 | 0.0234 | 0.0196 | 0.0141 | 0.0120 | 0.0102 | 0.0121 |
| **W** | 0.0425 | 0.0362 | 0.0253 | 0.0192 | 0.0120 | 0.0138 | 0.0197 |
| **WSW** | 0.0941 | 0.1075 | 0.0657 | 0.0707 | 0.0456 | 0.0863 | 0.0933 |
| **SW** | 0.0999 | 0.1016 | 0.1394 | 0.2022 | 0.2134 | 0.2698 | 0.3171 |
| **SSW** | 0.0367 | 0.0374 | 0.0403 | 0.0620 | 0.1055 | 0.0899 | 0.0658 |
| **S** | 0.0207 | 0.0152 | 0.0253 | 0.0263 | 0.0360 | 0.0384 | 0.0280 |
| **SSE** | 0.0149 | 0.0350 | 0.0138 | 0.0236 | 0.0216 | 0.0152 | 0.0121 |
| **SE** | 0.0241 | 0.0117 | 0.0150 | 0.0212 | 0.0240 | 0.0123 | 0.0132 |
| **ESE** | 0.0379 | 0.0526 | 0.0369 | 0.0573 | 0.0312 | 0.0290 | 0.0208 |
| **E** | 0.0528 | 0.0806 | 0.1233 | 0.1146 | 0.1031 | 0.0457 | 0.0444 |
| **ENE** | 0.0953 | 0.1098 | 0.1152 | 0.0958 | 0.1007 | 0.1160 | 0.0987 |
| **NE** | 0.1906 | 0.2126 | 0.1924 | 0.1535 | 0.1055 | 0.1516 | 0.1574 |
| **NNE** | 0.1194 | 0.1157 | 0.1118 | 0.0781 | 0.1415 | 0.0645 | 0.0730 |
| **TOTAL** | **0.0994** | **0.0977** | **0.0991** | **0.2908** | **0.0476** | **0.1574** | **0.2081** |

**Table 3-28 Tower D, 2020, 15 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0725 | 0.0438 | 0.0255 | 0.0141 | 0.0110 | 0.0030 | 0.0065 |
| **NNW** | 0.0789 | 0.0308 | 0.0100 | 0.0059 | 0.0027 | 0.0008 | 0.0035 |
| **NW** | 0.0738 | 0.0249 | 0.0033 | 0.0043 | 0.0000 | 0.0015 | 0.0040 |
| **WNW** | 0.1132 | 0.0391 | 0.0177 | 0.0090 | 0.0000 | 0.0008 | 0.0060 |
| **W** | 0.1145 | 0.0948 | 0.0642 | 0.0200 | 0.0137 | 0.0023 | 0.0244 |
| **WSW** | 0.0649 | 0.1126 | 0.1495 | 0.0875 | 0.0658 | 0.0611 | 0.0875 |
| **SW** | 0.0305 | 0.0391 | 0.0831 | 0.1032 | 0.1288 | 0.1366 | 0.1536 |
| **SSW** | 0.0153 | 0.0201 | 0.0199 | 0.0502 | 0.0740 | 0.0792 | 0.0959 |
| **S** | 0.0178 | 0.0320 | 0.0144 | 0.0337 | 0.0630 | 0.0551 | 0.0586 |
| **SSE** | 0.0178 | 0.0178 | 0.0133 | 0.0247 | 0.0219 | 0.0475 | 0.0472 |
| **SE** | 0.0204 | 0.0261 | 0.0166 | 0.0310 | 0.0438 | 0.0611 | 0.0447 |
| **ESE** | 0.0522 | 0.0664 | 0.0210 | 0.0530 | 0.0658 | 0.0808 | 0.0497 |
| **E** | 0.0445 | 0.1055 | 0.1285 | 0.1114 | 0.1370 | 0.0958 | 0.0860 |
| **ENE** | 0.0725 | 0.1031 | 0.1340 | 0.1671 | 0.2247 | 0.1532 | 0.1764 |
| **NE** | 0.0954 | 0.1505 | 0.1872 | 0.2142 | 0.1123 | 0.1917 | 0.1461 |
| **NNE** | 0.1158 | 0.0936 | 0.1118 | 0.0706 | 0.0356 | 0.0294 | 0.0099 |
| **TOTAL** | **0.0895** | **0.0961** | **0.1028** | **0.2902** | **0.0416** | **0.1508** | **0.2291** |

**Table 3-29 Tower D, 2020, 60 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0573 | 0.0320 | 0.0255 | 0.0290 | 0.0301 | 0.0257 | 0.0114 |
| **NNW** | 0.0585 | 0.0237 | 0.0066 | 0.0090 | 0.0219 | 0.0091 | 0.0045 |
| **NW** | 0.0636 | 0.0190 | 0.0055 | 0.0086 | 0.0164 | 0.0068 | 0.0050 |
| **WNW** | 0.0611 | 0.0154 | 0.0066 | 0.0114 | 0.0164 | 0.0158 | 0.0040 |
| **W** | 0.0802 | 0.0379 | 0.0188 | 0.0157 | 0.0274 | 0.0211 | 0.0089 |
| **WSW** | 0.0891 | 0.1232 | 0.1141 | 0.0647 | 0.0603 | 0.0755 | 0.0805 |
| **SW** | 0.0865 | 0.1055 | 0.1617 | 0.1758 | 0.1726 | 0.2460 | 0.3534 |
| **SSW** | 0.0394 | 0.0379 | 0.0454 | 0.0561 | 0.0904 | 0.0868 | 0.0572 |
| **S** | 0.0229 | 0.0367 | 0.0177 | 0.0298 | 0.0493 | 0.0317 | 0.0229 |
| **SSE** | 0.0305 | 0.0249 | 0.0155 | 0.0212 | 0.0192 | 0.0128 | 0.0109 |
| **SE** | 0.0420 | 0.0344 | 0.0133 | 0.0255 | 0.0329 | 0.0083 | 0.0050 |
| **ESE** | 0.0420 | 0.1043 | 0.0410 | 0.0463 | 0.0301 | 0.0151 | 0.0040 |
| **E** | 0.0509 | 0.0841 | 0.1395 | 0.1177 | 0.1479 | 0.0574 | 0.0179 |
| **ENE** | 0.0725 | 0.0912 | 0.0952 | 0.1228 | 0.0877 | 0.1125 | 0.1183 |
| **NE** | 0.1107 | 0.1505 | 0.1838 | 0.1840 | 0.0740 | 0.1623 | 0.2182 |
| **NNE** | 0.0929 | 0.0794 | 0.1096 | 0.0824 | 0.1233 | 0.1132 | 0.0780 |
| **TOTAL** | **0.0895** | **0.0961** | **0.1028** | **0.2902** | **0.0416** | **0.1508** | **0.2291** |

**Table 3-30 Tower D, 2021, 15 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0703 | 0.036 | 0.0355 | 0.0105 | 0.0043 | 0.0014 | 0.0077 |
| **NNW** | 0.0632 | 0.0262 | 0.0071 | 0.0067 | 0.0064 | 0.0014 | 0.0071 |
| **NW** | 0.0691 | 0.0218 | 0.0036 | 0.0055 | 0.0021 | 0.0014 | 0.0055 |
| **WNW** | 0.1089 | 0.0393 | 0.0201 | 0.0105 | 0.0064 | 0.002 | 0.0082 |
| **W** | 0.1358 | 0.083 | 0.0486 | 0.0198 | 0.0149 | 0.0041 | 0.0148 |
| **WSW** | 0.041 | 0.083 | 0.1434 | 0.0896 | 0.0298 | 0.044 | 0.1015 |
| **SW** | 0.0316 | 0.0382 | 0.0545 | 0.1157 | 0.1085 | 0.1469 | 0.1558 |
| **SSW** | 0.0316 | 0.0306 | 0.0332 | 0.0488 | 0.0787 | 0.0826 | 0.0845 |
| **S** | 0.0234 | 0.0229 | 0.0225 | 0.0299 | 0.034 | 0.0596 | 0.0521 |
| **SSE** | 0.0211 | 0.0284 | 0.0201 | 0.0274 | 0.0447 | 0.0501 | 0.0455 |
| **SE** | 0.0293 | 0.0448 | 0.0118 | 0.0459 | 0.0723 | 0.0609 | 0.0477 |
| **ESE** | 0.0375 | 0.06 | 0.0261 | 0.0505 | 0.0894 | 0.0968 | 0.0521 |
| **E** | 0.0422 | 0.0884 | 0.1173 | 0.1056 | 0.1383 | 0.1178 | 0.0933 |
| **ENE** | 0.0597 | 0.1103 | 0.1161 | 0.1511 | 0.1553 | 0.1666 | 0.1794 |
| **NE** | 0.103 | 0.1725 | 0.2239 | 0.2092 | 0.1511 | 0.1388 | 0.1322 |
| **NNE** | 0.1323 | 0.1146 | 0.1161 | 0.0732 | 0.0638 | 0.0257 | 0.0126 |
| **TOTAL** | **0.0975** | **0.1046** | **0.0963** | **0.2712** | **0.0537** | **0.1686** | **0.2081** |

**Table 3-31 Tower D, 2021, 60 m AGL Frequency**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Dir** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **N** | 0.0656 | 0.0295 | 0.0379 | 0.0210 | 0.0255 | 0.0271 | 0.0154 |
| **NNW** | 0.0457 | 0.0186 | 0.0071 | 0.0122 | 0.0234 | 0.0135 | 0.0033 |
| **NW** | 0.0410 | 0.0142 | 0.0036 | 0.0093 | 0.0191 | 0.0088 | 0.0033 |
| **WNW** | 0.0714 | 0.0251 | 0.0095 | 0.0109 | 0.0128 | 0.0115 | 0.0022 |
| **W** | 0.0984 | 0.0306 | 0.0142 | 0.0210 | 0.0277 | 0.0217 | 0.0071 |
| **WSW** | 0.1019 | 0.1037 | 0.0829 | 0.0711 | 0.0553 | 0.1056 | 0.0943 |
| **SW** | 0.0609 | 0.0972 | 0.1481 | 0.1801 | 0.1128 | 0.2295 | 0.3423 |
| **SSW** | 0.0422 | 0.0382 | 0.0462 | 0.0652 | 0.1149 | 0.0975 | 0.0565 |
| **S** | 0.0422 | 0.0295 | 0.0320 | 0.0354 | 0.0277 | 0.0440 | 0.0165 |
| **SSE** | 0.0304 | 0.0404 | 0.0237 | 0.0295 | 0.0383 | 0.0122 | 0.0055 |
| **SE** | 0.0422 | 0.0513 | 0.0130 | 0.0307 | 0.0426 | 0.0115 | 0.0044 |
| **ESE** | 0.0375 | 0.0775 | 0.0450 | 0.0526 | 0.0511 | 0.0237 | 0.0044 |
| **E** | 0.0351 | 0.0742 | 0.1244 | 0.0947 | 0.1213 | 0.0440 | 0.0176 |
| **ENE** | 0.0691 | 0.0950 | 0.0972 | 0.0997 | 0.0894 | 0.1219 | 0.1135 |
| **NE** | 0.1101 | 0.1758 | 0.2168 | 0.1818 | 0.1213 | 0.1341 | 0.2276 |
| **NNE** | 0.1066 | 0.0993 | 0.0983 | 0.0846 | 0.1170 | 0.0934 | 0.0861 |
| **TOTAL** | **0.0975** | **0.1046** | **0.0963** | **0.2712** | **0.0537** | **0.1686** | **0.2081** |

**Table 3-32 Tower D Annual Stability Class as Percentage**

| FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pasquill Stability Class | | | | | | | |
| **Year** | **A** | **B** | **C** | **D** | **E** | **F** | **G** |
| **2014** | 0.0494 | 0.1426 | 0.0608 | 0.1898 | 0.1599 | 0.3291 | 0.0684 |
| **2015** | 0.0662 | 0.0920 | 0.1763 | 0.4153 | 0.1017 | 0.1122 | 0.0364 |
| **2016** | 0.0628 | 0.1443 | 0.0589 | 0.1780 | 0.1420 | 0.3216 | 0.0951 |
| **2017** | 0.0501 | 0.1280 | 0.0705 | 0.2144 | 0.1377 | 0.3232 | 0.0763 |
| **2018** | 0.0550 | 0.1243 | 0.0616 | 0.2187 | 0.1546 | 0.3312 | 0.0547 |
| **2019** | 0.0994 | 0.0977 | 0.0991 | 0.2908 | 0.0476 | 0.1574 | 0.2081 |
| **2020** | 0.0895 | 0.0961 | 0.1028 | 0.2902 | 0.0416 | 0.1508 | 0.2291 |
| **2021** | 0.0975 | 0.1046 | 0.0963 | 0.2712 | 0.0537 | 0.1686 | 0.2081 |
| **AVERAGE %** | **7.12** | **11.62** | **9.08** | **25.86** | **10.49** | **23.68** | **12.20** |

### 3.6.1.5 Extreme Weather

#### 3.6.1.5.1 Thunderstorms

The NCDC Storm Event Database (NOAA 2025) was queried to obtain information on thunderstorms in the vicinity of the Facility site. The period of record available for review was January 1, 1950 to November 30, 2024. The area of interest is Roane County Tennessee, which is the location for the Facility, and the surrounding nine-county area encompassing Anderson, Cumberland, Knox, Loudon, McMinn, Meigs, Morgan, Monroe, and Rhea counties, an area of 4,245 $mi^2$. Refer to Figure 3-82 for a map showing the ten-county area of interest. The output from the query contained 2,484 thunderstorm days during the 74-year period of record or 33.6 thunderstorm days per year. Several individual thunderstorms may occur during each of the thunderstorm days. Thunderstorm days can occur during every month of the year; however, they were most prevalent during the months of March through August, peaking during the month of July.

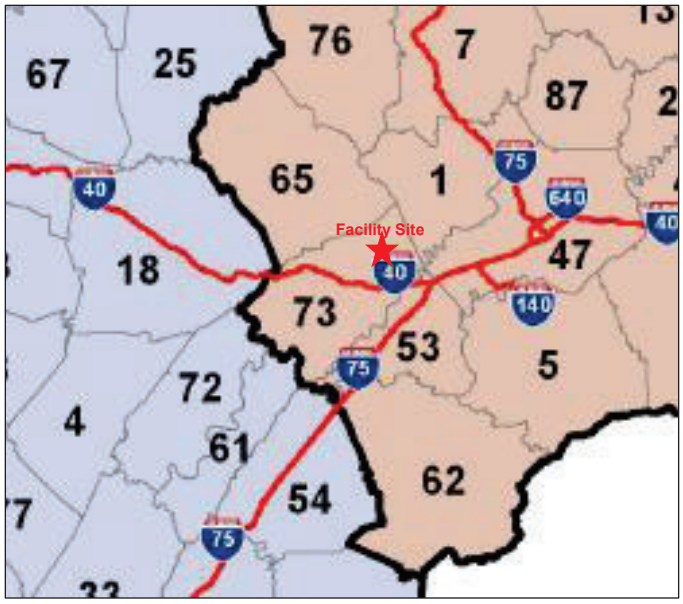



**Figure 3-82 County Map of Interest**

1. Anderson County
61. Meigs County
18. Cumberland County
62. Monroe County
47. Knox County
65. Morgan County
53. Loudon County
72. Rhea County
54. McMinn County
73. Roane County **

If the thunderstorms are of sufficient strength, they may be accompanied by strong winds, hail and even tornadoes. Winds greater than 40 knots (74 km/hr) occurred with thunderstorms on 1,779 occasions during the 74-year period of record, greater than 50 knots on 1,764 occasions, and greater than 56 knots on 586 occasions. 50 knots equates to the wind speed for a derecho and 56 knots equates to the minimum wind speed of an EF-0 tornado. The largest tornado that occurred in the aforementioned counties was an EF-4 that occurred in Meigs/McMinn on May 2, 1953. Four deaths and eight injuries were reported in Meigs County. Roane County has had three EF-0 and two EF-1 tornadoes in Oct 1977, Jun 2011, Jun 2014, Feb 1993, and Aug 2023, respectively. No reported injuries or fatalities occurred from these tornadoes, and the estimated property damage cost was less than $50k. Hail occurred 756 occasions during the 74-year period coincidence with thunderstorms.

#### 3.6.1.5.2 Tornadoes

A tornado is defined as a violent vortex in the atmosphere. When the vortex reaches the ground, it is classified as a tornado. If the vortex does not reach the ground, it is classified as a funnel cloud. Tornadoes and funnel clouds always occur in association with thunderstorms, especially those which produce hail.

Most of the tornado activity in the United States occurs east of the Rocky Mountains. The total number of tornadoes in Roane County Tennessee, which is the location for the Facility, and the surrounding nine-county area encompassing Anderson, Cumberland, Knox, Loudon, McMinn, Meigs, Morgan, Monroe, and Rhea for the period of record (January 1, 1950 to November 30, 2024) was 109. Most of the tornado activity (83.5% of occurrences) occurred from February through June. The annual frequency of occurrence of a tornado in the ten-county region is 1.47 (109 tornadoes/74-years). The probability of a tornado developing at the Facility site is very small, mainly due to the mountainous terrain that starts west and south-west of the Facility site.

#### 3.6.1.5.3 Flood / Flash Flood

The Facility site is located near the base of the White Oak Mountain which is one of a series of paralleling ridges running approximately north-northeast in the Tennessee Valley between the Cumberland Plateau/Mountains to the west and the Blue Ridge Mountains to the east. The ridge averages 1,368 feet AMSL, the highest point being 1,495 feet AMSL. The Facility site is approximately 800 to 825 feet AMSL. The Clinch River lies approximately 3.3 miles south-west of the Facility site, which is approximately 750 feet AMSL. This location is approximately 24 miles south-west of the Norris Dam and Norris Reservoir. While a breach of the dam (retaining $1.11 \times 10^{11}$ $ft^3$ of water) would not cause a flooding problem for the Facility site, due to the elevation difference between the site and the Clinch River, heavy rains and significant snow melt from the nearby ridge could result in localized flooding of streams coming off the mountain. These streams have been identified, and appropriate terracing of the site and redirection of streams is planned.

The NCDC Storm Event Database (NOAA 2025) was queried to obtain information on flooding/flash flooding in the vicinity of the Facility site. The period of record available for review was January 1, 1950 to November 30, 2024. The area of interest is Roane County Tennessee, which is the location for the Facility site. Roane County has experienced 45 floods/flash-floods over the 74-year period. No reported injuries or fatalities have occurred from these floods/flash-floods; however, property damage on the order of $2.8 M did occur throughout the county in lower lying areas in May 2003 and a second flood occurred in February 2019 that resulted in $10.5 M in property damage. Both of these episodes were related to heavy rains versus snow melt of dam failure.

#### 3.6.1.5.4 Snow Falls / Blizzards

As stated in Section 3.6.1.5.3, the Facility site is located near the base of the White Oak Mountain, and heavy snow melt could result in potential flooding. The NCDC Storm Event Database (NOAA 2025) was queried to obtain information on snow fall/blizzards in the vicinity of the Facility site. The review of the period of record available for review was conducted (January 1, 1950 to November 30, 2024). Blowing snow occurs when snow is on the ground and high winds cause the snow to be entrained into the air near the surface. Blowing snow can become a hazard because it reduces visibility and causes the snow to accumulate into drifts on the leeward side of buildings, vehicles, fence posts and structures, in general. During blizzard conditions, visibility

can be reduced to zero. The formation of drifts can make roads and parking lots impassable. The terrain in the vicinity of the Facility site is hilly to mountainous. This type of terrain can result in the formation of snowdrifts. The other consideration is the snow accumulation on above ground power lines. This accumulation, along with ice, can lead to power line failure and power outages to the local areas.

In February 2014, a maximum of 16 inches of snow fell at the higher elevations due to strong upper-level disturbance combined with deep moisture pulled from the Carolina coast over a 2-day period. This tends to be the maximum snowfall that occurs in this region. No property damage has been reported for any of the snowfalls that have occurred in Roane County; however, two indirect deaths were reported in January 2024 during a snowstorm that dumped approximately 7-9 inches. No details of the indirect deaths were documented.

#### 3.6.1.5.5 Icing / Ice Storms

The NCDC Storm Event Database (NOAA 2025) was queried to obtain information on ice storms in the vicinity of the Facility site. The review of the period of record available for review was conducted (January 1, 1950 to November 30, 2024). Over the 74-year period of record, Roane County has had six ice storms recorded. One in 1998, one in 2005, one in 2010 and three in 2015 that occurred within one month (Feb to Mar). One storm that occurred in 2010 was proceeded by 2-4 inches of snow followed by freezing rain that accumulated 0.25 to 0.5 inches of ice. This storm resulted in approximately $10k in property damage, but no personnel deaths or injuries. The first of the three ice storms that occurred in 2015 resulted in one fatality. This fatality was identified as indirect and was associated with cold weather. No additional details were provided. No property damage was recorded.

#### 3.6.1.5.6 Lightning

The NCDC Storm Event Database (NOAA 2025) was queried to obtain information on lightning in the vicinity of the Facility site. The review of the period of record available for review was conducted (January 1, 1950 to November 30, 2024). Over the 74-year period of record, Roane County has had two major lightning storms occur with thunderstorms: one in 1996, and another in 2018. The 1996 lightning strike destroyed one house by initiating a house fire. The second storm occurred on July 7, 2018, with an event at 1500 local time and again at 1600 local time. Both of these events reported a fatality and gave the same descriptive narrative, with the exact same coordinates so it is unlikely that this was two separate events. The fatality was related to someone working outside mowing a lawn. No property damage was reported with this storm in 2018. For the surrounding nine counties, 17 lightning storms have been recorded over the 74-year period (or 0.23 lightning strikes per year). These lightning strikes resulted in three direct injuries and $400k in property damage as two businesses were destroyed.

### 3.6.2 BASELINE AIR QUALITY

The federal Clean Air Act (CAA) (42 U.S.C. Chapter 85) (USC 1990) requires the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered to be harmful to public health and the environment (42 U.S.C, Chapter 85, §7409 and §7410). The standards are designed to primarily protect the general public, including sensitive populations such as asthmatics, children, and the elderly. They are also intended to safeguard public welfare by reducing effects such as decreased visibility and damage

to animals, crops, vegetation, and buildings. EPA has established standards for six criteria of pollutants, including two size ranges for particulate matter. The state of Tennessee has partially adopted the federal NAAQS. Table 3-33, lists the ambient air quality standards as administered by the EPA and those administered by the Tennessee Department of Environment and Conservation (TDEC).

Attainment, nonattainment, and maintenance areas are three regulatory designations the U.S. EPA uses to describe how well a geographic area meets the NAAQS. An attainment area is a region where monitored air pollution levels comply with federal air-quality standards. A nonattainment area fails to meet one or more NAAQS; these areas have pollution levels above allowable limits for pollutants such as ozone, $PM_{2.5}$, $PM_{10}$, or sulfur dioxide. A maintenance area is a former nonattainment area now meeting standards: After an area improves its air quality and EPA redesignates it to attainment, it becomes a maintenance area.

The Air Quality Index (AQI) is a national index that categorizes air quality based on a 500-point scale for each of the criteria of air pollutants. The categories and numeric values are as follows: Good (0-50); Moderate (51-100); Unhealthy for Sensitive Groups (101-150); Unhealthy (151-200); Very Unhealthy (201-300); and Hazardous (300-500). Tennessee generally enjoys “good” air quality. The AQI for Roane County (the county in which the Facility will be located) in 2024 was classified as “good” 100% of the time (EPA 2025f).

Tennessee has an active State Implementation Plan (SIP), which includes rules for ozone, particulate matter, sulfur dioxide, and other pollutants. Air quality data for the state of Tennessee was obtained from the TDEC Chapter 1200-3-3.03 Ambient Air Quality Standards (TDEC 2006).

**Note**: EPA AQI Limits are current as of May 31, 2025; however, TDEC limits date to October 2006.

**Table 3-33 EPA Ambient Air Quality Standards for Criteria Pollutants (black text)**
**TDEC Ambient Air Quality Standards for Criteria Pollutants (blue text)**

| Pollutant | Primary/ Secondary | Standard | Level |
|---|---|---|---|
| Ozone | Primary and Secondary | The 3-year average of the 4th highest daily maximum 8-hour average concentration cannot exceed level measured at each monitor within an area over each year. (a) | 0.070 ppm |
| Ozone | Primary and Secondary | The 1-hour average maximum concentrations, not to be exceeded more than once per year. (e) | 235 µg/m$^3$<br>0.12 ppm |
| Particulate Matter (10 micrometers) | Primary and Secondary | The 24-hour average cannot exceed level more than once per year on average over three years. | 150 µg/m$^3$ |
| Particulate Matter (10 micrometers) | Primary and Secondary | The average annual arithmetic mean cannot exceed the level. | 50 µg/m$^3$ |
| | | The 24-hour average maximum concentrations, not to be exceeded more than once per year. (f) | 150 µg/m$^3$ |
| Particulate Matter (2.5 micrometers) | Primary | The 3-year annual average of the weighted annual mean concentration cannot exceed level. | 9.0 µg/m$^3$ |
| | Secondary | The 3-year annual average of the weighted annual mean concentration cannot exceed level. | 15.0 µg/m$^3$ |
| | Primary and Secondary | The 3-year average of the 98th percentile (based on the number of samples taken) of the daily concentrations must not exceed level. | 35 µg/m$^3$ |
| Particulate Matter (2.5 micrometers) | Primary and Secondary | No Equivalent | - - - |
| Carbon Monoxide | Primary | The 1-hour average cannot exceed level more than once per year. | 35 ppm |
| | Primary | The 8-hour average cannot exceed level more than once per year. | 9 ppm |
| Carbon Monoxide | Primary and Secondary | The 1-hour average maximum concentration, not to be exceeded more than once per year | 40,000 µg/ m$^3$<br>35 ppm |
| | | The 8-hour average maximum concentration, not to be exceeded more than once per year | 10,000 µg/ m$^3$<br>9 ppm |
| Sulfur Dioxide | Primary | The 3-year average of the 99th percentile (based on the 1 hour) of the daily maximum concentrations must not exceed level. (b) | 0.075 ppm |
| | Secondary | The 3-year average annual arithmetic mean cannot exceed the level. | 0.01 ppm |
| Sulfur Dioxide | Primary | The average annual arithmetic mean cannot exceed the level. | 80 µg/m$^3$<br>0.03 ppm |
| | | The daily (24-hour) maximum concentrations, not to be exceeded more than once per year. | 365 µg/m$^3$<br>0.14 ppm |
| | Secondary | The 3 hour average maximum concentrations, not to be exceeded more than once per year. | 1,300 µg/m$^3$<br>0.5 ppm |
| Lead | Primary and Secondary | The rolling three-month average cannot exceed the level. (c) | 0.15 µg/m$^3$ |
| | | The rolling three-month average cannot exceed the level. (c) | 1.5 µg/m$^3$ |
| Lead | Primary and Secondary | The rolling three-month average cannot exceed the level. The first exceedance is considered a violation of the standard. | 1.5 µg/m$^3$ |

| Pollutant | Primary/ Secondary | Standard | Level |
|---|---|---|---|
| Nitrogen Dioxide | Primary and Secondary | The annual mean of 1-hour averages cannot exceed the level. (d) | 0.053 ppm |
| | Primary | The 3-year average of the 98th percentile (based on the 1 hour) of the daily maximum concentrations must not exceed the level. | 0.10 ppm |
| Nitrogen Dioxide | Primary and Secondary | The average annual arithmetic mean cannot exceed the level. | 100 µg/m$^3$ 0.05 ppm |

a) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) $O_3$ standards are not revoked and remain in effect for designated areas. Additionally, some areas may have certain continuing implementation obligations under the prior revoked 1-hour (1979) and 8-hour (1997) $O_3$ standards.

b) The previous SO2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a State Implementation Plan (SIP) call under the previous SO2 standards (40 CFR 50.4. A SIP call is an EPA action requiring a state to resubmit all or part of its SIP to demonstrate attainment of the required NAAQS.

c) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

d) The level of the annual NO2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

e) The standard is attained when the expected number of days per calendar year with maximum hourly concentration above 150 µg/m3, as determined by Appendix K in Federal Register, Volume 52, No. 126 July 1, 1987, (Federal Register 1987), is equal to or less than one.

f) The 24-hour guideline is attained when the expected number of days per calendar year with maximum hourly concentration above 0.12 ppm (235 µg/m3) is equal to or less than 1 as determined by the Federal Register, Volume 44, No. 28, February 8, 1979, Part V, Appendix H, pp 8220 (Federal Register 1979).

#### 3.6.2.1 Ozone

Ozone is a ground-level summertime air pollution problem which primarily forms when photochemical pollutants from cars and industrial sources react with sunlight. These photochemical pollutants are called ozone precursors and include oxides of nitrogen ($NO_x$) and volatile organic compounds (VOC). Levels of ozone are usually highest in the afternoon because of the intense sunlight, warm temperatures and the time required for ozone to form. Based upon EPA monitoring data (EPA 2025c), a few counties in the western portion of the state have had ozone concentrations in the marginal to moderate range. All other counties have remained below the ozone standard since monitoring began.

#### 3.6.2.2 Particulate Matter (10 micrometers)

Particulate matter (PM) includes both solid matter and liquid droplets suspended in the air. Particles with aerodynamic diameters less than or equal to 2.5 micrometers (µm) and 10µm are referred to as PM2.5 ('fine' particles) and PM10, respectively. $PM_{10}$ includes both fine and coarse particles. Aerodynamic diameter used to define PM is defined as the diameter of a unit-density (1 g/cm$^3$) sphere that settles at the same velocity as the particle. Thus, physical diameter and aerodynamic diameter can differ depending on the particle's density and shape (EPA 1977). For

example, a low-density pollen with a physical diameter of 15 μm and a high-density metal particle with a physical diameter of 5 μm could both behave aerodynamically like a 10-μm particle.

One of the primary sources of particulate matter in Tennessee is burning of fossil fuels (coal, oil, and gas), wood burning, gravel pits, agricultural activities, and dust from roads and construction. As of 2017, the Effective date of State's Area Redesignation, no nonattainment has been recorded by the EPA monitoring data (EPA 2025c).

#### 3.6.2.3 Particulate Matter (2.5 micrometers)

$PM_{2.5}$ generally comes from wood burning, agricultural burning and other area sources, as well as vehicle exhaust including cars, diesel trucks and buses. Fine particulate can also be formed secondarily in the atmosphere by chemical reactions of pollutant gases. Tennessee currently has six counties that previously exceeded the $PM_{2.5}$ standard and were designated as a nonattainment area, this includes a portion of Roane County centered on the Kingston Fossil Plant (Census 2000 Block Group 47-145-0307-2), which does not include the Site. According to the 2012 $PM_{2.5}$ standard, Tennessee is not currently under the nonattainment or maintenance (EPA 2025d).

#### 3.6.2.4 Carbon Monoxide

Carbon monoxide (CO) is an odorless, colorless gas that forms when the carbon in fuels does not burn completely. In Tennessee, the majority of CO comes from vehicle exhaust. Only one city/county in Tennessee has been designated as nonattainment for CO, which was Memphis/Shelby County dating back to 1994. At that time, the CO level was designated as marginal at ≤12.7 ppm. In 1994, the EPA accepted the State's Implementation Plan (SIP) (EPA 2025f) for CO and Memphis/Shelby County was moved to the attainment category. No additional nonattainments have been recorded for any county in Tennessee to date.

#### 3.6.2.5 Sulfur Dioxide

Sulfur dioxide ($SO_2$) is a colorless, reactive gas produced by burning fuels containing sulfur, such as coal and oil, and by industrial processes. Historically, the greatest sources of $SO_2$ were industrial facilities that derived their products from raw materials like metallic ore, coal and crude oil, or that burned coal or oil to produce process heat (petroleum refineries, cement manufacturing and metal processing facilities). Currently, on-road vehicles, marine craft and diesel construction equipment also release significant $SO_2$ emissions into the air. Sulfur content for U.S. retail fuels is very low (10 ppm for gasoline, 15 ppm for diesel). The diesel limit of 15 ppm applies to small marine craft. However, large vessel fuel standards are tiered: 1,000 ppm in the U.S. In Tennessee, three counties were designated as nonattainment for $SO_2$, which were Benton, Humphreys, and Polk Counties dating back to 1998. In 1998, the EPA accepted the SIP (Federal Register 1998) for $SO_2$ and Benton, Humphreys, and Polk Counties were moved to the attainment category. One other county in Tennessee has failed to meet attainment or is designated as nonattainment and that is Sullivan County. Sullivan County has been in nonattainment since 2013 to present as noted by the EPA notice (Federal Register 2022) in the Federal Register. As a result of this determination, the State of Tennessee is required to submit by April 5, 2023, revisions to the Tennessee SIP that, among other things, provide for the attainment of the $SO_2$ NAAQS in the Sullivan County Area as expeditiously as practicable but no later than April 5, 2027. As of the start of 2025, Sullivan County is still in nonattainment.

#### 3.6.2.6 Lead

Lead is a highly toxic metal that was used for many years in household products, automobile fuel and industrial chemicals. Airborne lead was associated primarily with automobile exhaust and lead smelters. Air concentrations of lead in the U.S. began to drop dramatically starting in the mid-1970s, especially between 1975 and 1985, due to the phase-out of leaded gasoline. In Tennessee, three counties were designated as nonattainment for Lead, which were Fayette, Shelby, and Williamson Counties dating back to 1995, 2001, and 1999, respectively. Each of these counties were redesignated to a maintenance status, by the EPA, in 1995 (Federal Register 1995), 2001 (Federal Register 2001), and 1999 (Federal Register 1999), respectively. One other City/County in Tennessee was designated as nonattainment which was Bristol/Sullivan County dating back to 2016. This county was redesignated to a maintenance status, by the EPA, in 2016 (Federal Register 2016). No additional nonattainments have been recorded for any county in Tennessee to date.

#### 3.6.2.7 Nitrogen Dioxide

Nitrogen dioxide ($NO_2$) is a reddish brown, highly reactive gas that forms from the reaction of nitrogen oxide (NO) and oxygen in the atmosphere. The term "$NO_x$" refers to both NO and $NO_2$. $NO_x$ and VOC are both photochemically reactive and can result in the formation of ozone. On-road vehicles are the major sources of $NO_x$. Nationwide, on-road vehicles are the largest source of $NO_x$ emissions, followed by stationary fuel combustion, nonroad vehicles, and industrial processes (EPA 2023). Industrial boilers and processes, home heaters and gas stoves can also produce $NO_x$. $NO_x$ is not considered a significant pollution problem in Tennessee.

#### 3.6.2.8 Nonattainment and PSD Class I Areas

A nonattainment area is a geographic area that exceeds the air quality standards set by the EPA. This can exist for one or more pollutants, such as ozone ($O_3$), particulate matter ($PM_{10}$ and $PM_{2.5}$), nitrogen dioxides ( $NO_2$), carbon monoxide (CO) and sulfur dioxide ($SO_2$). Volatile organic compounds (VOC) are a precursor to the formation of criteria pollutants, e.g., ground-level ozone.. "Revoked NAAQS" means that the EPA has officially withdrawn or cancelled a previously established National Ambient Air Quality Standard (NAAQS), essentially removing the legal requirement for areas to meet a specific air pollution level set by that standard; in simpler terms, it means an air quality standard is no longer in effect and areas previously classified as nonattainment under that standard are no longer required to comply with it.

Prevention of Significant Deterioration (PSD) applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment or unclassifiable with the National Ambient Air Quality Standards (NAAQS). The PSD program protects air quality by requiring all major new and modified sources located in areas whose air quality has been designated under the CAA (EPA 2025a) as either being in attainment of the National Ambient Air Quality Standards (NAAQS) or as unclassifiable to undergo a preconstruction review for each air pollutant regulated under the PSD program that the new major stationary source or major modification will emit or increase in significant amounts. Areas that are in attainment of the NAAQS are categorized as either "Class I", "Class II," or "Class III" which determines the increment of air quality deterioration allowed. Under the PSD program, all

international parks, national wilderness areas and national memorial parks that exceed 5,000 acres, and of national parks that exceed 6,000 acres are designated as mandatory federal Class I areas in order to preserve, protect and enhance air quality. Roosevelt Campobello International Park (covering approximately 2,721 acres) is the only international park in the U.S. that is jointly administered with Canada. There is no specified minimum acreage requirement for a site to be designated an international park. All other areas that attain the NAAQS are initially designated as Class II. Section 164 of the CAA (GPO 2013), gives states and tribes the ability to request redesignation from Class II to Class I called “non-federal” Class I areas.

There is currently one nonattainment area in Tennessee. This nonattainment area is for $SO_2$. The Sullivan County, Tennessee was designated nonattainment for $SO_2$ with an “Annual Design Value” at the time of designation of 196 ppb (0.196 ppm) and with the “Current Design Values” as of May 2024 at 67 ppb (0.067 ppm), which is lower than the EPA Primary Value (0.075 ppm), but greater than the EPA Secondary Value (0.01 ppm) (EPA 2025b). As noted previously, Sullivan County has been in nonattainment since 2013 to present as noted by the EPA notice (Federal Register 2022) in the Federal Register. As a result of this determination, the State of Tennessee is required to submit by April 5, 2023, revisions to the Tennessee SIP that, among other things, provide for the attainment of the $SO_2$ NAAQS in the Sullivan County Area as expeditiously as practicable but no later than April 5, 2027.

Prevention of Significant Deterioration (PSD) Class I areas are areas of special national or regional natural, scenic, recreational, or historic value for which the PSD regulations provide special protection. The PSD regulations do not contain an explicit requirement for air emission sources based on their distance from nearby Class I areas. However, as a matter of policy, the EPA recommend that permitting authorities notify the Federal Land Managers (FLMs) when a proposed PSD source is located within 100 km of a Class I area. If the source’s emissions are particularly large, the EPA further recommends notifying the FLMs even when the source is located beyond 100 km (e.g., up to 200 km). Given that air emissions from the project activities would be relatively small, the use of a 100-km range from the project area is considered appropriate.

The State of Tennessee has two Federal Class I areas: Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area. These areas are located approximately 34 mi southeast and approximately 39 mi south-southeast, respectively, of the Site. All other Class I areas located in neighboring states are situated beyond 62 mi from the Site.

### 3.6.2.9 Regional Emissions

EPA's Outdoor Air Quality Data webpage (EPA 2025e) provides access to air pollution data for the entire United States. Specifically, the EPA Green Book Data download "NAYRO" (EPA 2025c) provides county level nonattainment and maintenance counties for each NAAQS, including revoked area counties. If more than one nonattainment area for a NAAQS is in a county, the county will be listed with a row for each nonattainment area. In addition, the National Emissions Inventory database provides estimates of annual emissions of criteria air pollutants from all types of sources.

The EPA Air Emissions Modeling database for 2022 was queried to provide Facility emissions data for Roane County and the nine-county area surrounding the Facility site (EPA 2022). The counties included in the search were Anderson, Cumberland, Knox, Loudon, McMinn, Meigs, Morgan, Monroe, and Rhea. The requested pollutants were CO, $NO_x$, $PM_{10}$, $PM_{2.5}$, $SO_2$ and VOCs. The most recent year for which data were available was Jan 2022. Refer to Table 3-34 for the leading contributor for each of the requested pollutants.

**Note**: Meigs County only monitors for ammonia and Morgan County does not monitor for any of the pollutants, primarily because Morgan County is mostly mountainous (Blue Ridge Mountain) with little to no major industries.

Since air quality in Roane County has not changed much over the last couple decades and is categorized as "good" to "moderate", primarily associated with $PM_{10}$ and $PM_{2.5}$, it can be assumed that the air emissions from these regional sources have remained fairly constant over the same period of time and/or the air emissions have minimal impact within the region. It is anticipated that air quality in the region will continue to be in attainment of the ambient air quality standards for the foreseeable future.

**Table 3-34 Facility Criteria Air Pollutant Emissions in the Roane County and the Eight-County Region Surrounding the Oak Ridge Enrichment Facility Site (Based on 2022 Emissions)**

| | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | VOC |
|---|---|---|---|---|---|---|
| **Tons per Year – Roane County[1]** | 547.2 | 1,744.5 | 372.7 | 305.3 | 2,140.2 | 79.0 |
| **Kg per Year – Roane County** | 496,412 | 1,582,584 | 338,108 | 276,964 | 1,941,557 | 71,668 |
| **Tons per Year – Anderson County[2]** | 199.1 | 876.0 | 139.8 | 110.6 | 361.3 | 88.0 |
| **Kg per Year – Anderson County** | 180,620 | 794,694 | 126,824 | 100,335 | 327,766 | 79,832 |
| **Tons per Year – Cumberland County[3]** | 301.3 | 84.1 | 376.8 | 110.1 | 40.9 | 48.3 |
| **Kg per Year – Cumberland County** | 273,335 | 76,295 | 341,827 | 99,881 | 37,104 | 43,817 |
| **Tons per Year – Knox County[4]** | 1,867.8 | 833.0 | 474.1 | 281.9 | 205.4 | 1,007.9 |
| **Kg per Year – Knox County** | 1,694,440 | 755,685 | 430,096 | 255,735 | 186,336 | 914,351 |
| **Tons per Year – Loudon County[5]** | 240.3 | 326.9 | 364.3 | 267.9 | 154.7 | 1,846.8 |
| **Kg per Year – Loudon County** | 217,996 | 296,559 | 330,487 | 243,035 | 140,341 | 1,675,389 |
| **Tons per Year – McMinn County[6]** | 968.9 | 405.4 | 238.7 | 110.1 | 62.2 | 146.5 |
| **Kg per Year – McMinn County** | 878,971 | 367,773 | 216,545 | 99,881 | 56,427 | 132,903 |
| **Tons per Year – Meigs County[9]** | | | | | | |
| **Kg per Year – Meigs County[9]** | | | | | | |
| **Tons per Year – Monroe County[7]** | 128.8 | 123.3 | 215.0 | 175.1 | 1.4 | 863.2 |

| | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | VOC |
|---|---|---|---|---|---|---|
| **Kg per Year – Monroe County** | 116,845 | 111,856 | 195,045 | 158,848 | 1,270 | 783,082 |
| **Tons per Year – Morgan County[9]** | | | | | | |
| **Kg per Year – Morgan County[9]** | | | | | | |
| **Tons per Year – Rhea County[8]** | 243.7 | 217.9 | 212.5 | 122.2 | 93.7 | 197.9 |
| **Kg per Year – Rhea County** | 221,081 | 197,676 | 192,777 | 110,858 | 85,003 | 179,532 |

(1) TVA Kingston Fossil Plant is the largest contributor.

(2) TVA Bull Run Fossil Plant is the largest contributor.

(3) StonePeak Ceramics Inc is the largest contributor.

(4) Cemex Construction Materials Atlantic, LLC is the largest contributor with CMC Steel US, LLC the largest contributor for CO and Republics Plastics, L.P. K1 & K2 Plants the largest contributor for VOCs.

(5) Primary Products Ingredients Americas LLC is the largest contributor for CO, $NO_x$, $PM_{10}$, $PM_{2.5}$, and $SO_2$. Viskase Companies Inc is the largest contributor for VOC.

(6) Resolute FP US Inc. is the largest contributor for CO and $NO_x$, Johns Manville, Inc. is the largest contributor for $PM_{10}$, $PM_{2.5}$, $SO_2$, and VOCs.

(7) Monroe County is the largest contributor for CO. Havco Wood Products, LLC is the largest contributor for $NO_x$, $PM_{10}$, $PM_{2.5}$, $SO_2$. Yamaha Jet Boat Manufacturing USA, Inc is the largest contributor for VOCs.

(8) La-Z-Boy Tennessee is the largest contributor for CO. Huber Engineered Woods, LLC is the largest contributor for $NO_x$, $PM_{10}$, $PM_{2.5}$, VOCs. General Shale Brick Plant 42 is the largest contributor for $SO_2$.

(9) Meigs and Morgan Counties are not included in the EPA Air Emissions Reporting Database for the aforementioned pollutants.

## 3.7 NOISE

The following background information on the physics and science associated with noise and noise measurement is described in Section 3.7 of the Eagle Rock Enrichment Facility Environmental Report (AREVA 2011), which is incorporated by reference and was used to develop the baseline noise conditions for the Facility. OE is using the design of the previously approved EREF as the basis for the design of the Facility.

Any pressure variation that the human ear can detect is considered as “sound”, and noise is defined as “unwanted sound”. At high levels noise can damage hearing, cause sleep deprivation, interfere with communication, and disrupt concentration. In the context of protecting the public health and welfare, noise implies adverse effects on people and the environment.

The sound we hear is the result of a source inducing vibration in the air, creating sound waves. These waves radiate in all directions from the source and may be reflected and scattered or, like other wave actions, may turn corners. Sound waves are a fluctuation in the normal atmospheric pressure, which is measurable. This sound pressure level is the instantaneous difference between the actual pressure produced by a sound wave and the average or barometric pressure at a given point in space. This provides the fundamental method of measuring sound, which is in "decibel" (dB) units.

The dB scale is a logarithmic scale because the range of sound intensities is so great that it is convenient to compress the scale to encompass all the sound pressure levels that need to be measured. The sound pressure level is defined as 20 times the logarithm, to the base 10, of the ratio of the pressure of the sound measured to the reference pressure, which is 20 µPa (0.0002 dyne/cm$^2$). In equation form, sound pressure level in units of dB is expressed as:

dB= 20 Log10 P/Pr

Where: P = measured sound pressure level µPa (dyne/cm$^2$)
Pr = reference sound pressure level, 20 µPa (0.0002 dyne/cm$^2$)

Due to its logarithmic scale, if noise increases by 10 dB, it sounds as if the noise level has doubled. If the noise increases by 3 dB, the increase is barely perceptible to humans. Additionally, as a rule-of-thumb the sound pressure level from an outdoor noise source radiates out from the source, decreasing 6 dB per doubling of distance. Thus, a noise that is measured at 80 dB at 50 ft away from the source will be 74 dB at 100 ft, 68 dB at 200 ft, and 62 dB at 400 ft. This applies only to point sources (e.g., stationary diesel generators). For line sources (e.g., road traffic), the sound level decreases by approximately 3 dB for each doubling of distance. However, natural and man-made features such as planted trees, buildings, land contours, etc., will often reduce the sound level further due to dissipation and absorption of the sound waves. As sound propagates outward from the source, its level attenuates due to several mechanisms, including geometrical spreading, atmospheric absorption, ground effects, terrain features, vegetation, and variations in wind and temperature with height Occasionally buildings and other reflective surfaces may slightly amplify the sound waves, through reflected and reverberated sound waves.

The rate at which a sound source vibrates determines its frequency. Frequency refers to the energy level of sound in cycles per second, designated by the unit of measurement Hertz (Hz). The human ear can recognize sounds within an approximate range of 16 Hz to 20,000 Hz, but the most readily predominant sounds that we hear are between 500 Hz and 6,000 Hz (EPA 1973).

To measure sound on a scale that approximates the way it is heard by people, more weight must be given to the frequencies that people hear more easily. The "A-weighted" sound scale is used as a method for weighting the frequency spectrum of sound pressure levels to mimic the human ear. A-weighting is recommended by the EPA, the American Society for Testing and Materials (ASTM), and the International Electrotechnical Commission (IEC) (EPA 1974) (ASTM 2016) (IEC 2013) to describe noise because of its convenience and accuracy, and it is used extensively throughout the world. For the purpose and scope of this report and sound level testing, all measurements will be in the A-weighted scale (dBA). A-weighted levels are widely used not due to "convenience" or inherent "accuracy" in measuring all noise, but because they accurately approximate human hearing sensitivity. Convenience is merely a secondary factor.

### 3.7.1 EXTENT OF NOISE ANALYSIS

The following discussion on extent of noise analysis is described in Section 3.7.1 of the Eagle Rock Enrichment Facility Environmental Report (AREVA 2011), which is incorporated by reference and was used as the basis for performing noise-related calculations.

Community noise levels are often measured by the Day-Night Average Sound Level ($L_{dn}$). The $L_{dn}$ is the A-weighted equivalent sound level for a 24-hour period. Due to the potential for sleep disturbance, loud noises between 2200 and 0700 are normally considered more annoying than loud noises during the day. This is a psychoacoustic effect that can also contribute to communication interference, distraction, disruption of concentration and irritation. A 10 dB penalty is added to nighttime equivalent sound levels due to the sensitivity of people during nighttime hours (EPA, 1974). For example, a measured nighttime (2200 and 0700) equivalent sound level of 50 dBA can be said to have a weighted nighttime sound level of 60 dBA (50 + 10).

For the purposes of this report, an Equivalent Sound Level ($L_{eq}$) is used to measure average noise levels during daytime hours. The $L_{eq}$ is a single value of sound level for any desired duration, which includes all of the time-varying sound energy in the measurement period. To further clarify the relationship between these two factors, the daytime sound level equivalent averaged with the nighttime sound level equivalent equals the Day-Night Average: $L_{dneq}$ (Day) averaged with $L_{eq}$ (Night) = $L_{dn}$. Since the nighttime noise levels are significantly lower than the daytime noise levels, the daytime $L_{eq}$ is used alone, without averaging the lower nighttime value, to provide a more conservative representation of the actual exposure.

### 3.7.2 COMMUNITY DISTRIBUTION

The area surrounding the Site is a part of the ORR and can be characterized as industrial, with a large portion of the area being greenfield sites. Noise receptors include wildlife using the Site and vicinity, other industrial facilities in the vicinity, individuals traveling State Route (SR) 95, and residents in a nearby neighborhood. The nearest resident in this neighborhood is approximately 1.25 miles away and separated from the Site by a forested area for essentially the entire distance. The nearest city is Oak Ridge, which is approximately 6 miles away.

### 3.7.3 CURRENT SOURCES AND LEVELS OF NOISE

There have been two recent background noise level surveys performed, and one noise assessment conducted on the ORR that is near and relevant to the Facility site. These surveys and assessment are:

- Noise survey performed in January 2022 for the TRISO-X fuel fabrication facility site.
- Noise survey performed in June 2021 for the Hermes test reactor (Kairos Power); and
- Noise assessment conducted for the Oak Ridge Enhanced Technology Training Center (ORETTC) site adjacent to the Facility site.

#### 3.7.3.1 Noise Survey: TRISO-X

The proposed location of the TRISO-X fuel fabrication facility is directly across SR-95 from the Site approximately 0.6 miles off SR-95 in the HCS industrial park. The TRISO-X Environmental Report was submitted in September 2022 to NRC followed subsequently with Revision 1 in January 2025 (NRC 2025b).

The TRISO-X ER documents that a noise survey was conducted January 11-12, 2022, using four noise monitoring stations at the HCS and property boundaries. Five measurements were recorded at each location over the two-day period. The survey methodology and types and locations of monitors used are described in the above noted reference.

Results from analysis of the TRISO-X noise measurements concluded:

- **Sources**: Several natural and human-generated noise sources were observed during the ambient noise survey for the HCS. Dominant noise sources included area traffic on nearby SR-95 - Oak Ridge Turnpike and local roadways, as well as some drill rig activity on the HCS.
- **Results 1**: The $L_{eq}$ data indicate “relatively consistent sound levels across the four monitoring locations and across day and night events.”
- **$L_{eq}$**: measure to describe the level of varying noise over a period of time.
- **Results 2**: “The $L_{dn}$ results are representative of the typical ambient noise level at the HCS and are consistent with the $L_{dn}$ for quiet to normal suburban areas, which typically ranges from 48 to 57 dBA (EPA 1974).”
- **$L_{dn}$**: average equivalent sound level over 24-hr period with penalty added for noise **during** nighttime.
- **Municipal Sound Level Standards**: While maximum sound level data were not collected as part of the ambient noise survey for the HCS, the $L_{dn}$ and $L_{eq}$ values presented in Table 3.7.1-1 of the TRISO-X Environmental Report (ER) (see Table 3-35 of this report) indicate that the typical ambient noise levels associated with current baseline conditions at the HCS are well below noise level limits established by the “City of Oak Ridge”, refer to Section 3.7.6.1, Municipal Regulations for discussion of limits (Oak Ridge 2020).
- **Federal Sound Level Standards**: Based on the results of the TRISO-X ambient noise survey, the $L_{dn}$ at the HCS property boundary during current conditions ranged from

51.8 to 53.1 dBA (Table 3.7.1-1 in the TRISO-X ER) [see Table 3-35 in this report], which are below the EPA $L_{dn}$ guideline of 55 dBA.

**Table 3-35 TRISO-X Ambient Noise Monitoring Results**

| Monitoring Location Number | Measured Daytime[a] Ambient Noise Level; Event 1 ($L_{eq}$, dBA) | Measured Daytime[a] Ambient Noise Level; Event 2 ($L_{eq}$, dBA) | Measured Nighttime[b] Ambient Noise Level; Event 3 ($L_{eq}$, dBA) | Measured Nighttime[b] Ambient Noise Level; Event 4 ($L_{eq}$, dBA) | Measured Daytime[a] Ambient Noise Level; Event 5 ($L_{eq}$, dBA) | Calculated Average Community Noise Level ($L_{dn}$, dBA)[c] |
|---|---|---|---|---|---|---|
| NM-1 | 45.3 | 45.4 | 45.3 | 45.4 | 46.2 | **51.8** |
| NM-2 | 46.3 | 46.0 | 45.3 | 47.6 | 49.0 | **53.1** |
| NM-3 | 45.3 | 45.3 | 45.4 | 45.3 | 45.3 | **51.8** |
| NM-4 | 45.3 | 46.0 | 45.8 | 45.5 | 45.4 | **52.1** |

Notes:
a) Daytime events occur between 7:00 a.m. and 10:00 p.m.
b) Nighttime events occur between 10:00 p.m. and 7:00 a.m.
c) A 10 dBA penalty was added to the measured nighttime $L_{eq}$ sound levels in calculating the average community noise level to reflect the sensitivity of receptors during those hours.

Abbreviations:
$L_{dn}$ = day-night average community noise level
$L_{eq}$ = equivalent noise level
dBA = A-weighted decibel

Source: TRISO-X Environmental Report Table 3.7.1-1 (NRC 2022)

Each $L_{eq}$ measurement was converted to sound energy, adding a 10 dBA penalty to nighttime measurements to reflect the sensitivity of receptors during those hours. The average sound power was then calculated by averaging the sound energy from each of the three daytime measurements (weighting the daytime average sound energy by 15 hours per day) and two nighttime measurements (weighting the nighttime average sound energy by 9 hours per day). The sound energy weighted average was then used to calculate the day-night average community noise level ($L_{dn}$) for each monitoring location

### 3.7.3.2 Noise Survey: Hermes

The proposed location of the Hermes test reactor is at the East Tennessee Technology Park (ETTP) approximately 2.3 miles south of the Facility site. Kairos submitted its Environmental Report for Hermes in October 2021 to NRC. The Hermes ER documents that a noise survey was conducted June 15-16, 2021, using two noise monitoring stations, one near the site boundary and one in the interior of the site. The survey methodology and locations of monitors used are described in the Hermes ER (Kairos 2023).

The ETTP site is located in the same, general area of the ORR as are TRISO-X and the Facility site, as shown in Figure 3-5. All three sites collectively can be characterized as industrial areas with a large portion of the surrounding areas being greenfield sites.

Results from analysis of the Hermes noise measurements concluded:

- “The measured noise levels represent an ambient noise environment common to a quiet rural area surrounding the site.”

- The noise monitor located near the site boundary had higher ambient noise levels due to its “closer proximity to industrial activities at ETTP and as well as a public accessible road.”
- The $L_{dn}$ measured ambient noise levels were 53 dBA and 46 dBA, respectively, see Table 3-36.

**Table 3-36 Hermes Measured Ambient Noise Levels**

| Receptor | Location | $L_{eq(1)}$ | $L_{dn}$ |
|---|---|---|---|
| R1 | Site Boundary | 33-52 dBA | 53 dBA |
| R2 | Inside of Site | 33-46 dBA | 46 dBA |

Source: Kairos Power Hermes Environmental Report Table 3.2-9 (Kairos 2023)

#### 3.7.3.3 Noise Assessment: ORETTC

In January 2023 DOE’s National Nuclear Security Administration (NNSA) opened its Oak Ridge Enhanced Technology and Training Center (ORETTC) on the northern-most portion of the original Site (See Figure 3-83). Some 81 acres were made available for ORETTC, again adjacent to the Oak Ridge Turnpike, 1.5 miles from the SR-95 – SR-58 interchange. Only 24 acres of the 81 were planned to be disturbed to locate two training facilities. The Emergency Response Training Facility opened in January 2023 while the Simulated Nuclear and Radiological Activities Facility is in the early construction stage.

The location of the Facility sits on approximately 600 acres of the original SSP-2 site and is at the southern portion of the SSP-2 site, approximately 1 mile away from ORETTC and will largely be separated by dense trees.

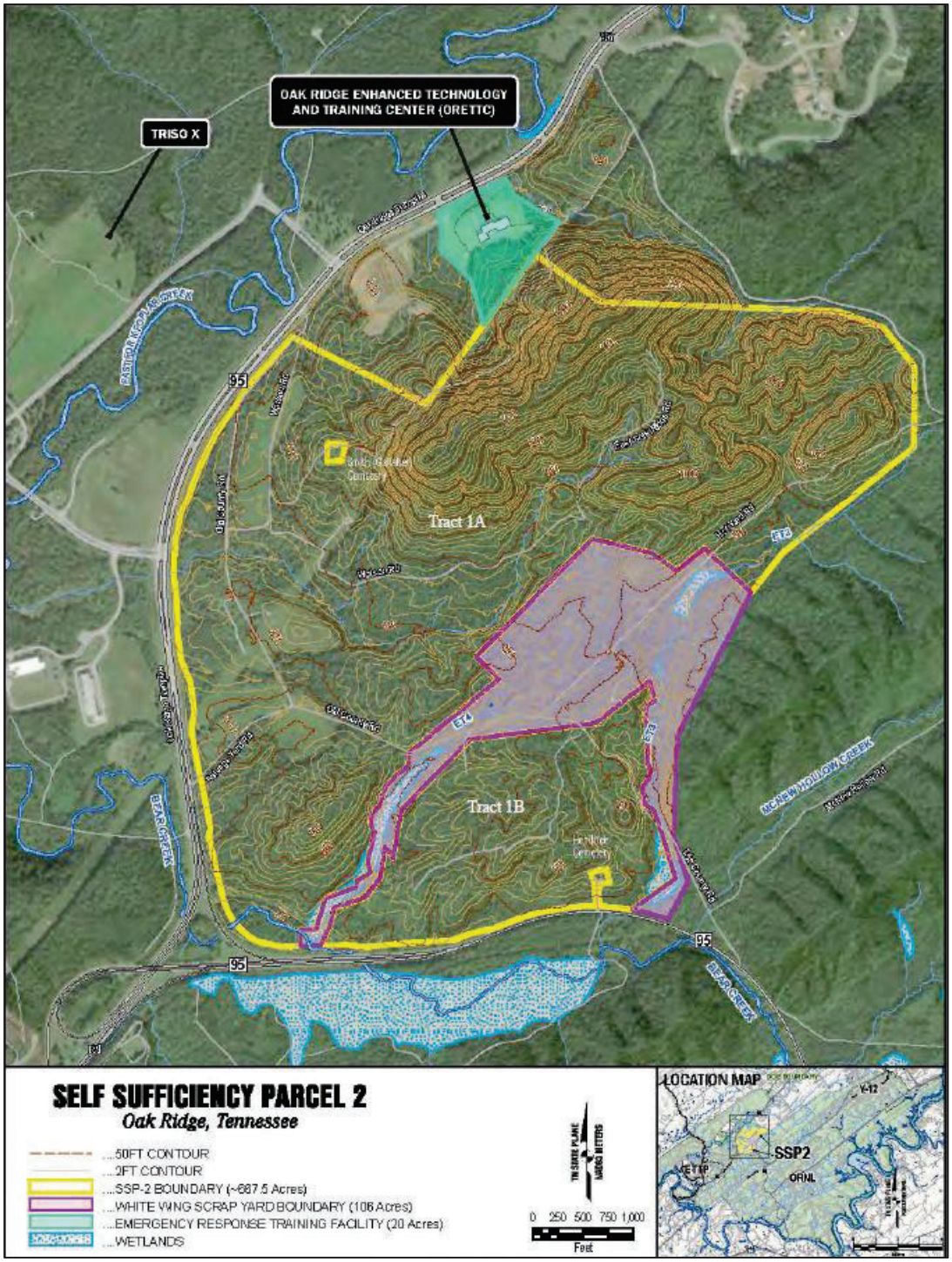



**Figure 3-83 Facility Boundary and ORETTC Location (DOE 2025)**

In DOE NNSA's environmental assessment for ORETTC as documented inf DOE/EA-2144 (DOE 2020a), DOE NNSA concluded:

- Because the ORETTC Site is a greenfield site, there are no existing noise sources.
- There are no sensitive noise receptors (schools, churches, daycare facilities, etc.) within 1 mile of the ORETTC Site. The nearest sensitive noise receptor is the George Jones

Memorial Baptist Church, which is approximately 1.5 miles southwest of the ORETTC Site. The nearest residence to the ORETTC Site is approximately 0.75 mile to the northeast, separated by relatively dense trees. That residence is approximately 100 yards south of the Oak Ridge Turnpike, so baseline traffic noise is relatively high near that residence.

- The area surrounding the proposed ORETTC is generally used for industrial purposes or a transportation corridor (Oak Ridge Turnpike) and is not considered to be noise sensitive.

#### 3.7.3.4 Noise Measurements for the Facility Site

Based upon the comparable noise measurements for TRISO-X and the Hermes test reactor as well as the noise assessment performed for ORETTC, which is located near the Site for the Facility, it is determined that the results from these three facilities are representative for the proposed Facility site. This determination is based on:

- The measured results from both TRISO-X and Hermes surveys, are very similar for $L_{dn}$ values: TRISO-X, 51.8 – 53.1 dBA and Hermes, 46 – 53 dBA. The surrounding area for both locations is still characterized as being industrial and largely a greenfield area. Both sets of measurements are consistent with noise levels common to a quiet rural area (EPA, 1974).
- The area surrounding the proposed ORETTC is generally used for industrial purposes or as a transportation corridor (Oak Ridge Turnpike) and "is not considered to be noise sensitive."

Thus, no additional noise measurements were determined to be needed for the Facility site.

### 3.7.4 TOPOGRAPHY AND LAND USE

The Facility will be located approximately 6 miles southwest of Oak Ridge, Tennessee, in Roane County on the eastern side of Tennessee SR-95 on approximately 600-acre site, which will be ultimately transferred from the DOE (DOE 2024c) to OE. There are no rights-of-way on the property with the exception of the right-of-way from Tennessee SR-95, which forms part of the northwest, western, and southern boundaries of the Site. Currently, a dirt road provides site access from Tennessee SR-95, while other dirt roads provide access throughout the Site. Ultimately, access to the Facility site will be via a new road directly across from Novus Drive off SR-95.

Currently, the Site is wooded with a limited amount of gravel/dirt roads available to access the site. Elevations at the property range from about 770 ft AMSL along the Oak Ridge Turnpike and the southern portions of the property to about 1,160 ft AMSL in the northern portion of the property for approximately 390 ft of relief. The surrounding area is primarily forest, with a few independent industrial properties to the west and north, and a residential subdivision to the north. Prior to DOE ownership, the property was used for residential and agricultural purposes.

### 3.7.5 METEOROLOGICAL CONDITIONS

The meteorological conditions at the Site have been evaluated and summarized to characterize the site climatology. See ER Section 3.6 for a detailed discussion.

As noted in Section 3.6., eleven meteorological towers with instrumentation set at various heights are located on the reservation of the ORNL and operated by ORNL. These towers surround the Facility site and provide details on meteorological conditions. These towers range from 2.49 miles to 6.32 miles from the site and surround the Site. A second set of meteorological tower data was obtained from nearby airports with automated surface observing systems (ASOS) or automated weather observing system-3 (AWOS-3) certified towers. These towers range from 8.5 miles to 57.2 miles from the site.

Eleven years of data (2011-2021) from the ORNL sites found average wind speeds ranging from 1.49 mph to 7.91 mph. See Table 3-9, for details. For each of these eleven meteorological towers, wind rose data is included in Table 3-13 and demonstrate the channeling effect of the mountains that surround the Site.

Noise intensities are affected by weather conditions for a variety of reasons. Snow-covered ground can absorb more sound waves than an uncovered paved surface that would normally reflect the noise. Operational noise can be masked by the sound of a rainstorm or high winds. Additionally, seasonal differences in foliage, as well as temperature changes, can affect the environmental efficiency of sound wave absorption (i.e., a fully leafed tree or bush will mitigate more sound than one without leaves). Because of those variables, the noise levels, both background and after the Facility is built, will be variable. However, even when such variations are taken into consideration, the background noise levels are within the HUD and EPA guidelines.

### 3.7.6 SOUND LEVEL STANDARDS

#### 3.7.6.1 Municipal Regulations

The City of Oak Ridge has established quantitative noise level limits based on adjacent property uses, as codified in Article XII of the City's Zoning Ordinance (Section 12.04). For properties with adjacent business uses, the zoning ordinance sets a maximum noise limit of 80 dBA during both daytime and nighttime hours. Additionally, the sound level should not exceed 70 dBA for more than 50 percent of the survey period or 75 dBA for more than 10 percent of the survey period. These restrictions are specific to outdoor spaces, at the lot boundary (Oak Ridge 2020).

While maximum sound level data were not collected as part of the ambient noise survey for TRISO-X, the $L_{dn}$ and $L_{eq}$ values presented in Table 3-35 are representative for the Facility project. They indicate the typical ambient noise levels associated with current baseline conditions at the HCS (TRISO-X site) are well below noise level limits established by the (Oak Ridge 2020).

No new or significant information regarding municipal regulations was identified.

### 3.7.6.2 State and County Regulations

Neither Roane County nor the State of Tennessee has developed noise regulations that specify acceptable community noise levels (NRC 2022).

No new or significant information regarding state and county regulations was identified.

### 3.7.6.3 Federal Regulations

Agencies with applicable standards for community noise levels include the U.S. Department of Housing and Urban Development (HUD 1985) and the EPA (EPA 1974) (AREVA 2011).

HUD has developed land use compatibility guidelines for acceptable noise versus the specific land use (see Table 3-37). The representative $L_{dn}$ values for the Facility as presented in Table 3-35 for TRISO-X range from 51.8 dBA to 53.1 dBA and are below the "Clearly Acceptable" value of <70 dBA for the "wholesale, industrial, manufacturing and utilities" land use category."

The EPA has broad-ranging guidelines for environmental noise levels. EPA guidelines recommend that outdoor noise levels do not exceed an $L_{dn}$ of 55 dBA, which is sufficient to protect the public from the effect of broadband environmental noise in typical outdoor and residential areas. This level is not a regulatory standard but is intentionally conservative to protect the most sensitive portion of the American population with an additional margin of safety (EPA 1974). Based on the results of the ambient noise survey, the $L_{dn}$ at the HCS property boundary during current conditions at that time ranged from 51.8 to 53.1 dBA (Table 3-35), below the EPA $L_{dn}$ guideline of 55 dBA (NRC 2025b). Using these results as representative for ambient noise levels for the Facility site demonstrate that the ambient noise levels for the Facility site will be below the EPA $L_{dn}$ guideline of 55 dBA. No new or significant information regarding federal regulations was identified.

**Table 3-37 U.S. Department of Housing Urban Development Land Use Compatibility Guidelines**

| | Sound Pressure Level (dBA $L_{dn}$) | | | |
|---|---|---|---|---|
| **Land Use Category** | **Clearly Acceptable** | **Normally Acceptable** | **Normally Unacceptable** | **Clearly Unacceptable** |
| Residential | <60 | 60-65 | 65-75 | >75 |
| Livestock farming | <60 | 60-75 | 75-80 | >80 |
| Office Buildings | <65 | 65-75 | 75-80 | >80 |
| Wholesale, industrial, manufacturing and utilities | <70 | 70-80 | 80-85 | >85 |

Source: Eagle Rock Environmental Report, Table 3.7-2 (AREVA 2011) (HUD 1985)

## 3.8 HISTORIC AND CULTURAL RESOURCES

Cultural resources include prehistoric or historic districts, archaeological sites, buildings, structures, or objects considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. When cultural resources meet any one of the National Register Criteria for Evaluation (36 CFR 60.4), they may be termed historic properties and be eligible for inclusion in the National Register of Historic Places (NRHP).

A cultural resource survey was conducted to identify the potential occurrence of archaeological and historic resources potentially eligible for the NRHP on and near the OE Facility Site. The survey included a Phase I archaeological survey and historic architecture viewshed survey. Identified resources were assessed against the criteria for the NRHP in order to determine their potential eligibility.

### 3.8.1 DEFINING THE AREA OF POTENTIAL EFFECTS

The Area of Potential Effects (APE) is considered to be the area in which there is potential for both direct and indirect effects to the physical integrity of a historical or cultural resource. The cultural resource survey was done of the SSP-2 parcel.

#### 3.8.1.1 Direct Effects

Direct effects are defined as those that result from activities that could damage or destroy the physical integrity of a cultural resource. Therefore, the area of potential effects for direct effects to cultural resources consists of the areas where construction activities and ground disturbances are proposed. For this project the area of potential direct effects is considered to be the Facility Site that covers approximately 300 acres.

#### 3.8.1.2 Indirect Effects

Indirect effects are those that do not directly destroy the physical integrity of a cultural resource but instead would adversely affect contributing elements of the cultural resource. For historic structures, this typically consists of visual effects to the viewshed of the cultural resource that may diminish the overall context. A 0.5-mi. buffer around the direct-effect APE is considered the APE for indirect effects to cultural resources.

### 3.8.2 EXISTING CONDITIONS

The cultural background of East Tennessee spans thousands of years. The earliest groups to leave a definitive material record of their presence were early Paleoindians who entered the region during the Late Pleistocene glacial epoch at least 12,000 years ago. Their descendants and the descendants of other Native American groups who migrated to the area later occupied the region for the next 11 millennia. This long prehistoric era lasted until the arrival of European explorers in the 16th and 17th centuries.

While cultural change is a slow and continual process, archaeologists and other researchers divide the human history of a region into distinct cultural periods. Archaeologists and historians recognize four broadly defined prehistoric periods for East Tennessee:

- Paleoindian (approximately 10,000 – 8000 B.C.)
- Archaic (8000 – 1000 B.C.)
- Woodland (1000 B.C. – A.D. 900)
- Mississippian (A.D. 900 – 1540)

The historic period includes the Contact/Protohistoric period (A.D. 1540 – 1672) and coincides with the early exploration of the Southeast by the Spanish and French.

Records on file at the Tennessee Division of Archaeology (TDOA) in Nashville and Tennessee Historical Commission (THC) Geographic Information System (GIS) were examined to determine if any cultural resource investigations were previously conducted within the archaeological survey area. Also, to provide a more expansive background and understanding of the cultural context of the area, records of cultural resources investigations previously conducted within the APE were also examined. Additionally, historic map research was conducted to determine the probability for historic cultural resources to be present within the archeological survey area.

#### 3.8.2.1 Archaeological Sites

According to the TDOA site file and database research, no archaeological sites or surveys have been recorded within the survey area. Archaeological survey have been conducted within 1mi of the survey area prior to this survey, as shown in Figure 3-84 and described in Table 3-38.

Review of the prehistoric and historic context of the area, previously recorded sites, and completed surveys in the vicinity of the archaeological survey area suggests a high potential for archaeological sites within the archaeological survey area.

**Table 3-38 Previously Recorded Archaeological Sites within 1 Mi of the Survey Area (CRA 2025)**

| Site | Site Type | Cultural Affiliation | NRHP Determination (Recommendation) | Source |
|---|---|---|---|---|
| 40RE134 | Precontact: Open Habitation | Woodland | Unassessed (Not Eligible) | Fielder 1974b |
| 40RE195 | Historic: Grist Mill | 1866–Present | Unassessed | DuVall 1992a, 1992b |
| 40RE196 | Historic: Rural Domestic Farmstead | 1901–Present | Unassessed | DuVall 1992a, 1992c |
| 40RE197 | Historic: Rural Domestic Farmstead | 1820–Present | Unassessed | DuVall 1992a, 1992d |
| 40RE200 | Historic: Grist Mill | 1820–1900 | Unassessed | DuVall 1992a, 1992e |
| 40RE224 | Historic: Town, Rural Domestic Multiple Features (Farmsteads, Barn, Well, Cistern, Church, Commercial, Post Office), Cemetery | 1866–Present | Unassessed (Eligible) | Lipke 2022a; Overfield et al. 2023 |
| 40RE228 | Precontact: Open Habitation | Undetermined | Unassessed | Lipke 2022b; Overfield et al. 2023; Pace 1995a, 1995b |
| 40RE229 | Precontact: Open Habitation | Archaic, Late Archaic, Woodland, Early Woodland | Unassessed | Pace 1995a, 1995c |
| 40RE230 | Precontact: Open Habitation | Undetermined | Unassessed | Pace 1995a, 1995d |
| 40RE231 | Historic: Rural Domestic House | 1933–Present | Unassessed | Pace 1995a, 1995e |
| 40RE567 | Historic: Rural Domestic House | 1901–Present | Unassessed | DuVall and Spice 2004; Spice 2004 |
| 40RE568 | Historic: Rural Domestic Farmstead | 1901–Present | Unassessed | Spice 2005a; DuVall and Spice 2005 |
| 40RE569 | Historic: Rural Domestic Farmstead | 1866–Present | Unassessed | Spice 2005b; DuVall and Spice 2005 |
| 40RE570 | Historic: Rural Domestic Farmstead | 1866–Present | Unassessed | Spice 2005c; DuVall and Spice 2005 |
| 40RE637 | Historic: Rural Domestic House | 1901–1950 | Unassessed (Not Eligible) | Raymond 2022a; Raymond et al. 2022 |
| 40RE638 | Historic: Rural Domestic House | 1933–1950 | Unassessed (Not Eligible) | Raymond 2022b; Raymond et al. 2022 |
| 40RE639 | Historic: Rural Domestic House | 1866–1950 | Unassessed (Potentially Eligible) | Raymond 2022c; Raymond et al. 2022 |
| 40RE640 | Historic: Rural Domestic House, Cellar | 1866–1950 | Unassessed (Potentially Eligible) | Raymond 2022d; Raymond et al. 2022 |
| 40RE641 | Historic: Rural Domestic House, Precontact: Open Habitation | 1901–1950, Undetermined | Unassessed (Not Eligible) | Raymond 2022e; Raymond et al. 2022 |
| 40RE647 | Precontact: Open Habitation | Undetermined | Unassessed (Not Eligible) | Lipke 2022c; Overfield et al. 2023 |

**Figure 3-84 SENSITIVE INFORMATION - Federal, State, Foreign Government, International Agency Controlled**

**SEE ENCLOSURE 1**

**Figure 3-84**

### 3.8.3 SURVEY METHODS

Cultural Resource Analysts, Inc. (CRA), a company specializing in archaeological site surveys, performed a phase I cultural resources survey on the Site from May 27th to June 30th of 2025 (CRA 2025). The survey consisted of 3 segments covering a total of 643.7 ac. shown in Figure 3-85. The White Wing Scrapyard and two creeks running south from it, the Smith-Gallaher and Hembree cemeteries, and the existing TVA transmission line right-of-way were excluded from the survey. The current TVA transmission easement would have been investigated when the initial easement was installed and thus not included in our survey. The remainder of the site to include the location where the TVA transmission line will be moved to was included. The archaeological survey consisted of pedestrian survey and screened shovel testing, supplemented by metal detecting. Areas of 15 percent or greater slope were examined only through pedestrian survey. Areas of greater than 50 percent slope were not surveyed due to safety concerns.

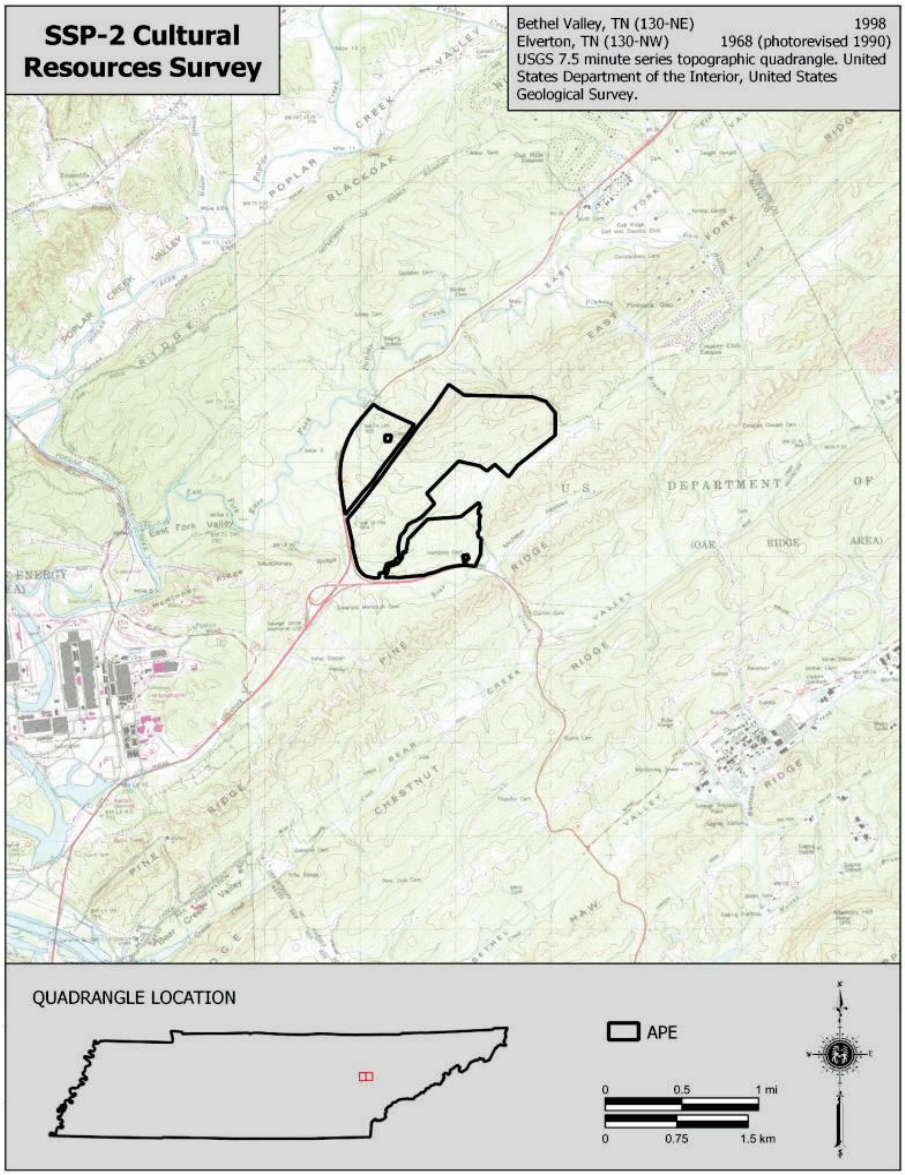



**Figure 3-85*:* Survey Area on the Site**

### 3.8.4 SURVEY FINDINGS

No archaeological sites were previously recorded within the survey area on the Site. As a result of the survey, seven new archaeological sites and one isolated find were recorded within the project area. The seven sites corresponded to historic rural domestic homesites occupied at the time of government acquisition in the 1940s. Additional historic structures were recorded within other parts of the Site during the 1940s, but no archaeological evidence for these structures or their use was encountered during the present survey. These results are displayed in Figure 3-86.

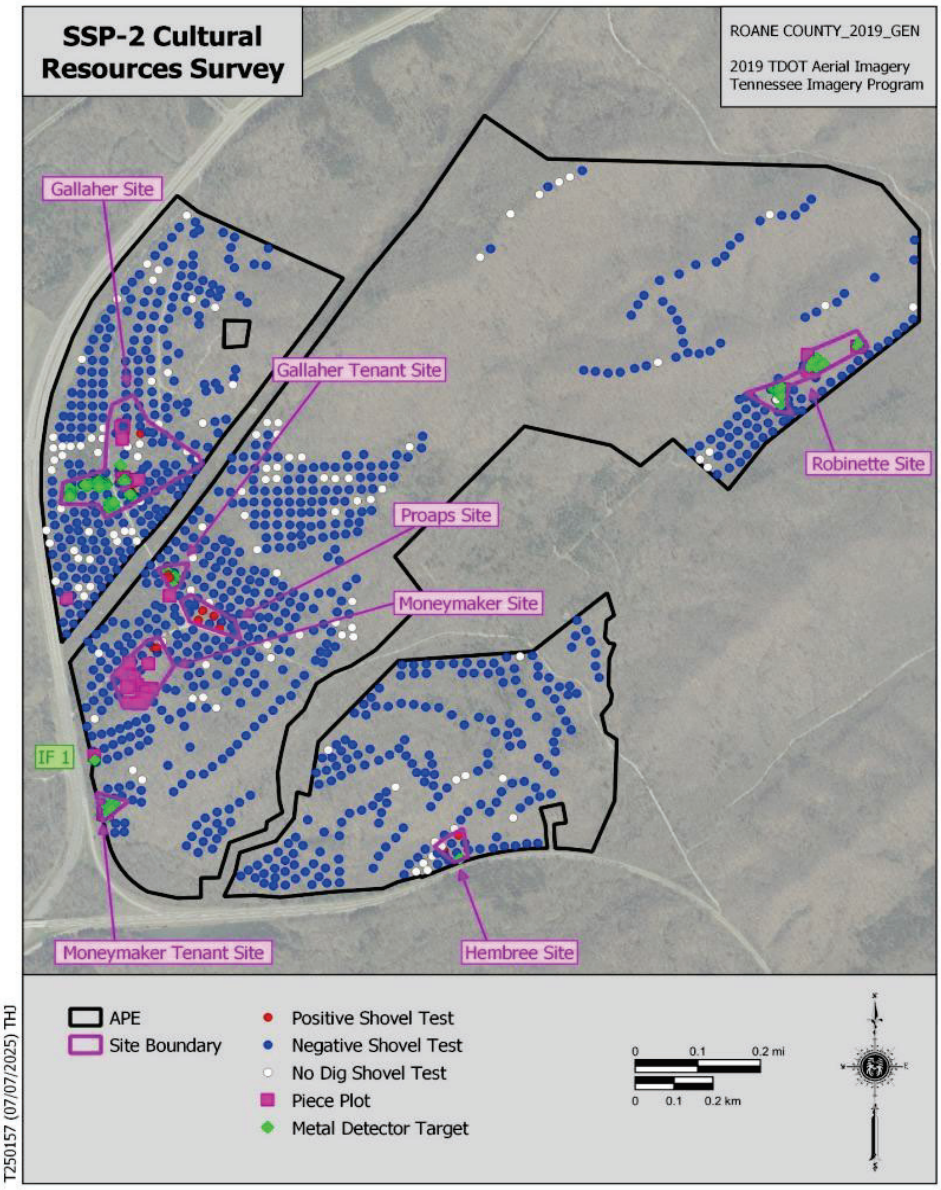



**Figure 3-86*:* Results from the Cultural Survey on the Site**

Archaeological investigations of rural domestic sites within the ORR dating from the nineteenth century through the early to mid-twentieth century may yield important information pertaining to this history. Sites with the greatest research potential are those with well-preserved complexes of several structures and activity areas, high density and diversity of artifacts, and evidence for

undisturbed subsurface features and other archaeological deposits. Evidence of stratigraphic integrity includes the presence of extant architectural remains and landscape features such as depressions. Based on these criteria, CRA recommended that the Gallaher, Gallaher Tenant, and Moneymaker Sites are potentially eligible for inclusion in the NRHP. At the Gallaher and Gallaher Tenant Sites, the areas of chief research potential are the domestic core areas of these sites, encompassing the dwellings and their surroundings. At the Gallaher Site, the locations of the tenant dwelling and a barn also have potential research interest. Other areas of these sites are unlikely to contribute to the sites' NRHP eligibility. These sites can be found in Figure 3-87.

Further archaeological investigation through a Phase II study will be conducted to determine the NRHP eligibility of these sites.

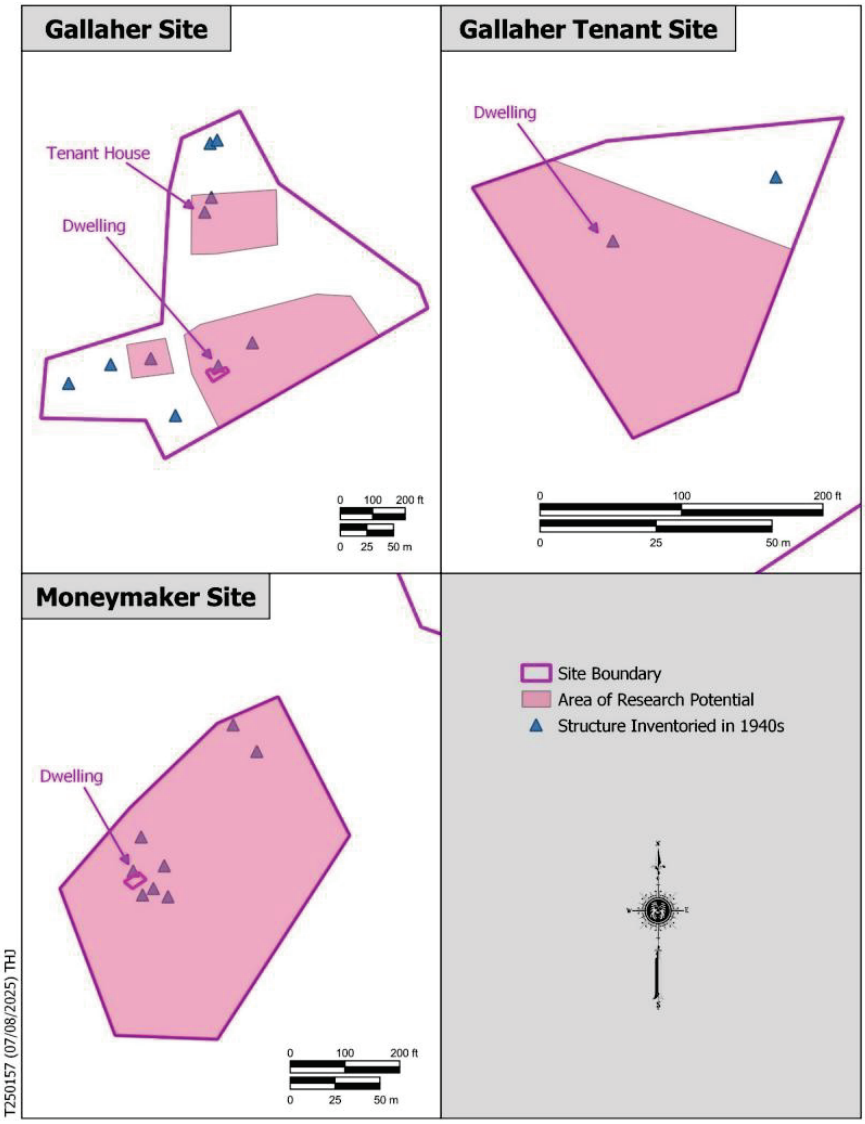



**Figure 3-87: Details of the Site Findings on the Site**

### 3.8.5 REGULATORY COORDINATION

Formal coordination with the TN SHPO will be conducted and included in the submittal of results of the cultural resource survey (see Chapter 1, Appendix 1A, Regulatory Correspondence). This coordination initiates regulatory review pursuant to Section 106 of the National Historic Preservation Act. However, the full Section 106 consultation process will be conducted by the U.S. Nuclear Regulatory Commission (NRC) through direct coordination with the TN SHPO.

## 3.9 VISUAL AND SCENIC RESOURCES

### 3.9.1 VIEWSHED BOUNDARIES

The OE Facility is located on a non-developed site that is approximately 600 acres known as the Site. The Site is adjacent to the Oak Ridge Turnpike/State Route 95 (SR-95). The site is primarily forested and was acquired from the DOE through the Oak Ridge Industrial Development Board and is located on the ORR.

The term “viewshed” refers to the landscape that is visible from a given vantage point. Viewshed boundaries for the Facility are defined as the area within 3 miles from the site’s center point, depicted in Figure 3-88. The viewshed from most of the site vicinity is limited by topography and areas of dense vegetation. However, the site vicinity, shown in Figure 3-88, represents an estimate of the foreground-middle ground distance zone, defined as the areas seen from viewing locations which are less than 3 to 5 mi. away, in accordance with the U.S. Department of the Interior (DOI) Bureau of Land Management (BLM) scenic quality rating assessment described in Section 3.9.10. Due to the relatively small scale of the Facility, the viewshed is limited to distances under 3 mi.

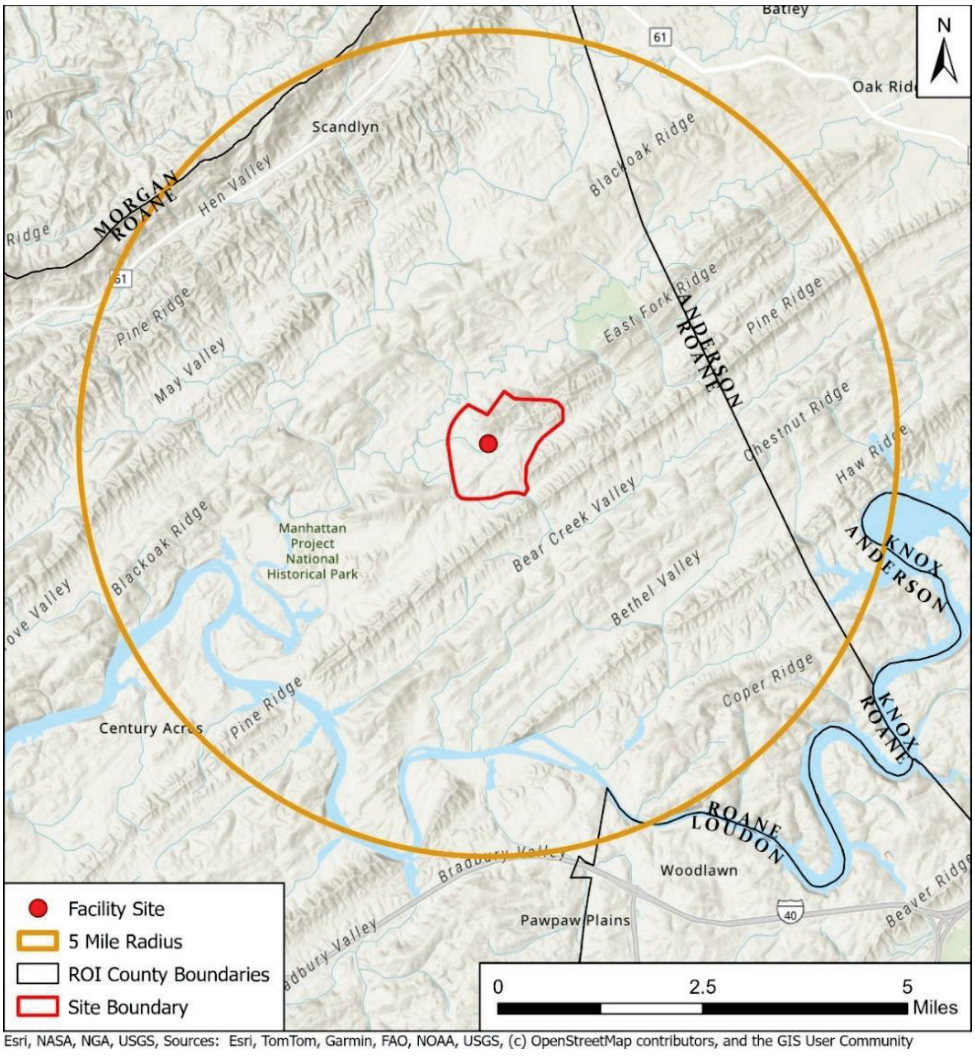



**Figure 3-88: Facility Site Vicinity Map**

### 3.9.2 LANDSCAPE CHARACTERISTICS

The Facility is located in northern Roane County in the Valley and Ridge physiographic province. The regional topography near the site is typical of the Valley and Ridge province which is characterized by northeast–southwest trending ridges and intervening valleys (NPS 2025). The Facility and other developed areas along SR-95 to the northeast and southwest are located on relatively flat or slightly undulating terrain associated with the East Fork Valley, while just northwest of the site, there is a steep incline to the top of Black Oak Ridge (see Figure 3-88).

The ecological environment of the Facility and its immediate surroundings is characterized by herbaceous cover as well as forest habitat, consisting of communities of evergreen, deciduous, and mixed forests. Section 3.5 provides detailed descriptions of the specific ecological features (flora, fauna, and ecosystems) present at the site. In addition, descriptions of the site's soil types are presented in Section 3.3 while surface water features are described in detail in Section 3.4.2.

Landscape features in the vicinity of the Facility, including the presence of open spaces and uncultivated land, are detailed in Section 3.1. There are no parks or wilderness areas, or other

recreational areas located within or immediately adjacent to the Facility that offer architectural or aesthetic features that would attract tourists to the area.

### 3.9.3 LOCATION OF CONSTRUCTED FEATURES

Apart from vegetation clearing, that has occurred on parts of the Site, the majority of the land is wooded vegetation. There are no buildings constructed on the site. There is an above ground TVA transmission line running through the property along East Fork Ridge; however, it will be moved to allow for construction on the site.

Constructed buildings within the vicinity include Philotechnics, ORNL Carbon Fiber Technology Facility, and an NNSA facility across SR-95 from the Facility. TRISO-X is currently constructing its fuel fabrication facility in the Horizon Center. North of the Facility is ORETTC.

### 3.9.4 SITE PHOTOGRAPHS

The Facility site is primarily wooded vegetation. Figure 3-89 provides an aerial view of the Facility and indicates various locations from which site photographs were taken. Site photographs are provided in Figure 3-90.

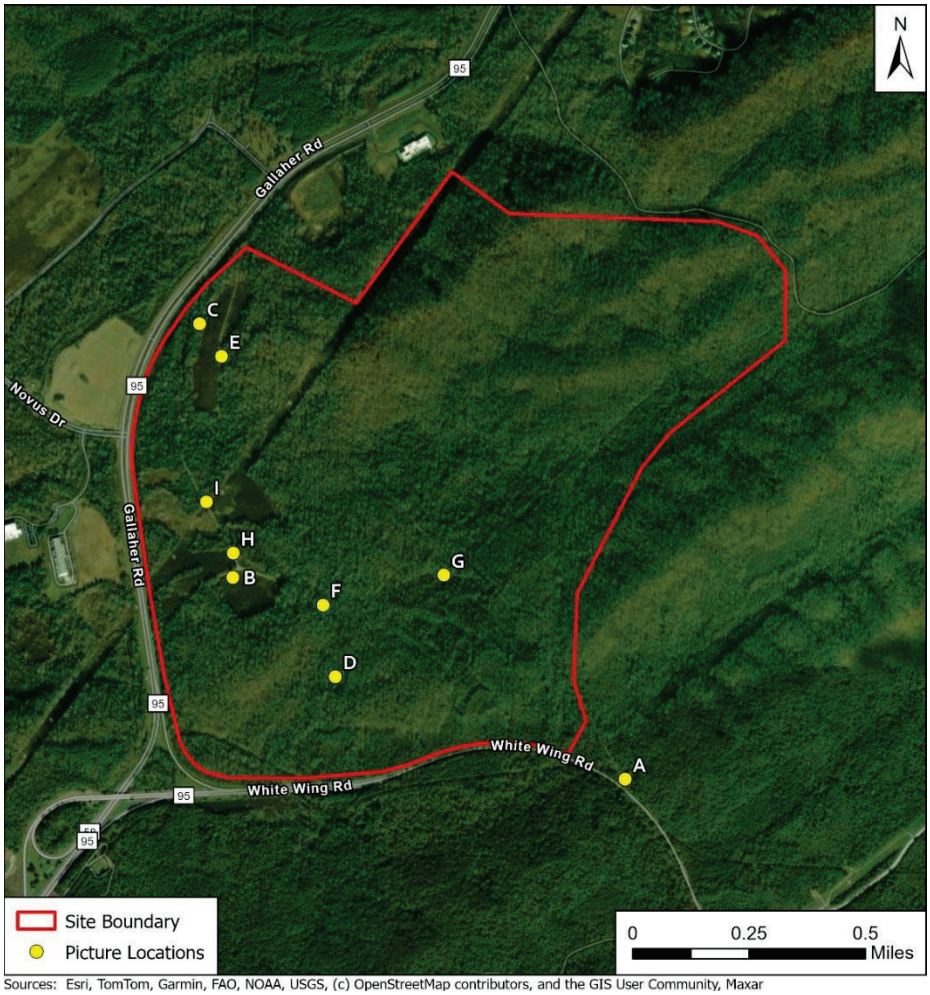



**Figure 3-89: Aerial View of SSP-2 with Image Locations**

**Figure 3-90: Images A-I of the Site and SSP-2**



**Image A: South Entrance to SSP-2 via Old County Road**



**Image B: View of Western Portion of the Site**



**Image C: Western Boundary of the Site with the Oak Ridge Turnpike on the Right**



**Image D: Southwestern Portion of the Site Looking North**



**Image E: View of the Ridge in the Central Portion of the Site from Watson Road**



**Image F: View of Southern Portion of the Site, Looking Southwest from Old County Road**



**Image G: Southwestern Portion of the Site, Looking Southwest from Old County Road**



**Image H: Southwestern Portion of the Site, Looking Northwest on Old County Road**



**Image I: View of Power Line Transect in Southwestern Portion of the Site, Looking Northeast**

### 3.9.5 RESIDENTS AND VISITORS POTENTIALLY AFFECTED BY VISUAL IMPACTS

#### 3.9.5.1 Residents

The closest residents to the Facility are located in a forested residential development off Forst Creek Parkway, approximately 1.25 mi north of the Facility. These residents would have minimal to no view of potential development at the Facility due to distance, intervening topography, and forested buffers.

#### 3.9.5.2 Area Visitation

The City of Oak Ridge is home to a number of museums, parks, and attractions that serve as popular visitor destinations (Explore Oak Ridge 2025). While the majority of these sites are concentrated near the city center in Anderson County, outside the project vicinity, there are some tourist attractions such as the K-25 History Center, the K-25 Overlook and Visitor Center, the Wheat Community Burial Ground, and the Black Oak Ridge Conservation Easement, that are located in and around the Heritage Center Industrial Park, between 1 and 3 mi. southwest of the Facility. However, due to factors related to distance, intervening topography and forested areas, views of the Facility are minimal or absent from all of these visitor destinations. The Facility at it tallest point will be 60 feet and, due to topography of the site with remaining vegetation and elevation from the road, will not be able to be scene while driving by except potentially at the newly created entrance. The site to the south has Bear Creek as a boundary that will remain with the DOE. This portion of land and its included trees will create a visual buffer for travelers headed north along SR-95. Travelers headed south will have their direct view of the facility blocked by ORTTEC and NNSA buildings along with a ridge and forest that will not be impacted. There will be a viewing window for north and south travelers as they pass by at the entrance to the site that will be adjacent to the Horizon Center, an industrial park itself. Landscaping will be installed to help minimize any visual impact and to help the entrance to blend in the with surrounding environment. With the relocation of the TVA transmission lines near SR-95, it will eliminate the straight pass-through view that travelers have and instead add 2-4 towers along the roadway as can be seen at other areas along SR-95.

### 3.9.6 VISIBILITY FROM ACCESS ROADS

The access point to the Facility will be located at the intersection of SR-95 and Novus Drive on the west side of the site. Due to the topography and forested areas, there will be minimal views of the Facility from SR-95 and other local roadways in the vicinity.

### 3.9.7 HIGH-QUALITY VIEW AREAS

Based on site visits and a review of available local information, there are no scenic features or vistas on the site of the Facility that are considered to be regionally or locally important or of high scenic quality. Both the vegetation and topography of the Facility are typical of other land parcels in Oak Ridge and northeastern Roane County.

### 3.9.8 APPLICABLE REGULATORY INFORMATION

Based on the current zoning map for the City of Oak Ridge, the Facility is zoned FIR (Federal Industry and Research). The zoning map can be found in Figure 3-8 (City of Oak Ridge 2025c). FIR land consists of DOE land as part of the ORR.

Development within the City of Oak Ridge is subject to certain design standards and requirements, as specified in the City's Zoning Ordinance (City of Oak Ridge 2025b). A number of these requirements regulate aspects of property's visual attributes, including:

- **Off Street Parking and Loading Requirements (Article XI)**: prescribes minimum number of parking spaces and loading/unloading areas, lot dimensions and layout, and lighting requirements.
- **Performance Standards (Article XII)**: sets controls for the emission of smoke, dust, and light/glare from industrial or other business activities.
- **Landscaping and Design Standards (Article XIII)**: details landscaping and streetscape requirements, architectural compatibility, screening and buffer transitions between zoning districts, and outdoor lighting requirements.
- **Sign Regulations (Article XIV)**: regulates size, location, design, and illumination of signs.

The BLM Visual Resource Management (VRM) policy inventory component was used to evaluate the aesthetic and scenic quality of the Site, as discussed in Section 3.9.10.

### 3.9.9 COORDINATION WITH LOCAL PLANNERS

Local zoning designations and the current zoning ordinance were obtained from the City of Oak Ridge Planning Division. In addition, OE representatives have been in coordination with local officials, including the City of Oak Ridge Community Development Department, the City of Oak Ridge Industrial Development Board, the Oak Ridge Electric Department, the Oak Ridge City Manager, and the Mayor of Oak Ridge, regarding the proposed development. No unusual planning, zoning, or building code issues were identified in association with the Facility. Additional coordination and plan review are anticipated to occur as appropriate during the project planning process.

### 3.9.10 AESTHETIC AND SCENIC QUALITY RATING

The BLM has developed and implemented its VRM policy to evaluate the aesthetic and scenic quality of public lands in the United States and to manage these public lands in a manner which protects the quality of the scenic values (BLM 2025). This VRM approach has two primary components: inventory and analysis. The inventory component involves assigning the visual resources of an area to an inventory class based on its visual appeal, public concern, and visibility from travel routes and key observation points. The analysis component of the BLM methodology focuses on manipulating the design characteristics of planned buildings and supporting infrastructure (e.g., utility lines, roads) to minimize the contrast between natural and disturbed areas of the landscape. For the purposes of this evaluation, the aesthetic and scenic quality of the Facility site were rated using only the inventory component of the VRM methodology.

### 3.9.10.1 Scenic Quality

Scenic quality is a measure of the visual appeal of a tract of land. In the BLM's visual resource inventory process, lands are given an A, B, or C rating based on the apparent scenic quality which is determined using seven key factors: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. For a given tract of land, a score is assigned for each of the seven key factors using the BLM's scoring criteria presented in Table 3-39. The total score, obtained by summing the individual scores for the seven key factors, is then used to apply a scenic quality rating for the site using the following BLM rating designations: A = total score of 19 or more; B = total score of 12 to 18; and C = total score of 11 or less (BLM 1986).

Due to the homogeneity of the landscape features across the Facility Site (i.e., similar physiographic characteristics, visual patterns, colors, and impacts from man-made modifications such as vegetation clearing) it was not necessary to subdivide the site into multiple scenic quality rating units. Thus, for the purposes of the scenic quality evaluation, the Facility was rated as a single unit. The results of the scenic quality evaluation are presented in Table 3-39. The Facility was assigned a total scenic quality score of 10 which places it within the lowest BLM scenic quality rating of C.

### 3.9.10.2 Sensitivity Level

The sensitivity level analysis portion of the BLM methodology considers the measure of public concern for scenic quality. Lands are assigned high, medium, or low sensitivity levels by analyzing various indicators of public concern including the type of users, amount of use, public interest, adjacent land uses, and special areas.

Typical users of the land of the Facility site would be on-site employees and contractors. Employees who work at the site or in the surrounding industrial park are expected to be less sensitive to changes in visual quality than the general public. The Facility would, however, be visible to members of the public from the North Boundary Greenway hiking and biking trail which borders the HCS to the west. Thus, the public would have interest in the value of the lands adjacent to the trail as a visual resource. However, the development of the site is consistent with the planned use of the ORR and compatible with current zoning designations. Additionally, the topography and surrounding areas of dense forest would obstruct views of the Facility from the remainder of the trail not directly adjacent to the site. Based on these considerations, the Facility is assigned a medium sensitivity rating overall.

### 3.9.10.3 Distance Zones

The BLM methodology also subdivides landscapes into three distance zones based on relative visibility of the area from travel routes and key observation points. The three distance zones are the foreground-middle ground, the background, and seldom seen. The foreground-middle ground zone typically includes areas visible from highways, rivers, or other viewing locations which are less than 3 to 5 mi. away; the background zone includes areas visible from 6 to 15 mi. away; and the seldom-seen zone includes areas not visible from travel routes or other frequently occupied places such residences and public areas.

Figure 3-88 provides an approximation of the foreground-middle ground distance zone, though as previously discussed, visibility from many of these areas is limited by topography and

intervening vegetation. Additionally, the majority of undeveloped areas within the site vicinity are rarely occupied and thus the viewshed from these areas would fall under the seldom-seen zone.

Due to the scale of the Facility and the regional topography, the site would not be readily distinguishable from the surrounding landscape at background distances.

#### 3.9.10.4 Determination of Visual Resources Inventory Class

The BLM provides a framework for integrating the results of scenic quality evaluation, sensitivity level analysis, and distance zone delineation. The scenic quality rating of C and the medium sensitivity rating place the Facility within Visual Resource Inventory Class IV for all three distance zones. Of the four visual resource inventory classes, Class IV allows for the greatest degree of landscape modification and is considered the least visual and scenic value. The BLM management objectives for Class IV areas allow for high levels of change, with the understanding that an attempt will be made to minimize the effects of the planned disturbance.

| Table 3-39 – Scenic Quality Inventory Evaluation and Scoring for the Facility Site | | | | |
|---|---|---|---|---|
| **Key Factor** | **BLM Scenic Quality Evaluation Scoring Criteria** | | | **Evaluation and Assigned Score for the Facility Site** |
| Landform | High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations, including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing, such as glaciers.<br>Score 5 | Steep canyons, mesas, buttes, cinder cones, and drumlins; interesting erosional patterns or variety in size and shape of landforms; detail features that are interesting, though not dominant or exceptional.<br>Score 3 | Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features.<br>Score 1 | • East Popular Ridge and Pine Ridge are present on the Facility site.<br>• Site mostly characterized by gently to moderately rolling foothills.<br>**Landform Score: 1** |
| Vegetation | A variety of vegetative types as expressed in interesting forms, textures, and patterns.<br>Score 5 | Some variety of vegetation, but only one or two major types.<br>Score 3 | Little or no variety or contrast in vegetation.<br>Score 1 | • The Facility site consists primarily of mature trees and scrub-shrub vegetation.<br>• There is little-to-no vegetation variety on the site.<br>**Vegetation Score: 1** |
| Water | Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape.<br>Score 5 | Either flowing, or still, but not dominant in the landscape.<br>Score 3 | Either absent, or present, but not noticeable.<br>Score 0 | • Small water streams are present on the site but not dominant in the landscape.<br>**Water Score: 3** |
| Color | Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water or snow fields.<br>Score 5 | Some intensity or variety in colors and contrast of the soil, rock, and vegetation, but not a dominant scenic element.<br>Score 3 | Subtle color variations, contrast, or interest; generally mute tones.<br>Score 1 | • Relatively uniform herbaceous cover and limited areas of woody vegetation provide little color variation or contrast.<br>**Color Score: 1** |
| Adjacent Scenery | Adjacent scenery greatly enhances visual quality.<br>Score 5 | Adjacent scenery moderately enhances overall visual quality.<br>Score 3 | Adjacent scenery has little or no influence on overall visual quality.<br>Score 0 | • Areas west of the site is being developed with similar facilities.<br>• Areas south and east of the site remains natural.<br>**Adjacent Scenery Score: 3** |

| Table 3-39 – Scenic Quality Inventory Evaluation and Scoring for the Facility Site | | | | |
|---|---|---|---|---|
| **Key Factor** | **BLM Scenic Quality Evaluation Scoring Criteria** | | | **Evaluation and Assigned Score for the Facility Site** |
| Scarcity | One of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing.<br>Score 5 | Distinctive, though somewhat similar to others within the region.<br>Score 3 | Interesting within its setting, but fairly common within the region.<br>Score 1 | • Vegetation and scenery within the HCS are common throughout the region and contain non-native species and successional communities typical of areas with significant past disturbance.<br>**Scarcity Score: 1** |
| Cultural Modifications | Modifications add favorably to visual variety while promoting visual harmony.<br>Score 2 | Modifications add little or no visual variety to the area and introduce no discordant elements.<br>Score 0 | Modifications add variety but are very discordant and promote strong disharmony.<br>Score -4 | • Human modifications to the site include a TVA right of way and small gravel roads. These modifications add little-to-no variety to the area and introduce no discordant elements.<br>**Cultural Modifications Score: 0** |
| | | | | **Total Key Factor Score: 10** |

Reference: **(BLM 1986)**

## 3.10 SOCIOECONOMIC ENVIRONMENT

This section describes the social and economic characteristics of the five-county area around the site of the OE Facility. These five counties are most likely to be affected by the Proposed Action through changes to labor force, infrastructure, and economics and thus referred to as the Region of Influence (ROI). The ROI consists of Roane, Morgan, Anderson, Knox, and Loudon counties. The Site is located in the City of Oak Ridge in Roane County, Tennessee. Other population centers, as shown in Figure 3-91 are located approximately the following driving distance from the site:

- Lenoir City, Loudon County: 8.3 miles south
- Kingston, Roane County: 12.2 miles southwest
- Harriman, Roane County: 17.5 miles west
- Farragut, Knox County: 18.9 miles southeast
- Knoxville, Knox County: 32.8 miles east

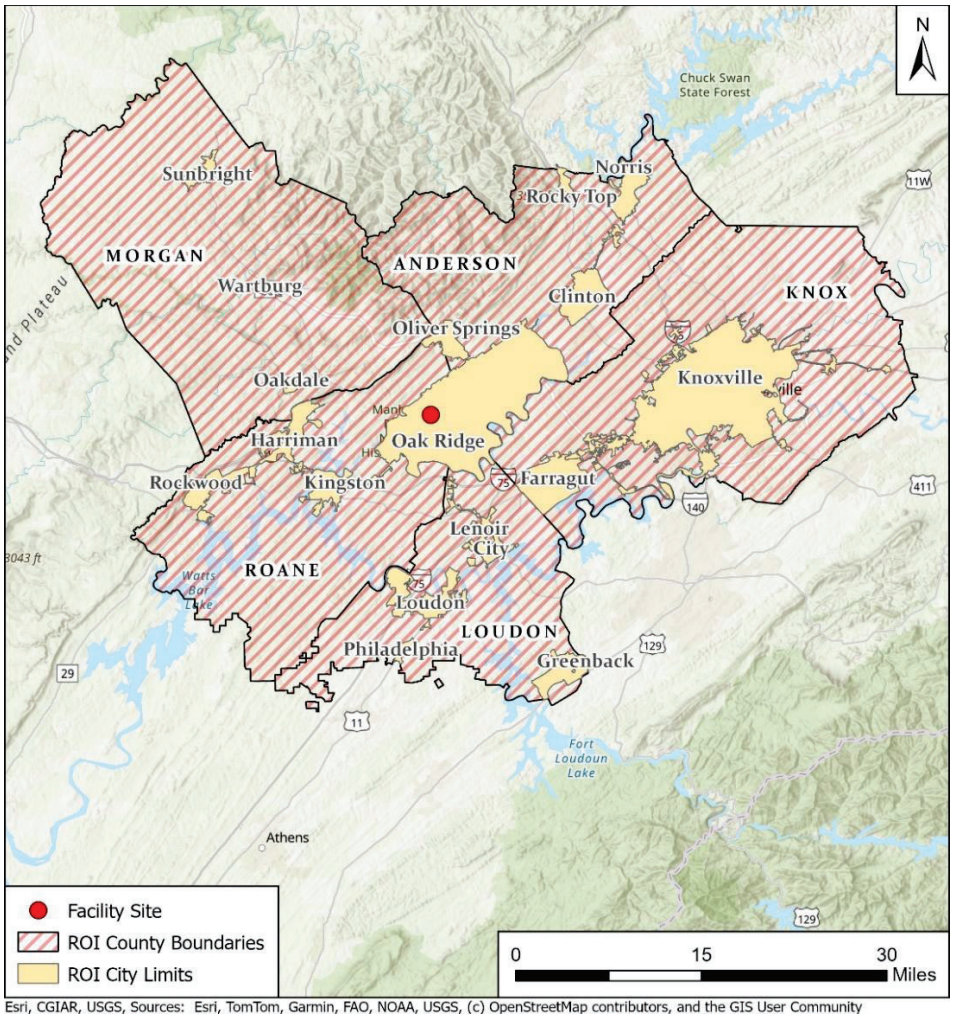



**Figure 3-91 – Population Centers within the Region of Influence**

### 3.10.1 POPULATION CHARACTERISTICS

#### 3.10.1.1 Population and Projected Growth

The Facility is located within the City of Oak Ridge in Roane County, Tennessee. According to the 2020 Census the population of Oak Ridge was 31,402 and the population of Roane County was 53,404. The populations for the surrounding counties within the ROI are as follows: Knox County 478,971; Anderson County 77,123; Loudon County 54,886; and Morgan County 21,305 (Table 3-40) (USCB 2020a). The cumulative population for the five counties within the ROI is 685,689, which accounts for 9.92% of the population of Tennessee.

The population within the ROI has grown at rates coinciding with the population growth rates of the state of Tennessee. With the ROI growth rates from 2000 to 2010 and 2010 to 2020 being 12.0% and 8.4% respectively while the growth rates for the State have been 11.5% and 8.9% for the same time frames (Table 3-40). Only two counties experienced declines in population during this investigation period with both Morgan County and Roane County seeing dips of 1.4% and 4.3% respectively both from 2010 to 2020. Anderson County has grown slightly with rates of 5.3% and 2.7%. Knox County and Loudon County both grew above the state rates for both the 2000 to 2010 window and the 2010 to 2020 window with Knox County seeing rates of 13.1% and 10.8% respectively and Loudon County growing at 24.2% and 13.0% respectively (USCB 2000) (USCB 2010a).

**Table 3-40: Population in the Region of Influence (2000-2020)**

| Jurisdiction | 2000 | 2010 | 2020 | Percent Change from 2000-2010 | Percent Change from 2010-2020 | Percent Change from 2000-2020 |
|---|---|---|---|---|---|---|
| Roane County | 51,910 | 54,181 | 53,404 | 4.4% | -1.4% | 2.9% |
| Knox County | 382,032 | 432,226 | 478,971 | 13.1% | 10.8% | 25.4% |
| Anderson County | 71,330 | 75,129 | 77,123 | 5.3% | 2.7% | 8.1% |
| Loudon County | 39,086 | 48,556 | 54,886 | 24.2% | 13.0% | 40.4% |
| Morgan County | 19,757 | 21,987 | 21,035 | 11.3% | -4.3% | 6.5% |
| ROI Total | 564,115 | 632,079 | 685,419 | 12.0% | 8.4% | 21.5% |
| Tennessee | 5,689,283 | 6,346,105 | 6,910,840 | 11.5% | 8.9% | 21.5% |

References: (USCB 2000); (USCB 2010a); (USCB 2020a)

The Boyd Center for Business and Economic Research at the University of Tennessee publishes a biennial report detailing population projections for the State of Tennessee and its 95 counties. The 2024 release uses 2022 as the base year and projects to 2070. The projections incorporate the 2020 Census; population changes from the recording of the 2020 Census and July 1, 2022; and changes to underlying rates of birth, death, and migration. The growth rate numbers

presented below use the 2020 Census data as the base year and the Boyd Center's projections for years past 2020.

Based on these projections, the population within the ROI can be expected to grow at a rate slightly above the growth rate for the State of Tennessee with rates of 35.3% and 33.9% respectively during the projection window of 2020 to 2070. Roane County, where the Facility will be located, is expected to shrink from 53,404 to 50,566 in these 50 years for a growth rate of -5.3%. Loudon County has the highest projected growth rate with 44.2%, or an increase of 24,240. Knox County is expected to see the most growth by population increase with an increase of 207,601 people and second in growth rate with a rate of 43.3%. Morgan County is expected to see the worst growth rate as the Boyd Center projects that it will lose 21.4% of its population from 2020 to 2070, or a loss of 4,499. Anderson County sits in the middle of these five counties as they are projected to increase by 22.9% from 77,123 to 94,759 by 2070 (Table 3-41) (UT 2024).

**Table 3-41: Population Projection for the Region of Influence Through 2070**

| Jurisdiction | 2020 | 2030 | 2050 | 2070 | Percent Change from 2020-2030 | Percent Change from 2030-2050 | Percent Change from 2050-2070 | Percent Change from 2020-2070 |
|---|---|---|---|---|---|---|---|---|
| Roane County | 53,404 | 55,734 | 52,731 | 50,566 | 4.4% | -5.4% | -4.1% | -5.3% |
| Knox County | 478,971 | 530,212 | 608,763 | 686,572 | 10.7% | 14.8% | 12.8% | 43.3% |
| Anderson County | 77,123 | 82,687 | 87,881 | 94,759 | 7.2% | 6.3% | 7.8% | 22.9% |
| Loudon County | 54,886 | 65,897 | 71,587 | 79,126 | 20.1% | 8.6% | 10.5% | 44.2% |
| Morgan County | 21,035 | 20,579 | 18,123 | 16,536 | -2.2% | -11.9% | -8.8% | -21.4% |
| ROI Total | 685,419 | 755,109 | 839,085 | 927,559 | 10.2% | 11.1% | 10.5% | 35.3% |
| Tennessee | 6,910,840 | 7,513,757 | 8,346,845 | 9,253,868 | 8.7% | 11.1% | 10.9% | 33.9% |

References: (USCB 2020a); (UT 2024)

### 3.10.1.2 Minority Populations

The term "minority population" is defined for the purposes of the United States Census Bureau (USCB) to include the five racial categories of black or African American, American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, and other races. It also includes those who declared two or more races. The minority population, therefore, was calculated to be the total population minus the white population. The results are displayed in Table 3-42. The minority population within five miles of the Facility, divided into Census block groups, is shown in Figure 3-92.

## Table 3-42: Minority Populations in the Region of Influence in 2020

| | Roane County | | Knox County | | Anderson County | | Loudon County | | Morgan County | | ROI Total | | Tennessee | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Total Population | 53,404 | 100.0% | 478,971 | 100.0% | 77,123 | 100.0% | 54,886 | 100.0% | 21,035 | 100.0% | 685,423 | 100.0% | 6,910,840 | 100.0% |
| White Alone | 48,463 | 90.7% | 379,510 | 79.2% | 66,863 | 86.7% | 47,353 | 86.3% | 19,130 | 90.9% | 561,319 | 81.9% | 4,900,246 | 70.9% |
| Combined Minority Population | 4,941 | 9.3% | 99,461 | 20.8% | 10,260 | 13.3% | 7,533 | 13.7% | 1,905 | 9.1% | 124,100 | 18.1% | 2,010,594 | 29.1% |
| Black or African American Alone | 1,303 | 2.4% | 40,360 | 8.4% | 2,888 | 3.7% | 584 | 1.1% | 971 | 4.6% | 46,106 | 6.7% | 1,083,772 | 15.7% |
| American Indian and Alaska Native Alone | 204 | 0.4% | 2,057 | 0.4% | 302 | 0.4% | 199 | 0.4% | 57 | 0.3% | 2,819 | 0.4% | 15,539 | 0.2% |
| Asian Alone | 342 | 0.6% | 11,962 | 2.5% | 981 | 1.3% | 459 | 0.8% | 46 | 0.2% | 13,790 | 2.0% | 134,302 | 1.9% |
| Native Hawaiian and Other Pacific Islander Alone | 21 | 0.0% | 319 | 0.1% | 53 | 0.1% | 11 | 0.0% | 8 | 0.0% | 412 | 0.1% | 3,594 | 0.1% |
| Some Other Race Alone | 402 | 0.8% | 13,619 | 2.8% | 1,209 | 1.6% | 2,942 | 5.4% | 164 | 0.8% | 18,336 | 2.7% | 23,977 | 0.3% |
| Population of Two or More Races | 2,669 | 5.0% | 31,144 | 6.5% | 4,827 | 6.3% | 3,338 | 6.1% | 659 | 3.1% | 42,637 | 6.2% | 270,223 | 3.9% |
| Hispanic or Latino[1] | 1,011 | 1.9% | 28,568 | 6.0% | 2,820 | 3.7% | 5,356 | 9.8% | 299 | 1.4% | 38,054 | 5.6% | 479,187 | 6.9% |

Reference: (USCB 2020b)

Note: 1) Per USCB definition, the “Hispanic or Latino” populations are not counted in the combined minority population

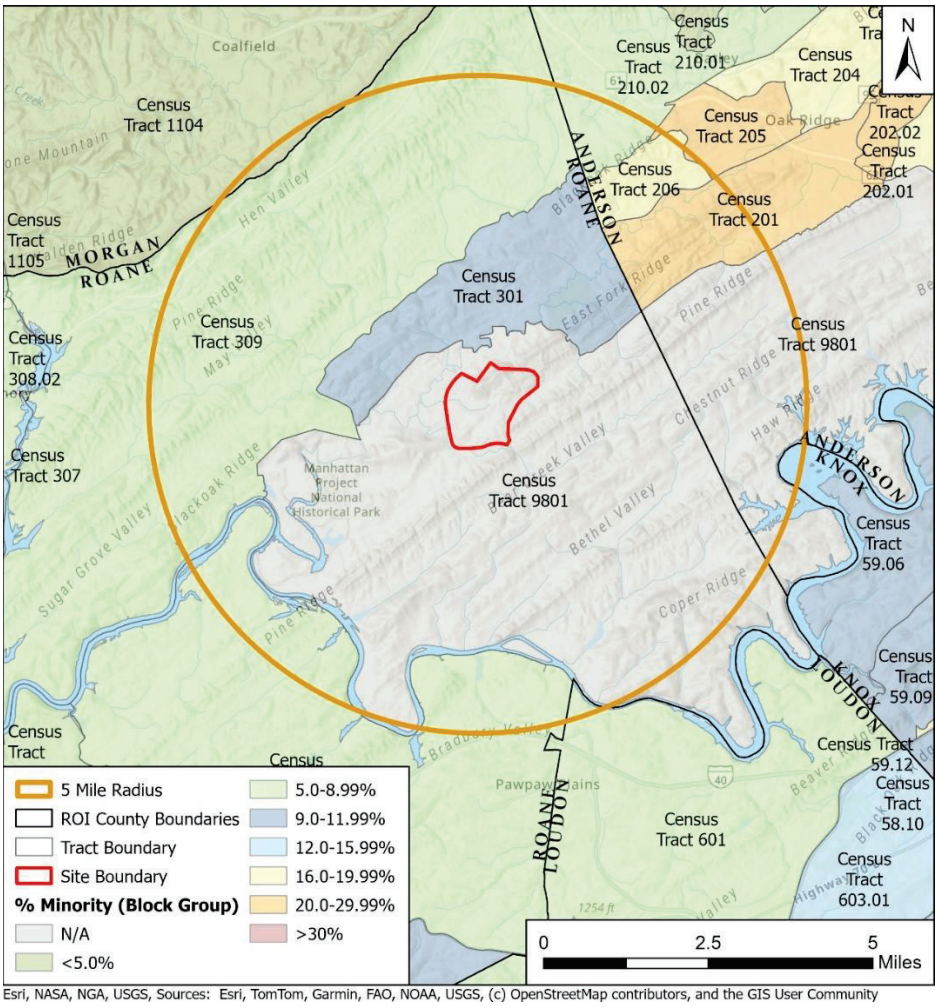



**Figure 3-92 – Minority Percentage by within 5 Miles of the Facility Site**

Based on the 2020 Census, minority populations in the ROI made up 18.1% of the total population. 6.7% reported black or African American, 2.0% reported Asian, 0.4% reported American Indian or Alaska Native, 0.1% reported Native Hawaiian or some other Pacific Islander, and 2.7% reported some other race while 6.2% reported two or more races. Hispanic or Latino is not counted in the minority population but are still listed in the table to gain insight. The Hispanic or Latino category was 5.6% of the total population in the ROI in 2020. Overall, there are a total of 162,154 people who reported belonging to the minority population.

Roane County, where the Facility is located, has the second lowest combined minority population by percentage within the ROI with just 9.3%. Population of two or more races was the leading population within the minority population at 5.0% with Black or African American being the second largest at 2.4%, all other categories were below 1.0%. Roane County's Hispanic and Latino population was the second lowest in the ROI at 1.9% (USCB 2020b).

### 3.10.1.3 Population Density

The five counties that make up the ROI hold a wide range of population densities. The largest county by square miles is also the lowest in population as Morgan County holds 21,035 people across 522.2 sq. mi. to have a population density of 40.3 people/sq. mi. Its estimated density for 2070 lowering to 31.7 people/sq. mi. Knox County has a density of 942.3 people/sq. mi. with an estimated 2070 density of 1350.7 people/sq. mi. Roane County has the second lowest population density with just 148 people/sq. mi. Anderson County and Loudon are both in the middle of the list with 228.7 people/sq. mi. and 239.4 people/sq. mi. Loudon County is expected to have a much higher density by 2070 as its projected density jumps to 345.1 people/ sq. mi. (Table 3-43). The site of the Proposed Action lies in Census Tract 9801, Census Block Group (CBG) 1 in Roane County and does not have a population as of 2020 (USCB 2020a). The population density within the ROI is displayed in Figure 3-93.

**Table 3-43: Population Density for the Region of Influence in 2020 & 2070**

| Jurisdiction | 2020 Population | Projected 2070 Population | Land Area (sq. mi.) | Population per sq. mi. (2020) | Population per sq. mi. (2070) |
|---|---|---|---|---|---|
| Roane | 53,404 | 50,566 | 360.8 | 148.0 | 140.1 |
| Knox | 478,971 | 686,572 | 508.3 | 942.3 | 1350.7 |
| Anderson | 77,123 | 94,759 | 337.2 | 228.7 | 281.0 |
| Loudon | 54,886 | 79,126 | 229.3 | 239.4 | 345.1 |
| Morgan | 21,035 | 16,536 | 522.2 | 40.3 | 31.7 |
| ROI Total | 685,419 | 927,559 | 1957.8 | 350.1 | 473.8 |

References: (USCB 2020a); (UT 2024)

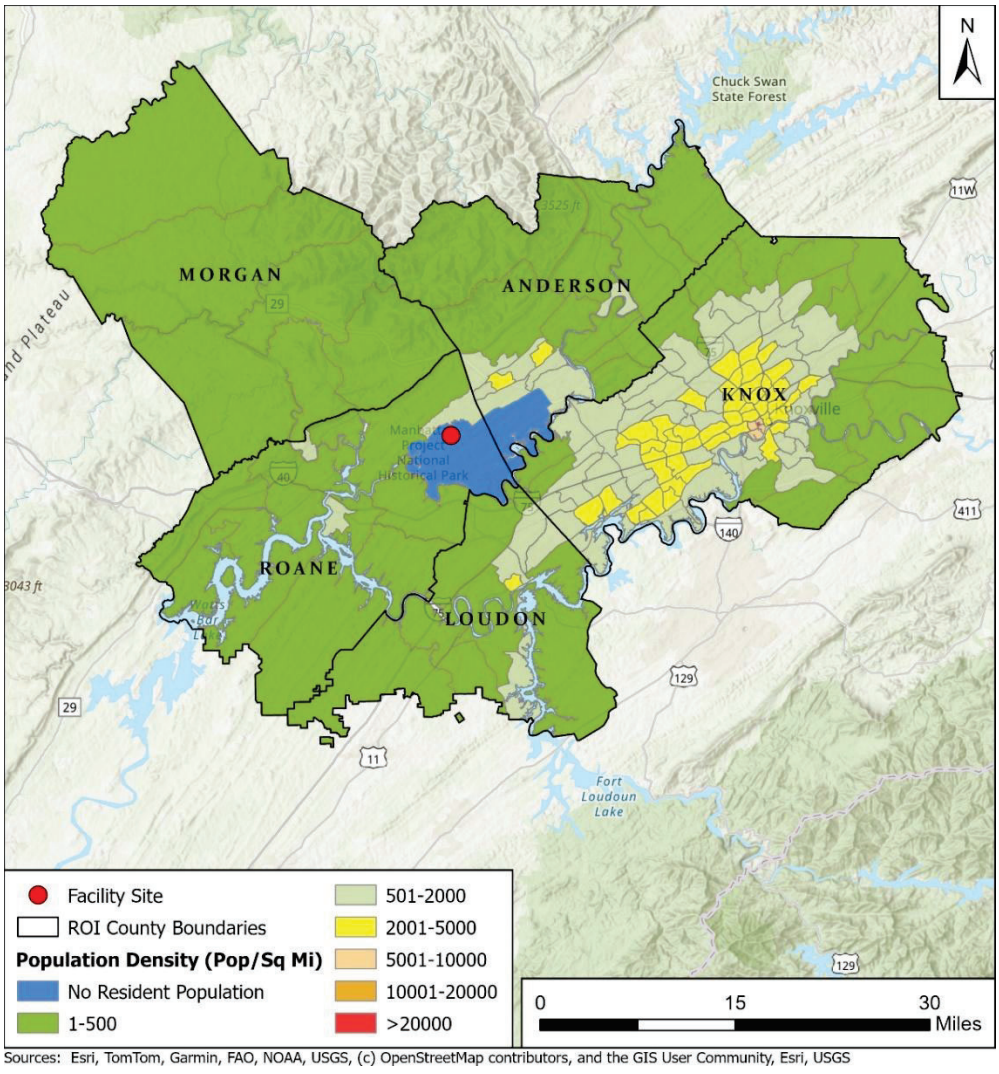



**Figure 3-93 – Population Density by CBG within the Region of Influence**

Based on the projected growth that is expected to occur within the ROI by 2070, as discussed in Section 3.10.1.1, the population density will also increase. The density for the ROI in 2070 is estimated to reach 473.8 people/sq. mi., an increase of 35.3%. Roane County's population density is expected to decrease as a result of the estimated decrease in population as it could see a decrease of just over 5% (Table 3-43).

## 3.10.2 ECONOMIC CHARACTERISTICS

### 3.10.2.1 Employment and Occupational Patterns

The labor force statistics for the ROI are displayed in Table 3-44. The data comes from the 2023 estimates by the United States Census Bureau as well as the 2010 Census. The 2023 unemployment rates within the ROI vary from 2.7% to 6.0% but the ROI checks in at 3.8% which is just under a full percent lower than the Tennessee unemployment rate of 4.7%. For the 2010 Census the ROI had a rate nearly double of 2023's rate with 6.4% of the labor force being unemployed. The state of Tennessee had an unemployment rate of 8.6% during that time. Roane

County's 2023 rate comes in at 4.8% nearly on par with the state's rate. Loudon County had the lowest rate with 2.7% and Morgan County owns a 6.0% rate (USCB 2010b) (USCB 2020a).

**Table 3-44: Labor Force and Employment Characteristics in the Region of Influence**

| | 2023 | | | | | 2010 |
|---|---|---|---|---|---|---|
| **Jurisdiction** | **Total Labor Force** | **Employed Civilian Labor Force** | **Labor Force in Armed Forces** | **Unemployed Labor Force** | **Unemployment Rate** | **Unemployment Rate** |
| Roane | 24,377 | 23,124 | 84 | 1,169 | 4.8% | 7.5% |
| Knox | 256,308 | 246,587 | 541 | 9,180 | 3.6% | 5.6% |
| Anderson | 35,960 | 34,057 | 114 | 1,789 | 5.0% | 9.2% |
| Loudon | 25,756 | 24,966 | 100 | 690 | 2.7% | 8.3% |
| Morgan | 8,238 | 7,706 | 38 | 494 | 6.0% | 8.4% |
| ROI Total | 350,639 | 336,440 | 877 | 13,322 | 3.8% | 6.4% |
| Tennessee | 3,485,218 | 3,301,152 | 19,903 | 164,163 | 4.7% | 8.6% |

References: USCB, 2023; (USCB 2010a)

The ROI as a whole sees 0.25% of the labor force serving in the armed forces which is less than half of the state average of 0.57%. Knox County has the most serving with 541 enlisted while Morgan County has the least with 38 which despite being the lowest in magnitude is the highest in rate as that is 0.46% of the labor force while Knox County is the lowest rate within the ROI with only 0.21% of the labor force enlisted.

Employment by industry is displayed in Table 3-45. The percentage of the labor force by industry aligns well with the state-wide percentages in Tennessee. There are no major outliners when considering the ROI as a whole. There are some outliners when broken down to the county level. Loudon County has a significantly higher percentage of agricultural workers with 3.1% of the working population in the industry compared to 0.6% in the ROI and 0.9% in the state. Anderson County and Morgan County both have about half that of the state average working in the information industry with 0.8% and 0.7% respectively compared to 1.7% in the state. Loudon County has a much smaller percentage of its workforce in the education industry as 16.6% of its work force belongs to the industry while the ROI and state are at 23.9% and 22.2% respectively.

The largest employers within the ROI as of 2023 belong almost exclusively to Knox County and Roane County. The data was gathered from the East Tennessee Economic Development Agency (ETEDA). The largest employers in ROI can be seen in Table 3-46. Of the 17 largest employers in the ROI, 13 are in Knox County and 4 are in Roane County. Knox County Schools are the largest employer in both the ROI and Knox County with 9,558 employees. The largest employer in Roane County is the Y-12 National Security Complex with 7,800 employees. Not listed in the table are the largest employers of the other three counties. Those are listed as follows: Anderson County Schools in Anderson County ranked 21$^{st}$ in the ROI with 1,050 employees; Loudon County Schools in Loudon County ranked 32$^{nd}$ in the ROI with 730 employees; and Morgan County does not have an employer ranked within the top 68 provided by the ETEDA (ETEDA 2023).

## Table 3-45: Employment by Industry in the Region of Influence in 2023

| | Roane County | | Knox County | | Anderson County | | Loudon County | | Morgan County | | ROI | | TN | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Industry** | **Number** | **Percent** | **Number** | **Percent** | **Number** | **Percent** | **Number** | **Percent** | **Number** | **Percent** | **Number** | **Percent** | **Number** | **Percent** |
| Agriculture, forestry, fishing and hunting, and mining | 262 | 1.1% | 900 | 0.4% | 121 | 0.4% | 754 | 3.1% | 57 | 0.8% | 2,094 | 0.6% | 31,831 | 0.9% |
| Construction | 1,469 | 6.4% | 16,626 | 7.0% | 2,731 | 8.3% | 2,046 | 8.4% | 783 | 11.0% | 23,655 | 7.3% | 239,612 | 7.0% |
| Manufacturing | 2,343 | 10.1% | 18,976 | 8.0% | 3,698 | 11.3% | 4,135 | 17.1% | 794 | 11.1% | 29,946 | 9.2% | 426,971 | 12.4% |
| Wholesale trade | 485 | 2.1% | 6,669 | 2.8% | 756 | 2.3% | 601 | 2.5% | 64 | 0.9% | 8,575 | 2.6% | 70,823 | 2.1% |
| Retail trade | 2,596 | 11.2% | 30,834 | 13.0% | 3,563 | 10.9% | 3,201 | 13.2% | 772 | 10.8% | 40,966 | 12.6% | 383,980 | 11.2% |
| Transportation and warehousing, and utilities | 1,542 | 6.7% | 11,586 | 4.9% | 2,028 | 6.2% | 1,766 | 7.3% | 510 | 7.1% | 17,432 | 5.4% | 257,519 | 7.5% |
| Information | 339 | 1.5% | 4,942 | 2.1% | 248 | 0.8% | 309 | 1.3% | 48 | 0.7% | 5,886 | 1.8% | 57,961 | 1.7% |
| Finance and insurance, and real estate | 947 | 4.1% | 16,277 | 6.8% | 1,480 | 4.5% | 1,039 | 4.3% | 197 | 2.8% | 19,940 | 6.1% | 197,819 | 5.7% |
| Professional, scientific, and management | 3,395 | 14.7% | 31,222 | 13.1% | 5,023 | 15.3% | 2,556 | 10.6% | 770 | 10.8% | 42,966 | 13.2% | 384,901 | 11.2% |
| Educational services and health care | 5,473 | 23.7% | 59,555 | 25.0% | 7,331 | 22.4% | 4,017 | 16.6% | 1,523 | 21.3% | 77,899 | 23.9% | 765,695 | 22.2% |
| Arts, entertainment, recreation | 1,625 | 7.0% | 22,827 | 9.6% | 2,793 | 8.5% | 1,821 | 7.5% | 577 | 8.1% | 29,643 | 9.1% | 307,495 | 8.9% |
| Other services, except public administration | 1,304 | 5.6% | 10,231 | 4.3% | 1,662 | 5.1% | 1,047 | 4.3% | 307 | 4.3% | 14,551 | 4.5% | 165,778 | 4.8% |
| Public administration | 1,352 | 5.8% | 7,363 | 3.1% | 1,339 | 4.1% | 932 | 3.8% | 746 | 10.4% | 11,732 | 3.6% | 152,035 | 4.4% |
| Total | 23,132 | 100% | 238,008 | 100% | 32,773 | 100% | 24,224 | 100% | 7,148 | 100% | 325,285 | 100% | 3,442,420 | 100% |

References: USCB, 2023

**Table 3-46: Largest Employers in the Region of Influence in 2023**

| Company | County | Total Employees | Description |
|---|---|---|---|
| Knox County Schools | Knox | 9,558 | Public education system |
| The University of Tennessee - Knoxville | Knox | 8,959 | State university |
| Y-12 National Security Complex | Roane | 7,800 | Refurbishing nuclear weapon components and storage and recycling of nuclear material. |
| Oak Ridge National Laboratory | Roane | 5,772 | Research and Development |
| University of Tennessee Medical Center (UHS) | Knox | 5,387 | Health care system |
| State of Tennessee - Regional Offices | Knox | 3,176 | State administrative offices |
| Knox County Government | Knox | 2,600 | County government |
| Team Health, Inc. | Knox | 2,260 | Health care providers |
| City of Knoxville | Knox | 2,136 | Municipal government |
| UCOR | Roane | 2,122 | Engineering, environmental management & clean-up |
| East Tennessee Children's Hospital | Knox | 1,838 | Area children's hospital |
| CVS Caremark Corp. | Knox | 1,477 | Drugstores and pharmaceutical distribution |
| U.S. Postal Service | Knox | 1,470 | Mail service |
| United Parcel Service (UPS) | Knox | 1,450 | Shipping and delivery operation |
| Copper Cellar Corp. | Knox | 1,402 | Full-service restaurants |
| Roane County Schools | Roane | 1,257 | Public education system |
| Tennessee Valley Authority (TVA) | Knox | 1,232 | Regional power authority & development agency |

References: (ETEDA 2023)

### 3.10.2.2 Income

The per capita income and median income for the ROI and the State of Tennessee are represented in Table 3-47 with data from surveys conducted by the United States Census Bureau in 2023. The per capita income for the State of Tennessee was $38,538. The per capita income for the ROI ranges from $30,576 in Morgan County to $43,108 in Knox County. Morgan County is the major outlier within the ROI as the per capita income is only 79.3% of that of the state. Roane County and Anderson County are quite similar with 94.3% and 95.0% respectively. Loudon County has the second highest percentage with 111.1% of the state's per capita income (USCB 2020a).

**Table 3-47: Income Data for Counties within the Region of Influence in 2023**

| | Roane County | Knox County | Anderson County | Loudon County | Morgan County | Tennessee |
|---|---|---|---|---|---|---|
| Per Capita Income | $36,357 | $43,108 | $36,600 | $42,817 | $30,576 | $38,538 |
| Percent of State Per Capita Income | 94.3% | 111.9% | 95.0% | 111.1% | 79.3% | - |
| Median Household Income | $66,218 | $70,265 | $57,625 | $80,296 | $57,408 | $67,631 |
| Percent of State Median Household Income | 97.9% | 103.9% | 85.2% | 118.7% | 84.9% | - |

Reference: (USCB 2020a)

The median household income across the State of Tennessee for 2023 was $67,631. The lowest two counties within the ROI for median household income were Morgan County with $57,408 and Anderson County with $57,625. Roane County sits closest to the state's median with a median household income within the county of $66,2185 which is 97.9% of the state's median. Knox County is the second highest median household income in the ROI despite having the largest per capita income as the median for the county comes in at $70,625. Loudon County has the largest median household income with $80,296 or 111.1% of the state's median household income. The percentage of population living below the poverty line in the region around the Proposed Action is displayed in Figure 3-94.

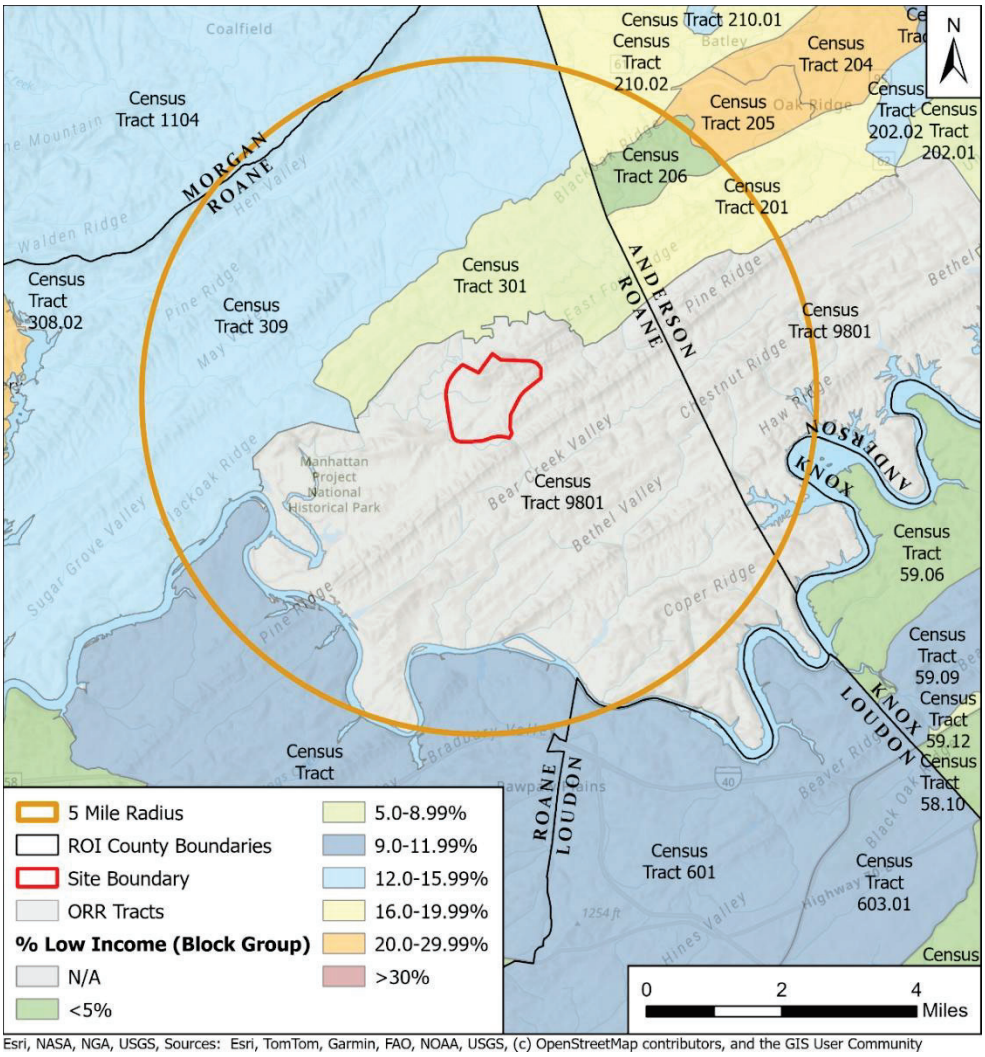



**Figure 3-94 – Percent of Low-Income Population within 5 Miles of the Facility Site**

### 3.10.2.3 Tax Structure

The State of Tennessee's primary stream of tax revenue comes from sales tax which represented 56% of incoming tax dollars for the 2023 fiscal year. Tennessee is tied for the second highest sales tax rate in the United States with three other states with rates at 7%. The second largest stream of tax revenue is franchise and excise tax which represents 18% of incoming tax dollars. The State of Tennessee has no personal income tax.

The property tax structure for the State of Tennessee is outlined in Table 3-48 (TN 2024). The property taxes for the City of Oak Ridge and Roane County, where the Facility is located, for tax years 2013 through 2023 are listed in Table 3-49. As of tax year 2023, the City of Oak Ridge has a property tax rate of 2.3136% and Roane County has a property tax rate of 2.4526% which combines for a total tax rate of 4.7662%. The property tax rate for the City of Oak Ridge in 2023 was the lowest it has been in 10 years and the highest for Roane County in the past 10 years. The combined rate is slightly higher than the 10-year average of 4.710% (City of Oak Ridge 2024a).

**Table 3-48: Property Tax Structure in Tennessee**

| Property Classifications | Assessment Percent |
|---|---|
| Residential Property | 25% |
| Farm Property | 25% |
| Commercial and Industrial Property | 40% |
| Public Utility Property | 55% |
| Business Personal Property | 30% |

Reference: (TN 2024)

**Table 3-49: Property Tax Rates (2013-2023) (in $ per $100 Assessed Value)**

| Tax Year | Fiscal Year | Oak Ridge City Tax Rate | Roane County Tax Rate | Total |
|---|---|---|---|---|
| 2013 | 2014 | 2.39 | 1.97 | 4.36 |
| 2014 | 2015 | 2.39 | 1.97 | 4.36 |
| 2015 | 2016 | 2.52 | 2.35 | 4.87 |
| 2016 | 2017 | 2.52 | 2.35 | 4.87 |
| 2017 | 2018 | 2.52 | 2.35 | 4.87 |
| 2018 | 2019 | 2.54 | 2.35 | 4.89 |
| 2019 | 2020 | 2.56 | 2.45 | 5.01 |
| 2020 | 2021 | 2.3136 | 2.26 | 4.5736 |
| 2021 | 2022 | 2.3136 | 2.28 | 4.5936 |
| 2022 | 2023 | 2.3136 | 2.34 | 4.6536 |
| 2023 | 2024 | 2.3136 | 2.4526 | 4.7662 |

Reference: (City of Oak Ridge 2024a)

The counties within the ROI also collect a county sales tax on all purchases made within the respective county. This tax ranges from 2% as the minimum to 2.75% as the maximum.

The 2023 fiscal year revenues and expenditures for Roane County included $42.27 million in revenue and $39.51 million in expenditures. The greatest revenue streams included $16.41 million in property taxes, $8.39 million in charges for services, and $4.61 million in operating grants and contributions. The greatest expenses included $10.16 million in public safety, $7.73 million in public health and welfare, and $5.74 million in general government (TN 2024).

### 3.10.3 COMMUNITY CHARACTERISTICS

#### 3.10.3.1 Housing

The housing characteristics for the ROI are listed in Table 3-50. There are 309,701 total housing units across the ROI with most units belonging to Knox County in which 214,606 units are located. Morgan County has the least amount of housing with just 8,550 units. Roane County, Anderson County, and Loudon County are all relatively similar with 25,560, 35,570, and 25,415 respectively. The occupancy rate for the ROI sits at 91.2%. Morgan County is the major outlier in occupancy rate with the lowest rate at 84.1%, the remaining four counties range from 88.2% to 92.2%. Most units in the ROI are single units with 73.3% of all housing units being single units whether attached or detached. The multi-unit rate across the ROI is 20.5% which is heavily influenced by the high rate of 24.8% in Knox County while the next highest is Anderson County with 16.3%. Morgan County has the lowest rate of multi-unit housing with just 3.7% of all housing units. The average household size for owner-occupied units in the ROI was 2.52. All five counties are reasonably within the range of this average. The average household size for renter-occupied units in the ROI was 2.19. Roane County, Knox County, and Anderson County all sit around this average with 2.22, 2.15, and 2.19 respectively. Loudon County and Morgan County have significantly higher average household sizes for renter-occupied units with 2.58 and 2.65 respectively (USCB 2023a).

The median value of owner-occupied units in the ROI varies greatly. Morgan County has the lowest median value of owner-occupied units with $144,000. Loudon County has the largest median value at $292,600, just over two times the median value in Morgan County. Roane County and Anderson County are quite similar with median values of $212,300 and $215,800 respectively. Knox County is the second largest median value at $279,700, just under that of Loudon County. There are 8,587 units valued at less than $50,000 in the ROI. Most of the homes in the ROI are in either of two categories, either $200,000 to $299,999 or $300,000 to $499,999. 49,965 units are in the lower of these two categories and 49,904 units are in the upper of these categories. There are 29,721 units valued above $500,000 in the ROI (Table 3-51) (USCB 2023a).

**Table 3-50: Housing Characteristics within the Region of Influence in 2023**

| | Roane | Knox | Anderson | Loudon | Morgan | ROI |
|---|---|---|---|---|---|---|
| Total Housing Units | 25,560 | 214,606 | 35,570 | 25,415 | 8,550 | 309,701 |
| Percent Occupied | 88.2% | 91.9% | 90.2% | 92.2% | 84.1% | 91.2% |
| Percent Vacant | 11.8% | 8.1% | 9.8% | 7.8% | 15.9% | 8.8% |
| Homeowner Vacancy Rate | 1.4% | 1.1% | 0.9% | 0.6% | 0.8% | 1.1% |
| Rental Vacancy Rate | 0.3% | 5.2% | 3.3% | 3.7% | 6.7% | 4.5% |
| **Units in Structure** | | | | | | |
| 1-unit, detached | 19,334 | 141,465 | 25,123 | 20,850 | 5,924 | 212,696 |
| 1-unit, attached | 572 | 11,690 | 1,116 | 785 | 32 | 14,195 |
| 2 units | 394 | 4,321 | 496 | 281 | 50 | 5,542 |
| 3 or 4 units | 649 | 6,770 | 1,113 | 408 | 129 | 9,069 |
| 5 to 9 units | 452 | 11,222 | 987 | 481 | 109 | 13,251 |
| 10 to 19 units | 342 | 13,952 | 1,604 | 136 | 25 | 16,059 |
| 20 or more units | 465 | 17,009 | 1,611 | 571 | 2 | 19,658 |
| Mobile home | 3,280 | 8,082 | 3,500 | 1,872 | 2,250 | 18,984 |
| Boat, RV, van, etc. | 72 | 95 | 20 | 31 | 29 | 247 |
| **Occupancy** | | | | | | |
| Occupied housing units | 22,539 | 197,298 | 32,069 | 23,438 | 7,188 | 282,532 |
| Owner-occupied | 17,492 | 128,142 | 22,785 | 18,972 | 6,060 | 193,451 |
| Renter-occupied | 5,047 | 69,156 | 9,284 | 4,466 | 1,128 | 89,081 |
| Avg household size of owner-occupied unit | 2.43 | 2.55 | 2.48 | 2.38 | 2.65 | 2.52 |
| Avg household size of renter-occupied unit | 2.22 | 2.15 | 2.19 | 2.58 | 2.65 | 2.19 |

Reference: (USCB 2023a)

**Table 3-51: Value of Owner-Occupied Homes in the Region of Influence in 2023**

| | Number of Housing Units | | | | | |
|---|---|---|---|---|---|---|
| **Value** | **Roane County** | **Knox County** | **Anderson County** | **Loudon County** | **Morgan County** | **ROI** |
| Total Owner-occupied units | 17,492 | 128,142 | 22,785 | 18,972 | 6,060 | 193,451 |
| Less than $50,000 | 1,363 | 4,312 | 1,271 | 805 | 836 | 8,587 |
| $50,000 to $99,999 | 1,467 | 5,665 | 2,354 | 1,169 | 1,195 | 11,850 |
| $100,000 to $149,999 | 2,342 | 10,690 | 3,445 | 1,644 | 1,113 | 19,234 |
| $150,000 to $199,999 | 2,805 | 15,488 | 3,317 | 1,681 | 899 | 24,190 |
| $200,000 to $299,999 | 4,619 | 34,432 | 5,388 | 4,535 | 991 | 49,965 |
| $300,000 to $499,999 | 3,105 | 36,093 | 5,126 | 4,930 | 650 | 49,904 |
| $500,000 to $999,999 | 1,521 | 18,168 | 1,704 | 3,314 | 297 | 25,004 |
| $1,000,000 or more | 270 | 3,294 | 180 | 894 | 79 | 4,717 |
| | **Median Value** | | | | | |
| Median Value for Owner-Occupied Units | $212,300 | $279,700 | $215,800 | $292,600 | $144,000 | - |

Reference: (USCB 2023a)

### 3.10.3.2 Education

The operating educational facilities statistics for the five counties within the ROI are listed in Table 3-52. These statistics are from the National Center for Educational Statistics (NCES). Public school statistics are from the 2022-2023 school year, and private school statistics are from the 2021-2022 school year. The facilities statistics are broken down by each school district within each county. The total number of schools is counted by the number of uniquely named institutions. The number of schools by grade level category is counted by the number of facilities that operate for that category which leads to the total not being equal to the sum of grade level categories as some schools operate facilities for all levels under one uniquely named institution. Grade level categories are counted by the following method: elementary counts grades K-5; middle counts grades 6-8; and secondary counts grades 9-12. Some schools operate within different categories, and these are considered when possible (i.e., a school district may operate a 6$^{th}$ grade classroom in elementary schools or operate 9$^{th}$ grade classrooms in middle schools) (NCES 2023).

There are 207 schools within the ROI across the five counties with 165 public schools and 42 private schools. Of these 207 schools there are 142 elementary schools, 82 middle schools, and 65 secondary schools. There are 7,080.3 teachers in the ROI with part-time teachers counted as a fraction of a full-time worker based on hours. The ROI has 99,629 students and a student-to-teacher ratio of 14.1. Public schools in the ROI have a slightly higher student-to-teacher ratio than private schools with 14.2 and 13.2 respectively. 91.1% of students in the ROI attend a public school and 8.9% are in private schools. Roane County has the highest percentage of students attending private schools with 19.2% or 1,501 students out of 7,819 students in the county. Knox County is the largest school district in the ROI with 131 schools and 68,883 students. Schools within a 5-mile radius of the Facility are displayed in Figure 3-95.Enrollment by school level, from nursery school to graduate school, in the ROI in 2023 is listed in Table 3-53 using statistics from 2023 provided by the USCB (USCB 2023b). 166,990 people in the ROI were enrolled in some level of schooling in 2023. 63.2% of these students are enrolled in K-12 schools, 5.9% in nursery or preschools, and 30.8% in college or professional school.

**Table 3-52: Education Facilities in the Region of Influence (2021-22 & 2023-24)**

| Geography | Total Number of Schools [1] | Elementary [2] | Middle [2] | Secondary [2] | Student Enrollment | Teachers (FTEs)[3] | Student to Teacher Ratio |
|---|---|---|---|---|---|---|---|
| **Anderson County** | | | | | | | |
| Anderson County School District | 18 | 11 | 6 | 5 | 6,157 | 481.80 | 12.8 |
| Oak Ridge School District | 7 | 4 | 2 | 1 | 5,002 | 357.38 | 14.0 |
| Clinton School District | 3 | 3 | | | 969 | 69 | 14.0 |
| Private Schools | 3 | 3 | 3 | 2 | 250 | 27.10 | 9.2 |
| **Knox County** | | | | | | | |
| Knox County School District | 91 | 55 | 21 | 21 | 60,194 | 4,037.90 | 14.9 |
| Tennessee School for the Deaf | 3 | 2 | 1 | 1 | 134 | 37.88 | 3.5 |
| Private Schools | 37 | 37 | 25 | 14 | 8,555 | 636.30 | 13.4 |
| **Loudon County** | | | | | | | |
| Lenior City School District | 4 | 3 | 2 | 2 | 2,606 | 165.51 | 15.7 |
| Loudon County School District | 9 | 6 | 4 | 2 | 5,011 | 351.33 | 14.3 |
| Private Schools | 1 | 1 | 1 | | 92 | 8 | 11.5 |
| **Roane County** | | | | | | | |
| Roane County School District | 18 | 7 | 7 | 7 | 6,318 | 438.59 | 14.4 |
| Private Schools | 4 | 4 | 4 | 4 | 1,501 | 278.40 | 5.4 |
| **Morgan County** | | | | | | | |
| Morgan County School District | 8 | 5 | 5 | 5 | 2,831 | 189 | 15.0 |
| Private Schools | 1 | 1 | 1 | 1 | 9 | 2.10 | 4.3 |
| **ROI Totals** | **207** | | | | **99,629** | **7,080.29** | **14.1** |

Reference: (NCES 2023)

Notes:

Total Number of Schools denotes named institutions. Elementary, Middle, and Secondary columns count the available facilities within each named institution. Some named institutions may offer facilities for more than one grade category. (i.e. K-12 schools are listed as one School but are counted in each of the three grade categories.)

1. FTE = full-time equivalent employee (part-time workers are reported as a fraction of an FTE).
2. Private school statistics are from the 2021-22 school year.
3. Public school statistics are from the 2023-24 school year.

**Table 3-53: Enrollment by Level of School in Region of Influence in 2023**

| Level of School | Roane County | Knox County | Anderson County | Loudon County | Morgan County | ROI |
|---|---|---|---|---|---|---|
| Nursery school, preschool | 469 | 7,799 | 940 | 551 | 110 | 9,869 |
| Kindergarten | 629 | 7,203 | 914 | 631 | 163 | 9,540 |
| Grade 1 to grade 4 | 3,222 | 24,785 | 3,056 | 2,440 | 451 | 33,954 |
| Grade 5 to grade 8 | 2,079 | 20,098 | 3,108 | 2,045 | 783 | 28,113 |
| Grade 9 to grade 12 | 2,515 | 24,207 | 4,041 | 2,657 | 587 | 34,007 |
| College, undergraduate years | 1,473 | 33,109 | 1,582 | 1,711 | 394 | 38,269 |
| Graduate or professional school | 294 | 11,256 | 965 | 566 | 157 | 13,238 |
| Total | 10,681 | 128,457 | 14,606 | 10,601 | 2,645 | 166,990 |

Reference: (USCB 2023b)

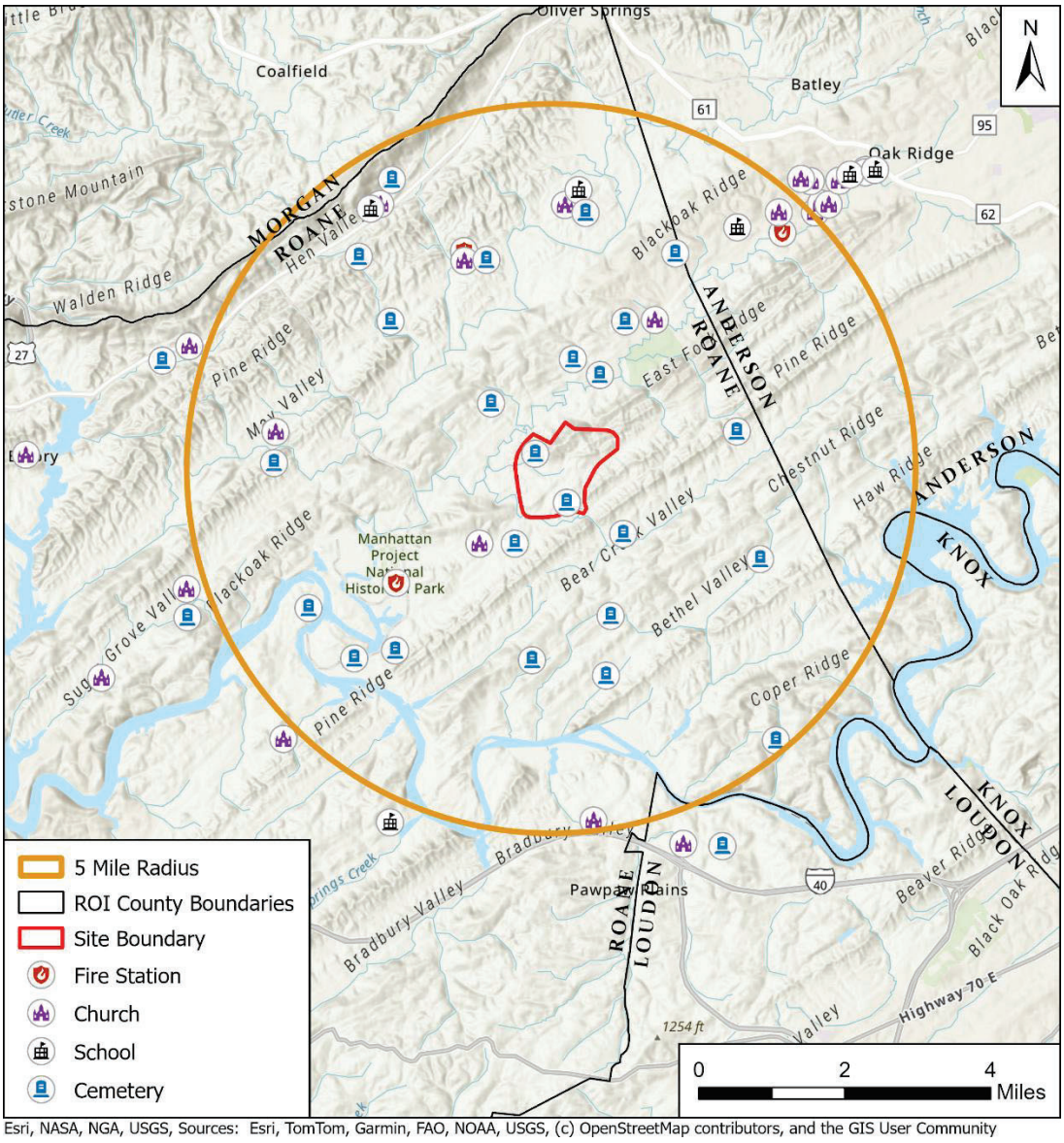



**Figure 3-95 - Community Facilities within 5 Miles of the Facility Site**

The level of education attainment in the 25 or older population in the ROI is listed in Table 3-54 using statistics from the USCB using 2023 data. Of the 481,229 people in the ROI 25 or older, 91.4% have received a high school diploma or equivalent and 44.1% have completed at least an associate degree or a professional degree. Both are higher than the state average, in which 90.1% have received a high school diploma or equivalent and 39.7% have some form of college degree. Morgan County has the highest percentage of the 25 or older population that has not received a high school diploma or equivalent with 16.5%. Knox County has the highest percentage of its 25 or older population possessing either a bachelor's degree, graduate degree, or professional degree with 40.1% (USCB 2023b).

**Table 3-54: Educational Attainment for the 25 or Older Population in 2023**

| | Roane County | | Knox County | | Anderson County | | Loudon County | | Morgan County | | ROI | | Tennessee | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level of School** | **Total** | **Percent** | **Total** | **Percent** | **Total** | **Percent** | **Total** | **Percent** | **Total** | **Percent** | **Total** | **Percent** | **Total** | **Percent** |
| Less than 9th grade | 1,391 | 3.4% | 9,209 | 2.8% | 1,783 | 3.2% | 2,054 | 4.8% | 953 | 6.1% | 15,390 | 3.2% | 190,711 | 3.9% |
| 9th to 12th grade, no diploma | 2,933 | 7.2% | 15,856 | 4.9% | 3,055 | 5.5% | 2,650 | 6.2% | 1,621 | 10.4% | 26,115 | 5.4% | 295,929 | 6.0% |
| High school graduate (includes equivalency) | 15,164 | 37.4% | 80,497 | 24.6% | 18,550 | 33.2% | 13,061 | 30.8% | 6,709 | 43.2% | 133,981 | 27.8% | 1,529,501 | 31.0% |
| Some college, no degree | 8,685 | 21.4% | 60,828 | 18.6% | 12,190 | 21.8% | 8,943 | 21.1% | 2,935 | 18.9% | 93,581 | 19.4% | 957,443 | 19.4% |
| Associate's degree | 3,396 | 8.4% | 29,222 | 8.9% | 5,566 | 10.0% | 3,613 | 8.5% | 1,191 | 7.7% | 42,988 | 8.9% | 395,771 | 8.0% |
| Bachelor's degree | 5,175 | 12.8% | 79,863 | 24.4% | 8,511 | 15.2% | 7,546 | 17.8% | 1,301 | 8.4% | 102,396 | 21.3% | 952,495 | 19.3% |
| Graduate or professional degree | 3,750 | 9.3% | 51,425 | 15.7% | 6,202 | 11.1% | 4,572 | 10.8% | 829 | 5.3% | 66,778 | 13.9% | 610,117 | 12.4% |
| Total People over 25 | 40,494 | 100% | 326,900 | 100% | 55,857 | 100% | 42,439 | 100% | 15,539 | 100% | 481,229 | 100% | 4,931,967 | 100% |

Reference: (USCB 2023b)

### 3.10.3.3 Health Care

Health care facilities in the ROI are shown in Table 3-55. The facilities are broken down by counties and in four categories for the facilities: hospitals, nursing homes, homes for the aged, and assisted living facilities. There are 14 hospitals in the ROI that provide a total of 3,088 beds to care for the local population. There are 23 nursing homes with 2,927 beds in the ROI as well as 5 homes for the aged with 270 beds. There are also 46 assisted care facilities with 3,292 beds (TN 2025).

The nearest hospital to the Facility is Methodist Medical Center in Oak Ridge which is a 283-bed regional medical center offering a variety of clinical services including emergency trauma care; a birthing center; specialized surgery; and cardiac, cancer, and rehabilitation services (Covenant Health 2024).

**Table 3-55: Licensed Health Care Facilities in the Region of Influence**

| | Hospitals | | Nursing Homes | | Homes for the Aged | | Assisted Care Living Facilities | |
|---|---|---|---|---|---|---|---|---|
| Jurisdiction | Number of Facilities | Total Beds | Number of Facilities | Total Beds | Number of Facilities | Total Beds | Number of Facilities | Total Beds |
| Roane County | 1 | 54 | 2 | 287 | 1 | 21 | 2 | 116 |
| Knox County | 11 | 2701 | 14 | 1756 | 3 | 200 | 31 | 2340 |
| Anderson County | 1 | 283 | 5 | 580 | 0 | 0 | 7 | 479 |
| Loudon County | 1 | 50 | 1 | 180 | 1 | 49 | 6 | 357 |
| Morgan County | 0 | 0 | 1 | 124 | 0 | 0 | 0 | 0 |
| ROI Total | 14 | 3088 | 23 | 2927 | 5 | 270 | 46 | 3292 |

Reference: (TN 2025)

### 3.10.3.4 Public Safety

The City of Oak Ridge Fire Department provides fire and emergency services to the Facility. There are four fire stations across the city with the Facility being closest to Station 4 located in the East Tennessee Technology Park on Enrichment Drive. Station 4 is 4.4 miles southwest of the Facility via Tennessee State Route 58 (Oak Ridge Turnpike). The Oak Ridge Fire Department owns the following equipment (City of Oak Ridge 2024b):

- Nine fire trucks (pumpers and ladder).
- Four radio-equipped rescue vehicles.
- Twelve radio-equipped support/command vehicles.
- A HazMat truck.
- Two ambulances.

All five ROI counties also have Sherriff's Departments that could provide additional resources if needed. As of 2023, 602 full-time law enforcement officers were employed in the ROI: 65 in Anderson County, 404 in Knox County, 60 in Loudon County, 27 in Morgan County, and 46 in Roane County (FBI 2023).

### 3.10.3.5 Transportation Services

The main freeways through the ROI are Interstate 40 and Interstate 75. Interstate 40 runs east-west and is the nearest freeway to the Facility being 7.8 miles away from the Site via Tennessee State Route 95 or 8.5 miles away via Tennessee State Route 58. Interstate 75 runs in conjunction with Interstate 40 for 16.5 miles through Loudon County and Knox County and then Interstate 75 continues running north-south just north of downtown Knoxville.

The nearest active rail transportation is the Norfolk Southern Railroad. The nearest railroad is 1.86 miles from the Facility at the Heritage Center, the former site of the K-25 Gaseous Diffusion Plant. There is no Amtrack service in the ROI.

The nearest airport facility to the Facility is the McGhee Tyson Airport (TYS) located in Alcoa, Tennessee. The airport is 22.1 miles southeast of the Facility. TYS has two parallel runways, one 10,000 ft and one 9,000 ft (FAA 2024). TYS handles commercial airline services, air cargo operations, general aviation, and military operations. In 2023 the airport services 2,835,773 passengers which was a 13.11% increase from the previous year. TYS eclipsed 2023's total by November 2024 with a year-to-date total of 3,046,148 passengers, a 17.15% increase from November of 2023 (KMAA 2024). McGhee Tyson is expecting passenger totals to continue to rise as the airport began phase one of its seven phase expansion on 7 November 2024.

## 3.11 PUBLIC AND OCCUPATIONAL HEALTH

This section describes levels of background radiation, major sources and levels of background chemical exposure, occupational injury rates, and health effects studies performed in the region of the selected site.

### 3.11.1 MAJOR SOURCES AND LEVELS OF BACKGROUND RADIATION

#### 3.11.1.1 General Background Radiation

The current sources of radiation at the Facility Site are associated with natural background radiation and work associated with the production of highly enriched uranium and plutonium from World War II efforts. Naturally-occurring radioactivity includes primordial radionuclides (nuclides that existed or were created during the formation of the earth and have a sufficiently long half-life to be detected today) and their progeny, as well as radionuclides that are continually produced by natural processes other than the decay of the primordial nuclides. These primordial radionuclides are ubiquitous in nature and are responsible for a large fraction of radiation exposure referred to as background exposure. The majority of primordial radionuclides are isotopes of the heavy elements and belong to the three radioactive series headed by $^{238}U$ (uranium series), $^{235}U$ (actinium series), and $^{232}Th$ (thorium series) (NCRP 1987a). Alpha, beta, and gamma radiation is emitted from the radionuclides in these series. The relationship among the nuclides in a particular series is such that, in the absence of chemical or physical separation, the members of the series attain a state of radioactive equilibrium, wherein the decay rate of each radionuclide is essentially equal to that of the radionuclide that heads the series. The radionuclides in each series decay eventually to a stable nuclide. For example, the decay process of the uranium series leads to a stable isotope of lead. There are also primordial radionuclides, specifically $^{40}K$ and $^{87}Rb$, which decay directly to stable elements without going through a series of decay sequences. The primordial series of radionuclides represents a significant component of background radiation exposure to the public (NCRP 1987a).

Cosmogenic radionuclides make up another class of naturally occurring nuclides. Cosmogenic radionuclides are produced in the earth's atmosphere and crust by cosmic-ray bombardment but are much less important as radiation sources than the primordial series (NCRP 1987a).

Naturally-occurring radioactivity in soil or rock near the earth's surface belonging to the primordial series represents a significant component of background radiation exposure to the public (NCRP 1987a). The radionuclides of primary interest are $^{40}K$ and the radioactive decay chains of $^{238}U$ and $^{232}Th$. These nuclides are widely distributed in rock and soil. Soil radioactivity is largely that of the rock from which it was derived. The original concentrations may have been diminished by leaching and dilution by water and organic material added to the soil or may have been augmented by adsorption and precipitation of nuclides from incoming water. Nevertheless, a soil layer about 0.25 m (0.8 ft) thick furnishes most of the external radiation from the ground (NCRP 1987a). In general, typical soil and rock contents of these radionuclides indicate that the $^{232}Th$ series and $^{40}K$ each contribute an average of about 150 to 250 μGy per year (15 to 25 mrad per year) to the total absorbed dose rate in air for typical situations, while the uranium series contribute about half as much (NCRP 1987a).

The public exposure from naturally-occurring radioactivity in soil varies with location. Some of the variation is linked to location, but factors such as moisture content of soil, the presence and amount of snow cover, the radon daughter concentration in the atmosphere, the degree of attenuation offered by housing structures, and the amount of radiation originating in construction materials may also account for variation (NCRP 1987b). Table 3-56 summarizes the background radiation exposure in the vicinity of the Facility. The background radiation exposure due to both natural and man-made sources is 9.1 millisievert per year (mSv/yr) (910 millirem [roentgen equivalent man] per year [mrem/yr]). Although this annual dose is higher than the national average for background radiation, 6.2 mSv/yr (620 mrem/yr) (NRC 2020), this annual dose is not an abnormal radiation hazard since the increase in dose (i.e., above average dose) is due to an above average terrestrial dose contribution that is still below the terrestrial dose contribution in several other States in the U.S.

**Table 3-56: Radiological Analyses of the Facility Site Soil**

| Nuclide | Frequency of Detection | Minimum Detected Concentration | Maximum Detected Concentration | Lower 95% Confidence Bound on a Median | Median Concentration | Upper 95% Confidence Bound on a Median |
|---|---|---|---|---|---|---|
| **Radionuclides (pCi/g)** | | | | | | |
| Cesium -137 | 4/4 | 5.78E-01 | 1.72E+00 | 4.60E-01 | 1.09E+00 | 2.56E+00 |
| Neptunium-237 | 3/4 | 7.21E-02 | 1.47E-01 | 7.18E-02 | 9.28E-02 | 1.20E-01 |
| Plutonium-238 | 1/4 | 5.98E-02 | 2.03E-01 | 4.57E-02 | 7.25E-02 | 1.15E-01 |
| Plutonium-239/240 | 1/4 | 3.17E-02 | 4.06E-02 | 1.18E-02 | 2.40E-02 | 4.87E-02 |
| Potassium-40 | 4/4 | 6.72E+00 | 1.38E+01 | 7.99E+00 | 9.70E+00 | 1.18E+01 |
| Radium-226 | 4/4 | 7.42E-01 | 9.92E-01 | 6.40E-01 | 9.31E-01 | 1.35E+00 |
| Technetium-99[a] | 3/6 | 1.39E+00 | 1.93E+00 | 7.36E-01 | 1.11E+00 | 1.67E+00 |
| Thorium-228 | 4/4 | 6.05E-01 | 1.72E+00 | 7.92E-01 | 1.13E+00 | 1.61E+00 |
| Thorium-230 | 4/4 | 8.18E-01 | 1.26E+00 | 8.66E-01 | 1.04E+00 | 1.24E+00 |
| Thorium-232 | 4/4 | 5.86E-01 | 1.49E+00 | 9.50E-01 | 1.10E+00 | 1.28E+00 |
| Uranium-233/234 | 4/4 | 8.38E-01 | 1.49E+00 | 1.01E+00 | 1.22E+00 | 1.47E+00 |
| Uranium-235 | 3/4 | 4.38E-02 | 1.78E-01 | 4.12E-02 | 5.83E-02 | 8.24E-02 |
| Uranium-238 | 4/4 | 8.67E-01 | 1.43E+00 | 1.09E+00 | 1.22E+00 | 1.36E+00 |

[a] Data are based on non-composited samples

Table pulled from Final Report on the Background Soil Characterization Project at the ORR, Oak Ridge, Tennessee, Table 7.1f (Chickamauga (K-25))

Background radiation for the public also includes various sources of man-made radioactivity, such as fallout in the environment from weapons testing, and radiation exposures from medical treatments, x-rays, and some consumer products. All of these types of man-made sources contribute to the annual radiation exposure received by members of the public. Of these, fallout from weapons testing should be included as an environmental radiation source for the Facility site. The two nuclides of concern with regard to public exposure from weapons testing are 137Cs and 90Sr due to their relative abundance, long half-lives (30.2 and 29.1 years, respectively) and their ability to be incorporated into human exposure pathways, such as external direct dose and ingestion of foods.

The geographic distribution of external dose from global fallout shows little variation across the United States (CDC 2005). Use of radiation in medicine and dentistry is also a major source of man-made background radiation exposure to the U.S. population. Although radiation exposures from medical treatments, X-rays, and some consumer products are considered to be background exposures, these sources do not comprise the background at the Facility site. Nevertheless, as a point of reference, medical procedures contribute an average of 0.39 mSv (39 mrem) for diagnostic X-rays and nuclear medicine contributes an average of 0.14 mSv (14 mrem) to the annual average dose equivalent received by the U.S. population (NCRP 1989). The increased use of radiation in medical procedures, particularly CT scanning, suggests that per capita radiation dose from medical procedures has increased significantly since the 1980s (NCRP 2008).

Consumer products (e.g., television receivers, ceramic products, tobacco products) also contribute to annual background radiation exposure. The average annual dose equivalent from consumer products and other miscellaneous sources (e.g., X-ray machines at airports, building materials) can range from fractions of a microsievert (millirems) to several Sieverts (hundreds of rems), as illustrated in Table 5.1 of NCRP Report No. 95 (NCRP 1987b).

Based on information in the following sections, the public in the Facility vicinity would receive an average natural background dose of 6.0 mSv/yr (598 mrem/yr; Table 3-57).

**Table 3-57: Summary of Background Radiation Exposure (mrem/yr) in Vicinity of the Facility**

| Source | Cosmic | Terrestrial | Internal | Medical | Consumer Product | Nuclear Power | Occupational |
|---|---|---|---|---|---|---|---|
| Natural | 31 | 536 | 31 | N/A | N/A | N/A | N/A |
| Man- Made | N/A | N/A | N/A | 298 | 12 | < 1 | < 1 |
| Subtotal | 598 | | | 312 | | | |
| Total | 910 | | | | | | |

Although this annual dose is higher than the United States average natural background dose of 3.1mSv/yr (310 mrem/yr) (NRC 2020), this annual dose is not an abnormal radiation hazard since the increase in dose (i.e., above average dose) is due to an above average terrestrial dose contribution that is still below the terrestrial dose contribution in several other States in the U.S.

### 3.11.1.2 Radiation Monitoring at ORNL

The location of the Facility is near the ORNL in Eastern Tennessee. A Site Environmental Report is published annually for DOE summarizing environmental monitoring programs and other environmental activities at the ORNL site (DOE 2024a).

The monitoring programs sample ambient air, drinking water, surface water, groundwater, soils, vegetation, agricultural products, wildlife, and direct radiation. Analyses of these samples include gross alpha and beta activity, and specific radionuclides (e.g., tritium, $^{90}$Sr, and isotopes of plutonium). Since air transport is considered the major potential pathway for releases from the ORNL Site to receptors, the environmental surveillance programs emphasize measurement of airborne radionuclides. Note that uranium is the principle radionuclide at the Facility. The Facility will not emit tritium, $^{90}$Sr, $^{131}$I, $^{137}$Cs, $^{239/240}$Pu, or $^{241}$Am, which are commonly monitored by the DOE and the state of Tennessee in the environment around the ORNL.

In its report for 2023, DOE estimates that the maximum radiation dose a hypothetical off-site individual could have received from DOE activities on ORR in 2023 was estimated to be 0.6 mrem from air pathways, 0.8 mrem from water pathways (drinking water, fish consumption, swimming, recreation, and other uses), and 1 mrem from consumption of wildlife harvested on ORR. This is under the 3 percent of the DOE 100mrem standard for all pathways and is significantly less than the 300 mrem annual average dose to people in the United States from background radiation.

Agricultural products, including lettuce, wheat, potatoes, and sheep as well as wildlife, and soil were sampled and reported on in the DOE Site Environmental Report. No gamma-emitting radionuclides were detected above the minimum detectable activity except for the naturally occurring radionuclides $^{40}$K, $^{214}$Bi, and $^{214}$Pb. Uranium isotopes were not detected above minimum detectable activities in any of the samples. Thorium-230 was detected in the cabbage sample from the area north of Y-12 with a low concentration just above the minimum detectable activity. This was the only radionuclide detected from the additional analyses performed in 2023.

### 3.11.2 CURRENT PROPOSED SITE RADIATION SOURCES

The Facility site has previously been unutilized. Since the site was unutilized, the only sources of radiation exposure to members of the public currently present at the Facility site are associated with natural background radiation and the residual radioactivity from weapons testing fallout.

A segment of SSP-2, the White Wing Scrap Yard, has some surface contamination and will remain DOE responsibility based on CERLA regulations until it is remediated and suitable to transfer to OE (DOE 2024b).

Twelve surface soil samples were taken for the initial characterization of the site. Samples were collected in various locations across the property. Analyses included gamma spectrometry and radiochemical analyses.

The laboratory results are summarized in Table 3-56.

In 1993 the Environmental Sciences Division of ORNL performed a Field Sampling study on the soils in the vicinity of the Facility. This sampling program pulled 12 samples in the vicinity of the SSP-2 parcel.

All 12 samples indicated the presence of the naturally-occurring primordial radionuclides: $^{40}K$, thorium $^{232}Th$, and the uranium decay series (including both $^{238}U$ and $^{235}U$). In addition, $^{137}Cs$ produced by past weapons testing, was also detected in all of the samples.

The median soil concentration for $^{40}K$ was determined to be 681.5 Bq/kg (18,400 pCi/kg). This result falls to the higher end of the typical range in North America of $^{40}K$ in soil, which is reported to be from $0.5 \times 10^{-6}$ to $3.0 \times 10^{-6}$ $g/g_{soil}$ (NCRP, 1976). This range equates to approximately 130 to 777 Bq/kg (3,500 to 21,000 pCi/kg).

The median concentration of $^{232}Th$ was found to be 53.7 Bq/kg (1,450 pCi/kg) in the Facility site soils. If it is assumed that the observed $^{238Th}$ is in secular equilibrium with the parent of the Thorium decay series ($^{232}Th$), then this observed average concentration falls in the higher end of the typical range for $^{232}Th$ in North America of $2 \times 10^{-6}$ to $12 \times 10^{-6}$ $g/g_{soil}$ (NCRP, 1976).

For the Uranium decay series, $^{238}U$ and its progeny, $^{234}U$, were detected in the site samples in the concentrations of 44.1 and 45.2 Bq/kg (1,190 and 1,220 pCi/kg), respectively. (The $^{234}U$ concentration is within 97 percent of that of the $^{238}U$.) The typical range of $^{238}U$ concentrations in soil is from about $1 \times 10^{-6}$ to $4 \times 10^{-6}$ $g/g_{soil}$ (NCRP, 1976). This range corresponds to approximately 12.6 to 50.3 Bq/kg (340 to 1,360 pCi/kg), placing the site results in about the upper-middle of the typical range.

The median $^{137}Cs$ concentration in the soil samples taken from the proposed site was 118.1 Bq/kg (3,190 pCi/kg). The presence of this radionuclide is attributed to past weapons testing fallout. Fallout from atmospheric testing of nuclear weapons is not uniform. The presence of $^{137}Cs$ is potentially the result of where past operations of Oak Ridge X-10 facilities may be a contributing factor for the higher levels of $^{137}Cs$ in these soils, however, immediately east of the HFIR facility located in Melton Valley tends to indicate another localized source.

ER Section 6.1.2 describes the Radiological Environmental Monitoring Program (REMP) for the Facility. The REMP includes the collection of data during pre-operational years in order to establish baseline radiological information that will be used in determining and evaluating impacts

from operations at the Facility on the local environment. The REMP will be initiated prior to Facility operations in order to develop a database of the pre-operational conditions.

The data summarized above, supplemented with the REMP data, fully characterize the background radiation levels at the Site.

### 3.11.2.1 Public and Occupational Exposure Limits

The radiation exposure limits for the general public have been established by the NRC in 10 CFR 20 and by the EPA in 40 CFR 190 (Table 3-58).

The NRC exposure limits place annual restrictions on the total dose equivalent exposure (1 mSv (100 mrem)), which includes external plus internal radiation exposures and dose equivalent rate (0.02 mSv (2 mrem)) in any one hour in unrestricted areas that are accessible by members of the public who are not employees, but who may be present during the year at the Facility. The annual whole body (0.25 mSv (25 mrem)), organ (0.25 mSv (25 mrem)), and thyroid (0.75 mSv (75 mrem)) dose equivalent limits established by the EPA apply to members of the public who are at offsite locations (i.e., at or beyond the Facility's site boundary). Public exposure at offsite locations due to routine operations comply with the more restrictive EPA limits. Annual exposure to the public is maintained ALARA through effluent controls and monitoring (refer to Section 6.1).

The NRC also places restrictions on radiation exposures incurred by employees at the Facility. The NRC restricts the annual radiation exposure that an employee may receive to a total effective dose equivalent (TEDE) of 50 mSv (5 rem), which includes external and internal exposure. In addition, the NRC places restrictions of the dose equivalent to the lens of the eye (0.15 Sv (15 rem)), skin (0.5 Sv (50 rem)), extremities (0.5 Sv (50 rem)), and on the committed dose equivalent to any internal organ (0.5 Sv (50 rem)). Annual radiation exposure for an employee is controlled, monitored, and maintained ALARA through the radiation safety program at the Facility.

**Table 3-58: Public and Occupational Radiation Exposure Limits**

| Individual | Annual Dose Equivalent Limit | Reference |
|---|---|---|
| Worker | 50 mSv (5 rem) TEDE<br>0.5 Sv (50 rem) CDE to any organ<br>0.15 Sv (15 rem) lens of eye<br>0.5 Sv (50 rem) skin<br>0.5 Sv (50 rem) extremity | 10 CFR 20 |
| General Public | 1 mSv (100 mrem) TEDE<br>0.02 mSv (2 mrem) in any 1-hour period | 10 CFR 20 |
| | 0.25 mSv (25 mrem) whole body<br>0.25 mSv (25 mrem) any organ<br>0.75 mSv (75 mrem) thyroid | 40 CFR 190 |

### 3.11.3 MAJOR SOURCES AND LEVELS OF CHEMICAL EXPOSURE

#### 3.11.3.1 Description of Chemical Sources

The Facility site has been unutilized. Consequently, there are currently no known major sources of chemical exposure at the site that may impact the public. Section 3.3 describes the soils and the results of tests conducted on the soil samples. All surface soils sample analyses resulted in no detections of organic, pesticide, or herbicide compounds (DOE 2024a).

#### 3.11.3.2 Summary of Health Effects Studies Related to Chemical Source Exposures

National Institute for Occupational Safety and Health (NIOSH), a division of the Centers for Disease Control and Prevention, maintains the Health Hazard Evaluation (HHE) Program to assist stakeholders in learning whether health hazards are present at their workplace and recommends ways to reduce hazards and prevent work-related illness. A search of the NIOSH HHE database identified nine (9) HHE Reports published for facilities in Eastern Tennessee, four (4) are located within a 30-mi. of the Facility (NIOSH 2025). Pertinent findings published in those HHE Reports had no impact on the Site.

#### 3.11.3.3 Toxic Constituents

The following are the principle toxic constituents that would exist at the Facility (DOE 1999).

- The primary constituent is uranium hexafluoride ($UF_6$). Uranium hexafluoride (Chemical Abstracts Service (CAS) Number: 7783-81-5, AEGL-3 is 36 mg/m$^3$ for 60 min) (NOAA n.d.) at ambient conditions is a volatile, white, crystalline solid. Solid $UF_6$ is readily transformed into the gaseous or liquid states by the application of heat. All three phases - solid, liquid, and gas - coexist at 147 °F (64 °C) (the triple point). Only the gaseous phase exists above 446 °F (230 °C), the critical temperature, at which the critical pressure is 45.5 atm (4.61 mPa). The vapor pressure above the solid reaches 1 atm (0.1 mPa) at 133 °F (56 °C), the sublimation temperature. $UF_6$ is hygroscopic (i.e., moisture-retaining) and, in contact with water ($H_2O$), either natural (flood/rain) or man-made (sprinklers), will decompose immediately to uranyl fluoride ($UO_2F_2$) and corrosive hydrogen fluoride (hydrofluoric acid - HF). When heated to decomposition, $UF_6$ emits toxic fluoride fumes.
- Hydrogen Fluoride (HF) (CAS Number: 7664-39-3, AEGL-3 is 44 ppm at 60 min) (NOAA n.d.) is lighter than air. Although HF is lighter than air and would disperse when released, a cloud of vapor and aerosol that is heavier than air may be formed under some release conditions (EPA 1992) (EPA 1993). Likewise, per CAMEO Chemicals (NOAA n.d.) HF is considered heavier than air (WHO 2017).

  It is essential to note that while HF (molecular weight 20 g/mole) is lighter than air, its relatively low boiling point (19.5ºC or 67.1ºF) means it can exist as either a gas or a liquid near typical ambient temperatures. If accidentally released, HF would tend to behave as a heavy (dense) gas because of two principal mechanisms: polymerization (due to the strong hydrogen bonding of HF molecules) and the formation of a vapor/aerosol cloud

- Uranyl fluoride ($UO_2F_2$) (CAS Number: 13536-84-0, $LD_{50}$: 2.5 mg/kg (Oral, Rat) PubChem) (NIH 2025) is an intermediate in the conversion of $UF_6$ to a uranium oxide or metal form and is a direct product of the reaction of $UF_6$ with moisture in the air. It is very soluble in water (solid). Uranyl fluoride also is hygroscopic and changes in color from brilliant orange to yellow after reacting with water. Uranyl fluoride is reported to be stable in air to 570 °F (300 °C), above which slow decomposition to $U_3O_8$ occurs. When heated to decomposition, $UO_2F_2$ emits toxic fluoride fumes.

With the toxic constituents defined and their form (i.e., solid, liquid or gaseous) and their material/physical behavior identified, the toxic constituents will be ground release and will tend to stay closer to the ground unless significant thermal / turbulent mixing occurs.

### 3.11.4 CHEMICAL EXPOSURE LIMITS

Of primary importance to the Facility is the control of uranium hexafluoride ($UF_6$). The $UF_6$ readily reacts with air, moisture, and some other materials. The most significant $UF_6$ reaction products in this plant are hydrogen fluoride (HF), uranyl fluoride ($UO_2F_2$), and small amounts of uranium tetrafluoride ($UF_4$).

$UO_2F_2$ is radiologically and chemically toxic due to its uranium content and solubility, and once inhaled, uranyl fluoride is easily absorbed into the bloodstream. If large quantities are inhaled, the uranium in the uranyl complex acts as a heavy metal poison that primarily affects the kidneys. Because of low specific activity values, the radiological toxicity of $UF_6$ and the $UO_2F_2$ byproduct are typically of less concern than the chemical toxicity.

Since $UO_2F_2$ is a soluble uranium compound, the values in Table 3-59 are utilized to evaluate the severity of public (individuals outside the controlled area boundary) exposure to soluble uranium.

**Table 3-59 Health Effects of Soluble Uranium**

| Health Effect | Uranium per kg body weight (mg U/kg) | Uranium (mg) in 70 kg person | Uranium Intake (mg) by 70 kg person |
|---|---|---|---|
| 50% lethality | 1.63 | 114 | 230 |
| Threshold for permanent renal damage | 0.3 | 21 | 40 |
| Threshold for transient renal injury or effect | 0.058 | 4.06 | 8.3 |
| No effect | 0.03 | 2.1 | 4.3 |

Source: Table 2 of NUREG-1391 (NRC 1991)

Table 3-60 presents the threshold exposure limit of uranium after 1h exposure as defined by the Emergency Response Planning Guidelines (ERPG-2) and the Acute Exposure Guideline Levels (AEGL-2).

**Table 3-60 Guideline for the Uranium exposure limits**

| Guideline | Consequences after 1h exposure | Airborne concentration limit |
|---|---|---|
| AEGL-1 | experience notable discomfort, irritation or certain asymptomatic, non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure (non-disabling) | > 2.4 mgU /$m^3$ |
| AEGL-2 | experiencing irreversible or other serious, long-lasting adverse health effects, or an impaired ability to escape (disabling) | > 6.5 mgU /$m^3$ |
| AEGL-3 | experience life-threatening health effects or death (lethality) | > 24.3 mgU /$m^3$ |
| ERPG-1 | experiencing more than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor | < 3.4 mgU /$m^3$ |
| ERPG-2 | experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action | < 10.1 mgU /$m^3$ |
| ERPG-3 | experiencing or developing life-threatening health effects | < 20.3 mgU /$m^3$ |

HF is a colorless, fuming liquid with a sharp, penetrating odor, which is also a highly corrosive chemical. The health dangers of $UF_6$ stem more from its chemical properties than from its radiological properties. Contact with HF can cause severe irritation of the eyes, inhalation can cause extreme irritation of the respiratory tract, and ingestion can cause vomiting, diarrhea and circulatory collapse. Initial exposure to HF may not cause the appearance of a typical acid burn; instead, the skin may appear reddened and painful, with increasing damage occurring over a period of several hours or days. Tissue destruction and loss can occur with contact to HF, and in worst cases large doses of HF can cause death due to the fluoride affecting the heart and lungs.

The EPA and OSHA have developed exposure limits for HF that are enforceable by law. The EPA has also established accidental release criteria for reporting purposes and public health protection. In addition, government and private organizations have developed guidelines and recommendations for HF exposure. Federal organizations that develop recommendations for public health from toxic substances are the Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH). The American Conference of Governmental Industrial Hygienists (ACGIH) also provides occupational exposure limits for HF, which are updated periodically and whose research is used by NIOSH, which in turn provides data and recommendations to OSHA. Lists of these regulations and guidelines are detailed in Table 3-61.

OSHA and NIOSH have set a limit of 2.0 mg/m$^3$ for HF for an 8-hr work shift. As with most toxicological information and health exposure regulations, limits have been established based on past exposures, biological tests, accident scenarios and lessons learned, and industrial hygiene data that is continually collected and researched in occupational environments.

**Table 3-61 Hydrogen Fluoride (HF) Regulations and Guidelines**

| Agency | Description | Concentration or quantity of material |
|---|---|---|
| ACGIH | TVL (8-hour-TWA | 0.5 ppm |
| | TVL-CEL | 2 ppm |
| NIOSH | REL (10-hour-TWA) | 3 ppm (2 mg/m$^3$) |
| | REL-CEL (15 min) | 6 ppm (5 mg/m$^3$) |
| CAL/OSHA | PEL (8-hour-TWA) | 0.4 ppm (0.33mg/m$^3$) |
| | PEL-STEL | 1 ppm (0.83 mg/m$^3$) |
| OSHA | PEL (8-hour-TWA) | 3 ppm (2 mg/m$^3$) |
| EPA | Accidental release prevention threshold quantity | 1000 lb (454 kg) |
| OSHA | Highly hazardous chemicals threshold quantity | 1000 lb (454 kg) |
| ERPG | ERPG-1 / ERPG-2/ ERPG-3 (1hour) | 2 / 20 / 50 ppm (1.6 / 16 / 41 mg HF / m$^3$) |
| AEGL | AEGL-1/AEGL-2/AEGL-3 (1 hour) | 1 / 24 / 44 ppm (0.8 / 20 / 36 mg HF / m$^3$) |

ACGIH: American Conference of Governmental Industrial Hygienists
NIOSH: National Institute for Occupational Safety and Health
OSHA: Occupational Safety and Health Administration
EPA: Environmental Protection Agency
CA/OSHA: California OSHA
ERPG: Emergency Response Planning Guidelines (established by the American Industrial Hygiene Association)
AEGL Acute Exposure Guideline Levels (established by the National Advisory Committee

TWA: Time Weighted Average
TVL:Threshold Limit Value
STEL: Short Term Exposure Limit
REL: Recommended Exposure Limit
PEL: Permissible Exposure Limit
CEL: ceiling

### 3.11.5 HISTORICAL EXPOSURE TO RADIOACTIVE MATERIALS

The Facility Site has been unutilized, thus there has been no historical exposure to radioactive materials as noted in the DOE's Clean Parcel Determination. (DOE 2025)

### 3.11.6 SUMMARY OF HEALTH EFFECTS

Health effects from radiation exposure became evident soon after the discovery of X-rays in 1895 and radium in 1898. Following World War II, many studies were initiated to investigate the effect of radiation on Japanese populations who survived the atomic bombing of Hiroshima and Nagasaki. The reports of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) (UNSCEAR 1986) (UNSCEAR 1988) and the National Academy of Sciences Committee of the Biological Effects of Ionizing Radiation (BEIR) (NAS 1972) (NAS 1988) are comprehensive reviews of the Japanese data. In addition, numerous radiobiological studies have been conducted in animals (e.g., mouse, rat, hamster, dog), and in cells and tissue cultures. Extrapolations to humans from these experiments are problematic and despite the large amount of accumulated data, uncertainties still exist regarding the effects of radiation at low doses and low dose rates. The most reliably estimated risks are those associated with relatively high doses (i.e., greater than 1 Gy (100 rad)) (NCRP 1989). The radiation health community is in general agreement that risks at smaller doses are at least proportionally smaller (e.g., no more than 1/100 the risk at 1/100 the dose). It is likely that the risks may be considerably smaller (NCRP 1980).

Serious radiation-induced diseases fall into two categories: stochastic effects and nonstochastic effects. A stochastic effect is defined as one in which the probability of occurrence increases with increasing absorbed dose but the severity in affected individuals does not depend on the magnitude of the absorbed dose (NCRP 1989). A stochastic effect is an all-or-none response as far as the individuals are concerned. Cancers such as solid malignant tumors, leukemia and genetic effects are regarded as the main stochastic effects to health from exposure to ionizing radiation at low absorbed doses (NCRP 1989). It is generally agreed among members of the scientific community that a radiation dose of 100 mGy (10 rads) increases the risk of developing cancer in a lifetime by about one percent (NCRP 1989). In comparison, a nonstochastic effect of radiation exposure is defined as a somatic effect which increases in severity with increasing absorbed dose in affected individuals, owing to damage to increasing numbers of cells and tissues (NCRP 1989). Examples of nonstochastic effects from radiation exposure are damage to the lens of the eye, nausea, epilation, diarrhea, and a decrease in sperm production in the male (NCRP 1980) (NCRP 1989). These effects have been observed only following high dose exposures, typically greater than 1 Gy (100 rads) to the whole body (NCRP 1989). The potential doses to the public due to routine operations at the Facility are presented in ER Section 4.12 and are several orders of magnitude below the natural background doses discussed here. For further information, NCRP Report No. 64 (NCRP 1980) provides an overview of research results and data relating to biological effects from radiation exposures.

### 3.11.7 OCCUPATIONAL INJURY

The Site has previously been unutilized, and therefore has no history of occupational injury. Data from the Orano Georges Besse-II (GB2) site in Tricastin, France provides estimated projections for the OE Facility for work accidents with lost time injuries (Table 3-62).

**Table 3-62 GB2 Worker Accident with Lost Time (Orano 2023)**

| | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| **Total** | 3 | 3 | 1 | 3 |

## 3.12 WASTE MANAGEMENT

This section provides descriptions of non-radioactive, radioactive, mixed, and hazardous waste systems currently generated at the Site. The Site is currently undeveloped land. There are no waste streams, no waste generation, nor waste discharge.

The EPA's solid waste management and disposal regulatory programs implemented under Resource Conservation and Recovery Act (RCRA) Subtitle C (Hazardous Wastes) and Subtitle D (Nonhazardous Wastes) regulate many liquids and semi-solids that are stored and managed in containers (e.g., drums, tanks) as solid wastes. Where applicable, the quantities, composition, and frequency of waste generation are described. Disposal plans, waste minimization, and environmental impacts of the operations are discussed in Section 4.13

### 3.12.1 GASEOUS WASTESTREAMS

The Site is undeveloped land. There are no gaseous effluent releases at the Site.

### 3.12.2 WASTEWATERS

The Site is undeveloped land. There is no liquid waste or wastewater effluent at the Site.

#### 3.12.2.1 Process Wastewater

The Site is undeveloped land. There is no liquid waste or wastewater effluent at the Site.

#### 3.12.2.2 Sanitary Wastewater

The Site is undeveloped land. There is no sanitary wastewater at the Site.

### 3.12.3 SOLID WASTES

The Site is undeveloped land. The current greenfield site is dedicated for industrial development. Currently, no solid waste is generated on the Site.

#### 3.12.3.1 Municipal Solid Wastes

The Site is undeveloped land. There is no municipal waste generated at the Site. OE has identified local municipal solid waste entities available to support transport and disposal of solid waste.

#### 3.12.3.2 Nonhazardous Industrial Wastes

The Site is undeveloped land. There is no nonhazardous waste generated at the Site.

#### 3.12.3.3 Hazardous Wastes

The Site is undeveloped land. There is no hazardous waste generated at the Site.

#### 3.12.3.4 Low-Level Radioactive Wastes

The Site is undeveloped land. There is no low-level radioactive waste generated from public land use activities in the Site.

# Chapter 4: Environmental Impacts

## TABLE OF CONTENTS


4 ENVIRONMENTAL IMPACTS ..... 4-1
4.1 LAND USE IMPACTS ..... 4-1
4.1.1 Proposed Action ..... 4-1
4.1.2 Cumulative Impacts ..... 4-3
4.2 TRANSPORTATION IMPACTS ..... 4-4
4.2.1 Proposed Action ..... 4-4
4.2.2 Radioactive Material Transportation ..... 4-8
4.2.3 Non-Radiological Environmental Impacts ..... 4-20
4.2.4 Cumulative Impacts ..... 4-22
4.3 GEOLOGY AND SOILS IMPACTS ..... 4-25
4.3.1 Site Soils ..... 4-25
4.3.2 Geological Impacts ..... 4-27
4.3.3 Cumulative Impacts ..... 4-28
4.4 WATER RESOURCES IMPACTS ..... 4-29
4.4.1 Groundwater ..... 4-29
4.4.2 Surface Water ..... 4-31
4.4.3 Floodplains ..... 4-36
4.4.4 Wetlands ..... 4-36
4.4.5 Cumulative Impacts ..... 4-36
4.5 ECOLOGY IMPACTS ..... 4-37
4.5.1 Proposed Action ..... 4-37
4.5.2 Summary of Ecology Impacts ..... 4-44
4.5.3 Mitigation Measures ..... 4-45
4.5.4 Cumulative Impacts ..... 4-45
4.6 AIR QUALITY IMPACTS ..... 4-46
4.6.1 Regional Air Quality ..... 4-46
4.6.2 Atmospheric Dispersion Characteristics ..... 4-53
4.6.3 Visibility Impacts ..... 4-60
4.6.4 Air quality Impacts from Decommissioning ..... 4-61
4.6.5 Mitigative Measures for Air Quality Impacts ..... 4-61
4.6.6 Cumulative Air Quality Impacts ..... 4-62
4.7 NOISE IMPACTS ..... 4-62

4.7.1 Proposed Action ..... 4-62
4.7.2 Noise Sources ..... 4-65
4.7.3 Noise Level Standards ..... 4-66
4.7.4 Potential Impacts to Sensitive Receptors ..... 4-66
4.7.5 Mitigation ..... 4-68
4.7.6 Cumulative Impacts ..... 4-69
4.8 Historical and Cultural Resources impacts ..... 4-70
4.8.1 Proposed Action ..... 4-71
4.8.2 Cumulative Impacts ..... 4-72
4.9 VISUAL/SCENIC RESOURCES IMPACTS ..... 4-72
4.9.1 Proposed Action ..... 4-72
4.9.2 Mitigation Measures ..... 4-78
4.9.3 Cumulative Impacts ..... 4-78
4.10 SOCIOECONOMIC IMPACTS ..... 4-79
4.10.1 Facility Construction ..... 4-79
4.10.2 Facility Operation ..... 4-80
4.10.3 Regional Impact Due to Construction and Operation ..... 4-80
4.10.4 Decommissioning ..... 4-82
4.10.5 Cumulative Impacts ..... 4-82
4.11 ENVIRONMENTAL JUSTICE ..... 4-82
4.12 PUBLIC AND OCCUPATIONAL HEALTH IMPACTS ..... 4-82
4.12.1 Proximity to Potential Receptors ..... 4-82
4.12.2 Non-Radiological Impacts ..... 4-84
4.12.3 Radiological Impacts ..... 4-86
4.12.4 Environmental Effects of Accidents ..... 4-111
4.12.5 Cumulative Impacts ..... 4-111
4.13 WASTE MANAGEMENT IMPACTS ..... 4-112
4.13.1 Waste Descriptions ..... 4-112
4.13.2 Waste Management System Description ..... 4-115
4.13.3 Waste Disposal Plans ..... 4-117
4.13.4 Waste Minimization ..... 4-118
4.13.5 Control and Conservation ..... 4-118
4.13.6 Cumulative Impacts ..... 4-119

## LIST OF TABLES

**Number** **Title**


Table 4-1 Estimated Impacts from Project-Related Traffic During Construction (2028)..... 4-7
Table 4-2 Estimated Impacts from Project-Related Traffic During Operation (2035)..... 4-7
Table 4-3 Supply Materials Shipped to the Facility During Construction..... 4-8
Table 4-4 Annual Radioactive Material Quantities and Shipments..... 4-9
Table 4-5 Potential Transportation Origins/Destinations and Distances..... 4-10
Table 4-6 Waste Materials Shipped from the Facility During Construction..... 4-12
Table 4-7 WebTRAGIS Output..... 4-12
Table 4-8 Annual Incident-Free Dose from Radioactive Material Transportation ..... 4-15
Table 4-9 RADTRAN Inputs ..... 4-16
Table 4-10 RADTRAN Vehicle Density Information..... 4-17
Table 4-11 Feed, Empty Feed, and Empty $DUF_6$ Cylinders Non-Radiological Incident Risk . 4-18
Table 4-12 Non-Radiological Environmental Impacts from Vehicle Incidents ..... 4-21
Table 4-13 Product and Empty Product Cylinders Non-Radiological Incident Risk ..... 4-23
Table 4-14: Radwaste Shipments Non-Radiological Incident Risk..... 4-24
Table 4-15 Facility Non-Radiological Environmental Impact from Vehicle Incidents ..... 4-25
Table 4-16 Fugitive Emissions during Construction..... 4-52
Table 4-17 Standby Diesel Generator Air Emissions During Operations..... 4-54
Table 4-18 Off-Site Vehicle Air Emissions During Construction ..... 4-54
Table 4-19 Summary of Maximum Annual Average Atmospheric Dispersion and Deposition Factors..... 4-56
Table 4-20 Sector Average Concentration, Undepleted, Undecayed $\chi$/Q Values ($sec/m^3$) for Grid Receptors..... 4-57
Table 4-21 Sector Average Concentration, Depleted, Decayed $\chi$/Q Values ($sec/m^3$) for Grid Receptors ..... 4-58
Table 4-22 Sector Average D/Q Values ($1/m^2$) for Grid Receptors..... 4-59
Table 4-23 Attenuated Noise Levels Expected for Operation of Representative Construction Equipment..... 4-63
Table 4-24 Noise Receptors/Facilities Near Facility Site ..... 4-67
Table 4-25 Local Labor Headcount by Calendar Year..... 4-79
Table 4-26 Total Local Labor Wages (in $1,000)..... 4-81
Table 4-27 Average State and County Sales Tax Revenue (in $1,000)..... 4-81
Table 4-28 Annual Average Effluent Air Concentrations at Critical Receptors..... 4-87
Table 4-29 40 Years Accumulative Soil Concentrations at Critical Receptors ..... 4-88
Table 4-30 Direct Radiation Annual Dose Equivalent by Source ..... 4-91
Table 4-31 Population Data (All Ages) for the Year 2050 within 50 Mi. ..... 4-92
Table 4-32: Estimated Vegetable (Below Ground) Production (lbs/yr) within 50 Miles..... 4-93
Table 4-33: Estimated Milk Production (gallons/yr) within 50 Mi..... 4-94
Table 4-34 Estimated Meat Production (lbs/yr) within 50 Mi..... 4-95
Table 4-35 Collective Population Effective Dose Equivalents to All Ages (Person-Sieverts) within 50 Mi..... 4-96
Table 4-36 Collective Population Effective Dose Equivalents to All Ages (Person-Rem) within 50 Mi..... 4-97
Table 4-37 Summary of 50 Mile Population for All Age Groups -All Airborne Pathways ..... 4-98
Table 4-38 Annual Dose Equivalents to Nearest Resident (Adult)..... 4-98
Table 4-39 Annual Dose Equivalents to Nearest Resident (Teen)..... 4-99

Table 4-40 Annual Dose Equivalents to Nearest Resident (Child) ..... 4-100
Table 4-41 Annual Dose Equivalents to Nearest Resident (Infant) ..... 4-101
Table 4-42 Annual Dose Equivalents to Nearby Business (Adult) ..... 4-102
Table 4-43 Annual Dose Equivalents to Maximum Site Boundary (Adult) ..... 4-103
Table 4-44 Annual Dose Equivalents to Maximum Hypothetical Resident (Adult) ..... 4-104
Table 4-45 Annual Dose Equivalents to Maximum Hypothetical Resident (Teen) ..... 4-105
Table 4-46 Annual Dose Equivalents to Maximum Hypothetical Resident (Child) ..... 4-106
Table 4-47 Annual Dose Equivalents to Maximum Hypothetical Resident (Infant) ..... 4-107
Table 4-48 Maximum Annual Gaseous & Liquid Radiological Impacts ..... 4-109
Table 4-49 Estimated Facility Occupational Dose Equivalent Rates ..... 4-109
Table 4-50 Annual Total Effective Dose Equivalent (All Sources) ..... 4-109
Table 4-51 Estimated Annual Facility Occupational (Individual) Exposures ..... 4-110
Table 4-52 Accident Criteria Chemical Exposure Limits by Category ..... 4-110
Table 4-53 Estimated Annual Non-Radiological Wastes ..... 4-112
Table 4-54 Estimated Annual Radiological and Mixed Wastes ..... 4-113
Table 4-55 Estimated Annual Liquid Effluent ..... 4-114
Table 4-56 Estimated Annual Gaseous Effluent ..... 4-115

## LIST OF FIGURES

**Number** **Title**

Figure 4-1 Proposed Intersection at Novus Drive for Access to Facility Site ..... 4-5
Figure 4-2 Graphic Depicting the Existing Terrain of the Site with the Excavation Plans and the Corner of the Facility in Blue ..... 4-26
Figure 4-3 Jurisdiction Waters Delineation at the Facility Site ..... 4-32
Figure 4-4 USGS Multi-Resolution Land Characteristics Consortium for the Site ..... 4-48
Figure 4-5 Watering Control Effectiveness for Unpaved Surfaces from AP-42 (EPA 2006) .. 4-52
Figure 4-6 Results from the archaeological study. ..... 4-70
Figure 4-7 Location of the Facility on the Site. ..... 4-73
Figure 4-8 Site Area and Facility Layout. ..... 4-74
Figure 4-9 External Renderings of the Facility ..... 4-75
Figure 4-10 Vicinity Sensitive Receptor Map ..... 4-83

# 4 ENVIRONMENTAL IMPACTS

This chapter details the impacts to the environment from the construction, operation, and decommissioning of the Facility. OE uses the term construction to include impacts to pre-construction activities, such as tree clearing to occur in Q3 of 2026, followed by grading, and other activities regulated through state and local agencies. Tree clearing is further discussed in Section 4.5, and grading is discussed in Section 4.1. The no-action alternative for this chapter is such that the Facility is not constructed and thus there is no impact to the environment.

## 4.1 LAND USE IMPACTS

This section assesses the impacts of construction, operation, and decommissioning on land use for the OE Facility on the Site and the surrounding region. As described in Section 3.1, the land use for the site and region is analyzed using the National Landcover Database (NLCD). Impacts to land use include effects from activities associated with construction, operation, and decommissioning, including excavation, grading, placement of fill material, temporary staging and construction laydown, construction of permanent features, and potential operational disturbances.

### 4.1.1 Proposed Action

Under the Proposed Action, the Facility is constructed and operated on the Site.

#### 4.1.1.1 Impacts from the Construction

The Site consists of approximately 600 acres. It is conservatively assumed that 300 of the 600 acres of the site are affected by construction activities in order to account for future activities or alterations to construction plans.

The potential construction-related land use impacts to the Site and near off-site areas are discussed in the following paragraphs. Portions of the Site have been disturbed but much of the site contains wooded vegetation that will be disturbed during construction.

#### 4.1.1.2 Special Land Uses

Special land uses in the region are discussed in Section 3.1.4. Permanent and temporary impacts from construction of the Facility do not occur within these special land use areas. No direct or indirect impacts occur to special land use classification areas. Therefore, impacts to special land use classification areas are SMALL.

##### 4.1.1.2.1 Oak Ridge Reservation

As discussed in Section 3.1.4, special land uses within the region include all three sites on the Oak Ridge Reservation (ORR), the East Tennessee Technology Park (ETTP), formerly known as the K-25 Site, the Oak Ridge National Laboratory (ORNL), and the Y-12 National Security Complex. These sites are located approximately 2.4 mi. southwest, 2.8 mi. southeast, and 6.3 mi. east respectively, of the Facility. Permanent and temporary impacts from construction of the

Facility are limited to the Site, consequently, impacts to ORR land uses from construction of the Facility are SMALL.

#### 4.1.1.2.2 Other Land Uses

As described in Section 3.1.4, other land uses within the vicinity include the Manhattan Project National Historical Park, Campbell Bend Barrens and Crowder Cemetery State Natural Areas, the North Boundary Greenway, and the McKamey-Carmichael Cemetery. Permanent and temporary impacts from construction of the Facility occur only on-site, with no impacts within the special land use areas. Consequently, impacts to other land uses from construction of the Facility are SMALL.

### 4.1.1.3 Agricultural Resources and Facilities

The agricultural resources and facilities on-site and within the region of the Facility are described in Section 3.1.5. There are no permanent or temporary impacts to cultivated crops or hay/pastureland on-site as result of construction. As discussed in Chapter 3, it is estimated that 13 percent of the soils in the Facility region are designated prime farmland. However, because the Facility lies wholly within the City of Oak Ridge, the prime farmland designation is waived, and other uses of the land, such as industrial development, are permitted. No other agricultural resources within the region of the Facility are located on-site or near off-site, and therefore, are not impacted by construction-related impacts.

There is no loss of agricultural lands on-site, including prime farmland or farmland of State-wide importance. As such, direct and indirect impacts to agricultural resources and facilities from construction are SMALL.

### 4.1.1.4 Mineral Resources

As described in Section 3.1, there is currently no coal, oil, or gas production in the Facility site region. Tennessee's non-fuel mineral production includes Portland cement, sand and gravel, stone, zinc, and ball clay. None of the mineral resources are located on-site. Permanent and temporary impacts from construction of the Facility occur on-site and in nearby off-site areas. Consequently, there are no direct or indirect impacts to mineral resources. Impacts to mineral resources from construction of the Facility are SMALL.

### 4.1.1.5 Major Population Centers and Infrastructure

Section 3.1.3 summarizes the major population centers and infrastructure located within the Facility region, which includes the major population center of Oak Ridge, several major transportation corridors, CSX Transportation (CSX) railroad, McGhee Tyson Airport, and the Clinch River. None of the major population centers or infrastructure are located on-site. Permanent and temporary impacts from construction of the Facility occur on-site and in nearby offsite areas. Therefore, construction-related direct and indirect impacts on major population centers and infrastructure are SMALL.

#### 4.1.1.6 Impacts from Operation

Impacts to land use after construction is complete and during operation of the Facility would not occur. Therefore, the impacts to land use would occur during the operation of the Facility are SMALL.

#### 4.1.1.7 Impacts from Decommissioning

Facility operation is expected to begin in the 2030s and the Facility intends to operate for 40 years until the 2070s when the decommissioning would begin. Decommissioning activities, however, are typically similar to construction activities and involve heavy equipment to remove building materials, such as wood, concrete, and steel, and process equipment from the site. Decontaminated and non-radiologically impacted building structures and roadways are likely to remain in place post-decommissioning for future reuse. As such, direct and indirect impacts from decommissioning are anticipated to be SMALL, similar to or less than the impacts associated with construction and contained within the previously disturbed site boundary.

### 4.1.2 Cumulative Impacts

There are no future projects outside of OE's use of the site expected to occur. The impacts of the change in land use are anticipated to be SMALL.

The geographic area of interest for land use impacts is the Site. OE intends to request Tennessee Valley Authority (TVA) to relocate their 161 kV transmission line which is currently passing through the property, to the edge of the Site along TN-95 to allow for the construction of the Facility. This would not result in a notable aggregate effect in conjunction with the effects of the Proposed Action.

Because the identified past, present and reasonably foreseeable future activities would result in localized effects only, the cumulative effect of the Project, added to effects associated with past, present, or reasonably foreseeable future projects, is SMALL.

Because the Project would not result in noticeable impacts to land use beyond the Site, the impact of the incremental contribution of either the preconstruction activities or the U.S. Nuclear Regulatory Commission (NRC)-authorized activities related to construction, operation and decommissioning of the Facility on land use is not a significant contributor to the SMALL cumulative impact. The cumulative land use impacts to the Facility is SMALL.

## 4.2 TRANSPORTATION IMPACTS

### 4.2.1 Proposed Action

Under the Proposed Action, the Facility is constructed and operated at the Site. The impact on the transportation resources are detailed in the following sections.

#### 4.2.1.1 Impact of Constructing an Access Road

Temporary areas, such as construction laydown and craft parking would be located on the Site.. A new access road (Access Road) from State Route 95 (SR-95) to the Facility will be at the intersection of SR-95 and Novus Drive. Due to the existing municipal road infrastructure, the impacts of the Access Road would be SMALL.

Based off the traffic study completed, the following recommendations for site access improvements and mitigation of increased traffic have been made to TDOT:

- Installation of a traffic control signal. (Figure 4-1)
- Installation of a northbound right turn lane with 300 feet of storage on SR-95.
- Installation of a southbound left turn lane with 300 feet of storage on SR-95.
- Restriping the existing eastbound approach to an exclusive left turn lane, a through lane, and a right turn lane on Novus Drive.
- Providing an exclusive left turn lane and a shared through/right lane for the westbound approach on the site access road.

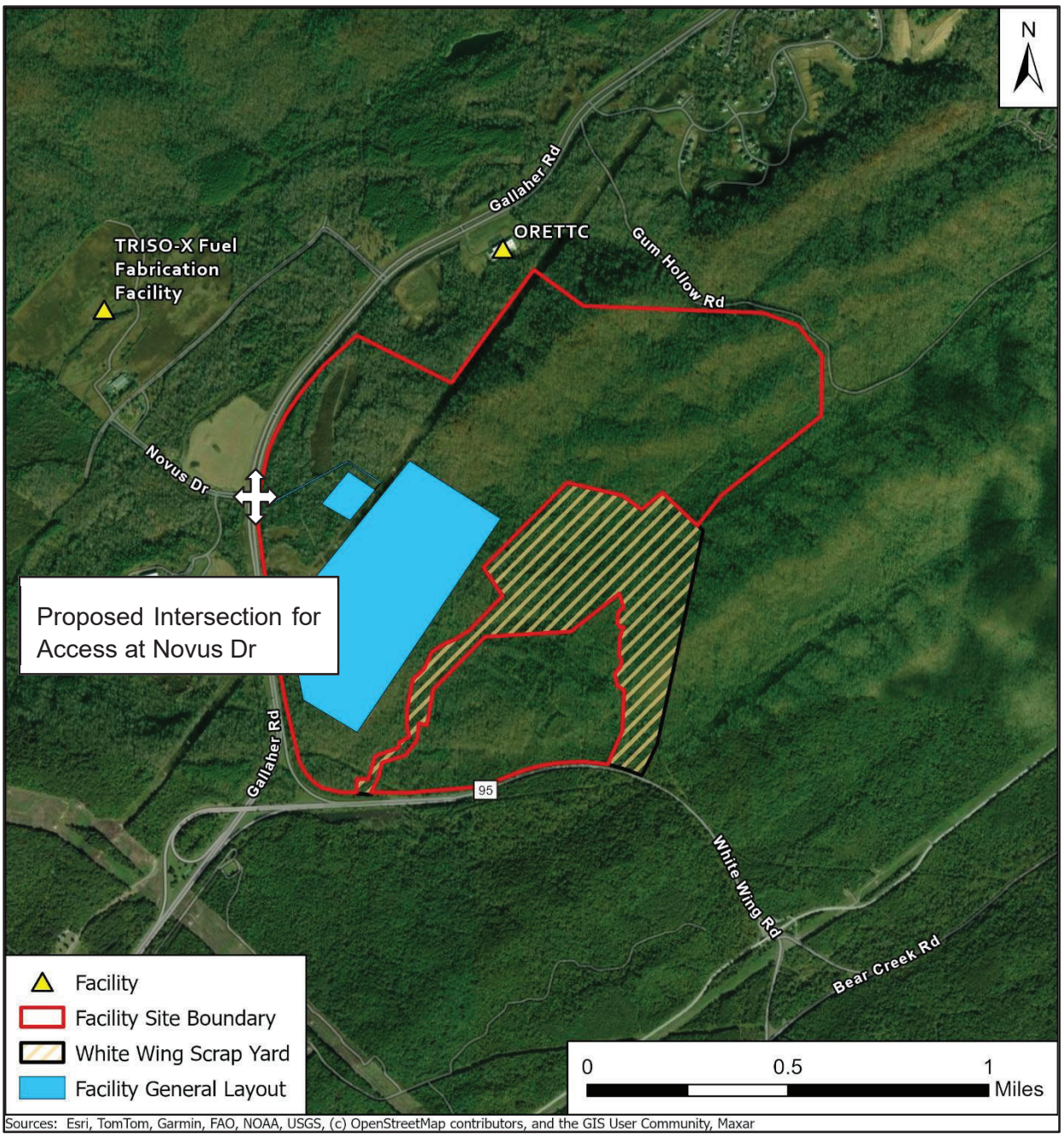



**Figure 4-1 Proposed Intersection at Novus Drive for Access to Facility Site**

With the recommendations above implemented, the traffic impacts of a new site access road at SR-95 and Novus Drive would be SMALL.

#### 4.2.1.2 Transportation Mode

The Facility uses trucks as common carriers for shipments during construction, operations, and decommissioning. Therefore, the impacts of rail traffic are not evaluated. Similarly, the impacts of air traffic are not evaluated. Therefore, the mode of transportation for the Facility consists of over-

the-road trucks. Vehicles and equipment are typical of those used in industrial/commercial construction. The primary transportation mode for the workforce would be by car.

#### 4.2.1.3 Transportation Routes

The transportation routes for the Facility are described in Section 3.2. These routes are used for construction, operational and decommissioning phases.

#### 4.2.1.4 Impacts from Construction

The impacts to transportation due to the construction of the Facility are presented in Table 4-1. The values in this table are bounding based on work schedule optimization.

Table 4-1 compares the anticipated increase in traffic from construction activities to average daily traffic counts from main roads to and from the Site. Traffic counts are available from Tennessee Department of Transportation (TDOT 2025). Table 4-1 shows the incremental impacts of the temporary increase in traffic on the regional transportation system from construction-related activity are SMALL.

Additional traffic and equipment movement would generate fugitive dust and noise. These impacts are discussed fully in Sections 4.6 and 4.7.

The overall impact of traffic volume increases associated with construction of the Facility would be SMALL. The impacts of traffic volume increases associated with construction of the Facility would be mitigated by designing the Access Road to minimize the disruption of traffic flow, particularly during the times of peak commute.

#### 4.2.1.5 Impacts from Operation

The impacts to transportation due to the operation of the Facility can be found in Table 4-2. The values in this table are bounding based on work schedule optimization.

Table 4-4, presents the materials, container types, and estimated annual traffic due to operational deliveries.

As discussed in Section 4.13, the annual volume of waste from operations would be small.

Table 4-2 captures the expected combined daily trips during operations. Table 4-2 shows that the increase in traffic from operations would be small; therefore, the overall impact are SMALL.

#### 4.2.1.6 Impacts from Decommissioning

The plans for decommissioning of the Facility are described in Chapter 10 of the License Application.

Staffing and shipments for decommissioning activities would be substantially lower than for construction activities. Therefore, transportation impacts due to decommissioning activities will be SMALL.

**Table 4-1 Estimated Impacts from Project-Related Traffic During Construction (2028)**

| Location of Traffic Count | TDOT Identifier | 5-Year Average Daily Traffic Count (2020 - 2024) | Project Daily Traffic Volume (2028) | Construction-Related Daily Round Trip Increase | Construction- Related Impact on Local Traffic (Percent) |
|---|---|---|---|---|---|
| Oak Ridge Turnpike (SR-95) | 73000059 | 12,379 | 15,334 | 608 | 4.0 |
| White Wing Road (SR-95) | 73000058 | 6,877 | 8,036 | 304 | 3.8 |
| Oak Ridge Turnpike (SR 58) | 73000060 | 13,559 | 17,188 | 304 | 1.8 |
| Gallagher Road East of Kingston (SR 58) | 73000061 | 12,301 | 13,903 | 304 | 2.2 |

**Notes**:
Number of construction workers per day: 590
Number of daily material deliveries and waste removals: 1
Number of daily trucks for construction: 17
Total daily round trips for workers and deliveries: 608

**Table 4-2 Estimated Impacts from Project-Related Traffic During Operation (2035)**

| Location of traffic count | TDOT Identifier | 5-Year Average Daily Traffic count (2020 – 2024) | Project Daily Traffic Volume (2035) | Operation- Related Daily Round Trip Increase | Project-Related Impact on Local Traffic (Percent) |
|---|---|---|---|---|---|
| Oak Ridge Turnpike (SR-95) | 73000059 | 12,379 | 18,859 | 982 | 5.2 |
| White Wing Road (SR-95) | 73000058 | 6,877 | 9,883 | 491 | 5.0 |
| Oak Ridge Turnpike (SR 58) | 73000060 | 13,559 | 21,139 | 491 | 2.3 |
| Gallagher Road East of Kingston (SR 58) | 73000061 | 12,301 | 17,099 | 491 | 2.9 |

**Notes**:
Number of employees per day: 390
Number of daily material deliveries and waste removals: 2
Number of construction workers per day: 590
Total daily round trips for employees, visitors, construction workers, and material delivery/waste removal: 982

**Table 4-3 Supply Materials Shipped to the Facility During Construction**

| Mode of Shipment | Year | Estimated Number of Truck Shipments per Year |
|---|---|---|
| Truck | 1 | 3,375 |
| Truck | 2 | 4,220 |
| Truck | 3 | 3,000 |
| Truck | 4 | 1,600 |
| Truck | 5 | 1,650 |
| Truck | 6 | 600 |
| Truck | 7 | 300 |
| Truck | 8+ | 1,000 |

### 4.2.2 Radioactive Material Transportation

Radioactive material shipments would be transported in packages that meet the requirements of 10 CFR 71 and 49 CFR 171-178. The NRC has evaluated the environmental impacts resulting from the transport of nuclear materials in NUREG-0170, (NRC 1977b), updated by NUREG/CR-4829, (NRC 1987). These references include accident scenarios related to the transportation of radioactive material. The NRC found that these accidents have no significant environmental impacts. The materials that would be transported to and from the Facility are within the scope of the environmental impacts previously evaluated by the NRC. Because these accident-related impacts have been addressed in a previous NRC Environmental Impact Statement (EIS) (NRC 1977b), these impacts do not require further evaluation in this report.

The dose equivalent to the public and workers from incident-free transportation as well as the Maximally Exposed Individual (MEI) have been conservatively calculated to illustrate the relative impact resulting from transporting radioactive material. Uranium feed, product, tails and associated LLW would be transported to or from the Facility. The following sections describe each of these conveyances, associated routes, and the dose contribution to the public and worker, as well as non-radiological environmental impacts associated with vehicle transportation.

#### 4.2.2.1 Radioactive Material Annual Quantities

The annual radioactive material quantity of packages and associated shipments transported to and from the Facility are summarized in Table 4-4, are discussed separately below.

**Table 4-4 Annual Radioactive Material Quantities and Shipments**

| Material | Container Type | Container/yr | Containers/Truck Shipment | Shipments/yr |
|---|---|---|---|---|
| Feed | 48-inch cylinder | 1,350 | 1 | 1,350 |
| Empty Feed | 48-inch cylinder | 1,350 | 2 | 675 |
| Product | 30-inch cylinder | 880 | 2 | 440 |
| Empty Product | 30-inch cylinder | 880 | 2 | 440 |
| $DUF_6$[a] | 48-inch cylinder | - | - | - |
| Empty $DUF_6$ | 48-inch cylinder | 1,200 | 2 | 600 |
| Radwaste | 55-gallon Drums | 900 | 60 | 15 |
| Other Waste | B-25 package | 240 | 2 | 120 |
| **Total** | | | | **3,640** |

Note: $DUF_6$ are stored at site until decommissioning

##### 4.2.2.1.1 Uranium Feed

The uranium feed for the Facility is natural uranium in the form of uranium hexafluoride ($UF_6$). The $UF_6$ would be transported to the Facility in 48-inch cylinders. These cylinders are designed, fabricated and shipped in accordance with American National Standard Institute (ANSI) N14.1 (ANSI 2023).

##### 4.2.2.1.2 Uranium Product

The enriched uranium product from the Facility would be transported in 30-inch cylinders. These cylinders are designed, fabricated and shipped in accordance with ANSI N14.1 (ANSI 2023).

##### 4.2.2.1.3 Depleted Uranium

Depleted uranium ($DUF_6$) would be shipped to conversion facilities via truck in 48-inch cylinders like the uranium feed cylinders. These 48-inch cylinders are designed, fabricated and shipped in accordance with ANSI N14.1 (ANSI 2023).

##### 4.2.2.1.4 Radioactive Waste

Waste materials are transported in packages by truck via highway in accordance with 10 CFR 71 and 49 CFR 171-178. Detailed descriptions of radioactive waste (radwaste) materials that would be shipped from the Facility for disposal are presented in Section 4.13.

##### 4.2.2.1.5 Empty Cylinders

The empty cylinders are empty uranium feed, uranium product, and $DUF_6$ cylinders.

#### 4.2.2.2 Transportation Modes, Treatment and Packaging

The radioactive materials transported to and from the Facility would be transported by truck by way of highway travel only, since rail spurs and barge slips are not available at the Facility site.

There would be no treatment of hazardous materials or mixed waste at the Facility that would require a Resource Conservation Recovery Act (RCRA) permit. Specific handling of radioactive and mixed waste is discussed, in detail, in Section 4.13. Packaging of product material, radioactive waste and mixed waste would be done in accordance with the Facility implementation procedures that follow 10 CFR 71 and 49 CFR 171-178. Product shipments would have additional packaging controls and in accordance with ANSI N14.1 (ANSI 2023). Radwaste materials would have additional packaging controls in accordance with each respective disposal or processing site's acceptance criteria.

#### 4.2.2.3 Transportation Routes and Distances

Table 4-5 presents potential origins and destination sites for the transportation of radioactive material along with the approximate distances as generated from the Web-Based Transportation Routing Analysis Geographic Information System (WebTRAGIS) computer code (Peterson 2018).

**Table 4-5 Potential Transportation Origins/Destinations and Distances**

| Facility | To or From the Facility | Type Description | Route Characteristic | Distance mi |
|---|---|---|---|---|
| $UF_6$ Conversion Facility Port Hope, Ontario [(a)] | To/From To | Feed / Empty Feed Empty $DUF_6$ | Commercial | 897 |
| $UF_6$ Conversion Facility Metropolis, IL | To/From To | Feed / Empty Feed Empty $DUF_6$ | Commercial | 269 |
| $UF_6$ Conversion Facility Overseas Port: Portsmouth, VA | To/From To | Feed / Empty Feed Empty $DUF_6$ | Commercial | 479 |
| $UF_6$ Conversion Facility Overseas Port: Baltimore, MD | To/From To | Feed / Empty Feed Empty $DUF_6$ | Commercial | 517 |
| Fuel Fabrication Facility Richland, WA | To/From | Empty Product / Product | HRCQ | 2,301 |
| Fuel Fabrication Facility Columbia, SC | To/From | Empty Product / Product | HRCQ | 267 |
| Fuel Fabrication Facility Wilmington, NC | To/From | Empty Product / Product | HRCQ | 468 |
| Fuel Fabrication Facility Overseas Port: Portsmouth, VA | From | Product | HRCQ | 485 |
| Fuel Fabrication Facility Overseas Port: Baltimore, MD | From | Product | HRCQ | 533 |
| Waste Control Specialist (WCS) Andrews, TX | From | Radwaste Disposal | Commercial | 1,123 |
| Energy Solutions Clive, UT | From | Radwaste Disposal | Commercial | 1,733 |

| Facility | To or From the Facility | Type Description | Route Characteristic | Distance mi |
|---|---|---|---|---|
| Energy Solutions Oak Ridge, TN | From | Radwaste Disposal | Commercial | 1 |
| $DUF_6$ Conversion Facility Paducah, KY | To | Empty $DUF_6$ | Commercial | 274 |
| $DUF_6$ Conversion Facility Portsmouth, OH | To | Empty $DUF_6$ | Commercial | 269 |

(a) Added 170-mi to WebTRAGIS output to account for route from Port of Buffalo, NY to Port Hope, ON. This portion of the route was assumed to be entirely urban for conservatism.

#### 4.2.2.4 Incident Free Dose Radiological Impact

NRC Radioactive Material Transport (NRC-RADTRAN or RADTRAN) was used to calculate the incident-free radiation dose to drivers, inspectors, and the public (Weiner, et al. 2013). The calculation of the dose was based on WebTRAGIS location-specific results, applicable NRC RADTRAN model inputs used in NUREG-1790 (NRC 2005), and transportation impact assessments performed by U.S. Department of Energy (DOE) (DOE 1999) (DOE 2001) (DOE 2002). The NRC and DOE RADTRAN model inputs are similar to the Facility model inputs designed for the uranium enrichment cycle radioactive material shipments. Any differences in the Facility model inputs were due to site location and throughput. Table 4-4, Table 4-5 and Table 4-6, indicate the parameters and relevant quantities that affected the Facility model inputs.

Table 4-8, indicates the incident-free dose to the public and workers affected by the transportation of radioactive materials to and from the Facility. Additionally, a scenario-based methodology was used to estimate the dose to the Maximally Exposed Individual (MEI) based on conservative shipment parameters and exposure durations. The MEI results are given per individual in Section 4.2.2.4.2. Table 4-11 presents the non-radiological environmental impact of radioactive material transportation to and from the Facility.

##### 4.2.2.4.1 Worker and Public

This section summarizes the incident-free transportation environmental impacts during the anticipated 40-year operations life of the Facility. Transportation categories include the transport of full and empty feed cylinders, full and empty product cylinders, full and empty $DUF_6$ cylinders, and radwaste containers. Containers would be loaded onto trailers for truck transportation to and from the Facility. The incident-free dose to the worker and public during the transportation of radioactive material was calculated using the WebTRAGIS (Peterson 2018) and RADTRAN (Weiner, et al. 2013) computer codes.

The WebTRAGIS code was used to obtain the origin/destination combinations and is presented in Table 4-4. WebTRAGIS inputs for Highway Route Controlled Quantity (HRCQ) route characteristics accounted for required state inspections. For a conservative estimate for dose impacts, this characteristic was also used for commercial routes. For all the routes, each material shipment was considered to be exclusive use and retained a two-man truck crew 16.5 ft away from the containers. Links prohibiting truck use, ferry crossings, and roads with hazardous materials were not considered.

The WebTRAGIS output for the various cases is presented in Table 4-7. Table 4-7 and Table 4-8 show the potential transportation routes for each category of radioactive material. To assess the most conservative (maximum) impact, the furthest distance for each respective facility per shipment type from Facility were chosen for analysis.

**Table 4-6 Waste Materials Shipped from the Facility During Construction**

| Mode of Shipment | Year | Type of Waste Material | Destination of Shipment | Estimated Number of Shipments per Year |
|---|---|---|---|---|
| Truck | 1 | Construction Debris | Landfill | 150 |
| Truck | 2 | Construction Debris | Landfill | 275 |
| Truck | 3 | Construction Debris | Landfill | 275 |
| Truck | 4 | Construction Debris | Landfill | 275 |
| Truck | 5 | Construction Debris | Landfill | 250 |
| Truck | 6 | Construction Debris | Landfill | 200 |
| Truck | 7 | Construction Debris | Landfill | 200 |

**Table 4-7 WebTRAGIS Output**

| Facility | Stops (Rest[a] / Gas[b] / Inspection[c]) | Link | Distance (mi) | Population Density [d] (people / mi$^2$) |
|---|---|---|---|---|
| $UF_6$ Conversion Facility Port Hope, Ontario [e] | 5 / 1 / 5 | Rural | 467 | 64.5 |
| | | Suburban | 235 | 1571.3 |
| | | Urban | 180 | 8723.1 |
| $UF_6$ Conversion Facility Metropolis, IL | 1 / 0 / 2 | Rural | 194 | 69.5 |
| | | Suburban | 75 | 1081.7 |
| | | Urban | 1 | 3868.1 |
| $UF_6$ Conversion Facility Overseas Port: Portsmouth, VA | 2 / 0 / 2 | Rural | 268 | 69.5 |
| | | Suburban | 197 | 1145.6 |
| | | Urban | 15 | 5844.2 |
| $UF_6$ Conversion Facility Overseas Port: Baltimore, MD | 2 / 0 / 3 | Rural | 268 | 97.8 |
| | | Suburban | 228 | 1974.2 |
| | | Urban | 22 | 4774.0 |
| Fuel Fabrication Facility Richland, WA | 15 / 4 / 10 | Rural | 1912 | 53.9 |
| | | Suburban | 371 | 1649.5 |
| | | Urban | 19 | 4782.5 |
| Fuel Fabrication Facility Columbia, SC | 1 / 0 / 2 | Rural | 163 | 67.4 |
| | | Suburban | 98 | 1099.9 |
| | | Urban | 7 | 4130.0 |
| Fuel Fabrication Facility Wilmington, NC | 2 / 0 /1 | Rural | 206 | 75.2 |
| | | Suburban | 252 | 1099.9 |
| | | Urban | 11 | 4143.9 |

| Facility | Stops (Rest[a] / Gas[b] / Inspection[c]) | Link | Distance (mi) | Population Density [d] (people / mi$^2$) |
|---|---|---|---|---|
| Fuel Fabrication Facility Overseas Port: Portsmouth, VA | 2 / 0 / 1 | Rural | 282 | 65.4 |
| | | Suburban | 196 | 943.5 |
| | | Urban | 8 | 5073.3 |
| Fuel Fabrication Facility Overseas Port: Baltimore, MD | 2 / 1 / 3 | Rural | 267 | 100.7 |
| | | Suburban | 247 | 1914.4 |
| | | Urban | 20 | 4774.0 |
| Waste Control Specialist (WCS) Andrews, TX | 9 / 2 / 2 | Rural | 834 | 51.7 |
| | | Suburban | 241 | 1345.4 |
| | | Urban | 48 | 5008.7 |
| Energy Solutions Clive, UT | 10 / 3 / 7 | Rural | 1454 | 69.5 |
| | | Suburban | 261 | 1565.8 |
| | | Urban | 18 | 5196.8 |
| Energy Solutions Oak Ridge, TN | 0 / 0 / 0 | Rural | 1 | 31.2 |
| | | Suburban | - | - |
| | | Urban | - | - |
| Depleted $UF_6$ Conversion Facility Paducah, KY | 1 / 0 / 1 | Rural | 196 | 69.5 |
| | | Suburban | 79 | 1081.7 |
| | | Urban | 1 | 3868.1 |
| Depleted $UF_6$ Conversion Facility Portsmouth, OH | 1 / 0 / 2 | Rural | 174 | 67.5 |
| | | Suburban | 96 | 989.5 |
| | | Urban | - | - |

(a) Rest Stops assumed to be every 4 hours, in accordance with WebTRAGIS User Manual for two drivers (Peterson, 2018)

(b) Gas stops assumed to take place every 525 mi in accordance with DOE, 2002b

(c) Inspection stops assumed to be at every state border crossing for all routes.

(d) Maximum population density reported for each link type

(e) Added 170-mi and one inspection stop to WebTRAGIS output to account for the portion of the route located in Canada. WebTRAGIS only accounts for U.S. routes. The Canadian portion of the route was assumed to be entirely urban for conservatism.

Based on the WebTRAGIS output in Table 4-7, the origin/destination routes that would have the highest impact per shipment type as a result of the longest distance to the respective facility to or from Facility and therefore demonstrate the most conservative impact.

- Uranium Feed: Port Hope, Ontario
- Uranium Product: Richland, WA
- Radwaste: Clive, UT
- $DUF_6$: Paducah, KY
- Empty Feed: Port Hope, Ontario
- Empty Product: Richland, WA

- Empty $DUF_6$: Port Hope, Ontario

The WebTRAGIS demographic results from Table 4-8 were used as RADTRAN inputs for each route. The RADTRAN input parameters, based on packaging and route characteristics, are presented in Table 4-9, and Table 4-10.

The number of annual shipments for each material is presented on Table 4-4. The number of containers per truck assumed is summarized in Table 4-4. Other RADTRAN inputs used are provided in Table 4-9 and Table 4-10.

RADTRAN results for incident-free transportation dose to the worker (crew) and public (off-link; on-link; rest, gas, and inspection stops; and person in traffic obstruction) are summarized on Table 4-8. The off-link dose correlates to residents that are located along the route and the on-link dose correlates to occupants of vehicles that share the route. The transportation dose represents the dose incurred during exclusive use transport and is exclusive of worker dose associated with Facility on-site shipment preparation activities. The dose is conservative based on the maximum impact, origin/destination scenarios for each radioactive material type, and the container dose rate.

**Table 4-8 Annual Incident-Free Dose from Radioactive Material Transportation**

| | | Incident-Free Dose, person-Sv/yr (person-rem/yr) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Stops | | | |
| **Origin / Destination** | **Radioactive Material** | **Worker Crew** | **Off-Link** | **Public On-Link** | **Rest Stops** | **Gas Stops** | **Inspection Stops** | **Person In Traffic** |
| Port Hope, ON | Feed | 2.63E-01 | 7.36E-03 | 6.28E-01 | 1.77E-02 | 1.42E-02 | 3.27E-02 | 1.96E-02 |
| | | (2.63E+01) | (7.36E-01) | (6.28E+01) | (1.77E+00) | (1.42E+00) | (3.27E+00) | (1.96E+00) |
| Port Hope, ON | Empty Feed | 3.96E-01 | 1.12E-02 | 5.08E-01 | 4.98E-02 | 3.98E-02 | 6.70E-02 | 4.02E-02 |
| | | (3.96E+01) | (1.12E+00) | (5.08E+01) | (4.98E+00) | (3.98E+00) | (6.70E+00) | (4.02E+00) |
| Port Hope, ON | Empty $DUF_6$ | 3.52E-01 | 1.80E-02 | 1.57E+00 | 4.43E-02 | 3.54E-02 | 5.95E-02 | 3.57E-02 |
| | | (3.52E+01) | (1.80E+00) | (1.57E+02) | (4.43E+00) | (3.54E+00) | (5.95E+00) | (3.57E+00) |
| Richland, WA | Product | 3.70E-01 | 1.64E-03 | 3.21E-02 | 8.49E-03 | 9.06E-03 | 1.49E-02 | 4.44E-03 |
| | | (3.70E+01) | (1.64E-01) | (3.21E+00) | (8.49E-01) | (9.06E-01) | (1.49E+00) | (4.44E-01) |
| Richland, WA | Empty Product | 3.70E+00 | 1.34E-02 | 3.33E-01 | 8.49E-02 | 9.06E-02 | 1.49E-01 | 4.49E-02 |
| | | (3.70E+02) | (1.34E+00) | (3.33E+01) | (8.49E+00) | (9.06E+00) | (1.49E+01) | (4.49E+00) |
| Clive, UT | Radwaste | 9.69E-03 | 1.77E-04 | 2.39E-03 | 8.88E-04 | 4.26E-05 | 7.62E-04 | 3.27E-04 |
| | | (9.69E-01) | (1.77E-02) | (2.39E-01) | (8.88E-02) | (4.26E-03) | (7.62E-02) | (3.27E-02) |
| | | | | | | | Total | 2.04E-05 |
| | | | | | | | | (2.04E-03) |

## Table 4-9 RADTRAN Inputs

| Input Parameter | Value | | Reference | Section |
|---|---|---|---|---|
| | m | ft | | |
| 48-inch Packaging Length | 3.8 | 12.5 | (NRC 2005) | Table D-4 |
| 48-inch Packaging Diameter | 1.22 | 4.0 | (NRC 2005) | Table D-4 |
| 30-inch cylinder Packaging Length | 2.06 | 6.8 | (NRC 2005) | Table D-2 |
| 30-inch cylinder Packaging Diameter | 0.76 | 2.5 | (NRC 2005) | Table D-2 |
| 55-gallon Drum Packaging Height | 0.889 | 2.9 | (DOE 2002) | Table 6.1 |
| 55-gallon Drum Packaging Diameter | 0.61 | 2.0 | (DOE 2002) | Table 6.1 |
| Crew Distance to Package | 2.5 (e) | 8.2 | (Weiner, et al. 2013) | Section 7.7 |
| Dose Rate at 1-m from Package mSv/hr (mrem/hr) - Feed, Product, Radioactive Waste | 0.01 | 1 | (f) | - |
| Dose Rate at 1-m from Package mSv/hr (mrem/hr) - Empty Feed, Empty $DUF_6$ | 0.03 | 3 | (f) | - |
| Dose Rate at 1-m from Package mSv/hr (mrem/hr) - Empty Product | 0.10 | 10 | (f) | - |
| Number of Truck Crew | 2 | | (NRC 2005) | Table D-13 |
| Number of People in Adjacent Vehicles | 2 | | (NRC 2005) | Table D-13 |
| Shielding Factor (a) | 1 | | - | - |
| People at Stops (Break / Gas) | 25 | | (NRC 2005) | Table D-13 |
| Stop Distance, [Break / Gas] | 20 | 65.6 | (NRC 2005) | Table D-13 |
| People at Stops (Inspection / Resident / Person in Traffic Obstruction) | 1 | | (DOE 2001) | Section 5.5 |
| Stop Distance, [Inspection] | 3 | 9.8 | (DOE 2001) | Section 5.5 |
| Stop Distance, [Resident] | 30 | 98.4 | (DOE 2001) | Section 5.5 |
| Stop Distance, [Person in Traffic Obstruction] | 1 | 3.3 | (DOE 2001) | Section 5.5 |
| Stop Time, hr/stop (Break / Inspections / Person in Traffic) | 0.5 | | (Weiner, et al. 2013) | Default |
| Stop Time, hr/stop (Gas) | 2 | | (DOE 2001) | Section 5.5 |
| Stop Time, hr/stop (Resident) (b) | 0.02 | | Assumption | - |
| Farm Fraction | 0.5 | | (Weiner, et al. 2013) | Default |
| Canadian Population Density (c), persons/$km^2$ | 3,368 | | (Canada 2016) | - |
| Canadian Daily Traffic Information (d), vehicles/hour | 4,865 | | (MOT 2021) | - |

(a) For conservatism, no shielding factors were used on all inputs that required it.

(b) Nearby resident stop time determined to conservatively take 1 minute for the truck to pass by the resident. Based on (DOE 2001) providing an average speed of 15 mph. With this speed, the truck would travel 0.25 mi in 1 minute.

(c) Canadian population density assumed to be entirely urban for conservatism on the RADTRAN route. Equal to the largest urban area in which the route encounters, which is Toronto.

(d) To account for the heavy traffic on Highway 401, the average annual daily traffic (AADT) for all points that were reported on Highway 401 were averaged and set to hourly conditions.

(e) Weiner, 2013 lists typical values for large trailer rigs at 2 to 3 meters. 2.5 meters is mid-range.

(f) Conservative value based on (NRC 2005), (NRC 2006), DOE, 1999, (DOE 2001), (DOE 2002), and actual cylinder transportation experience

**Table 4-10 RADTRAN Vehicle Density Information**

| | Traffic Density (vehicles/hr) [(a)] | | |
|---|---|---|---|
| **State** | **Rural** | **Suburban** | **Urban** |
| AR | 897 | 1,498 | 3,003 |
| CO | 1,248 | 2,342 | 4,051 |
| IA | 992 | 1,588 | 2,157 |
| ID | 1,123 | 2,670 | 5,624 |
| IL | 1,200 | 2,466 | 4,408 |
| KS | 926 | 1,610 | 2,463 |
| KY | 1,427 | 2,776 | 5,611 |
| MD | 1,953 | 3,656 | 6,100 |
| MO | 926 | 1,610 | 2,463 |
| NC | 1,427 | 2,776 | 5,611 |
| NE | 833 | 1,685 | 3,075 |
| NY | 835 | 1,818 | 4,002 |
| OH | 1,824 | 2,655 | 4,241 |
| OR | 1,123 | 2,670 | 5,624 |
| PA | 2,056 | 3,655 | 5,748 |
| SC | 1,427 | 2,776 | 5,611 |
| TN | 1,570 | 2,735 | 4,121 |
| TX | 897 | 1,498 | 3,003 |
| UT | 731 | 1,958 | 3,940 |
| VA | 2,056 | 3,655 | 5,748 |
| WA | 1,123 | 2,670 | 5,624 |
| WV | 2,056 | 3,655 | 5,748 |
| WY | 795 | 1,956 | 3,708 |
| Canada [(b)] | - | - | 4,865 |

(a) State specific data taken from Weiner et. Al, 2013. For states not specifically listed, the state data was taken from the respective EPA region.

(b) To account for the heavy traffic on Highway 401, the average annual daily traffic (AADT) for all points that were reported on Highway 401 were averaged and set to hourly conditions.

**Table 4-11 Feed, Empty Feed, and Empty $DUF_6$ Cylinders Non-Radiological Incident Risk**

| State | Accidents [a] Accidents / trk-mi | Incident Rate Fatalities[a] (Fatalities / trk-mi) | Injuries [a] (Injuries / trk-mi) | Route Distance [b] (mi) | Accidents | Risk Fatalities | Injuries |
|---|---|---|---|---|---|---|---|
| NY [c] | 5.55E-07 | 2.00E-08 | 2.98E-07 | 102.99 | 3.55E-05 | 1.28E-06 | 1.91E-05 |
| PA | 8.27E-07 | 2.17E-08 | 6.16E-07 | 184 | 1.52E-04 | 4.00E-06 | 1.13E-04 |
| TN | 1.98E-07 | 1.61E-08 | 1.48E-07 | 126 | 2.49E-05 | 2.03E-06 | 1.87E-05 |
| VA | 6.32E-07 | 2.59E-08 | 4.99E-07 | 94 | 5.94E-05 | 2.44E-06 | 4.69E-05 |
| WV | 2.77E-07 | 2.70E-08 | 1.80E-07 | 243 | 6.73E-05 | 6.57E-06 | 4.38E-05 |
| Canada [d] [e] | 9.96E-07 | 3.38E-08 | 7.44E-07 | 186 | 1.86E-04 | 6.30E-06 | 1.39E-04 |
| Sum (per trip): | | | | 897 | 5.25E-04 | 2.26E-05 | 3.80E-04 |
| | | | | | | | |
| Annual Feed Risk (risk/trip x 1,350 ship/yr x 2 round-trip/ship): | | | | | 1.42E+00 | 6.10E-02 | 1.03E+00 |
| | | | | | | | |
| Annual Empty Feed Risk (risk/trip x 675 ship/yr x 2 round-trip/ship): | | | | | 7.09E-01 | 3.05E-02 | 5.14E-01 |
| | | | | | | | |
| Annual Empty Depleted Uranium Risk (risk/trip x 600 ship/yr x 2 round-trip/ship): | | | | | 6.30E-01 | 2.71E-02 | 4.56E-01 |

(a) From Table 4 (Saricks and Tompkins 1999)
(b) From WebTRAGIS Output
(c) From Table 4 (Saricks and Tompkins 1999), New York did not list "Interstate, Primary, and Other". Only provided "Total" rates. Data taken for New York is "Total"
(d) Fatality and Injury rates for heavy trucks taken from (Mayhew, Simpson and Beirness 2004)
(e) Mayhew et al., 2004 did not provide accident rates. Canada accident rate taken as 95th percentile in the United States for conservatism

#### 4.2.2.4.2 Maximally Exposed Individual

The MEI is a person who would likely receive the highest radiation dose from a shipment to and/or from the Facility. The MEI impact is the potential dose for individuals exposed to any one shipment given the maximum exposure for all pathways. The dose from the shipment is independent of source and is based on the postulated exposure scenarios. The incident-free MEI scenario assumptions are taken from the other uranium enrichment cycle environmental analyses such as the DOE Final Programmatic EIS (FPEIS) for Depleted Uranium (DOE 1999) and the DOE/Argonne National Laboratory (ANL) Transportation Impact Assessment for Shipment of Uranium Hexafluoride (DOE 2001). The RADTRAN analysis is based on assumptions about exposure durations, dose rate, and the number of times an individual may be exposed to an offsite shipment. The assumptions for workers and the public are as follows (DOE 1999) and (DOE 2001):

Workers

Truck Crew Members: Truck crew members are assumed to be occupational radiation workers and would be monitored by a dosimetry program. Therefore, the maximum allowable dose would be limited by 10 CFR Part 20. Non-radiation workers, or the general public would receive much less exposure, as demonstrated below.

General Public

Inspectors: Inspectors are assumed to be either federal or state vehicle inspectors. Inspectors are not assumed to be monitored by a dosimetry program. An average exposure distance of 9.9 ft, an exposure duration of 30 minutes and unshielded exposure are assumed.

Resident: A resident is assumed to live 98 ft from a site entrance route. Shipments are assumed to conservatively take one minute to pass the nearest resident, and the resident is exposed unshielded. Cumulative doses are assessed for each site on the basis of the number of shipments entering or exiting the site, with the assumption that the resident is present for 100% of the shipments.

Person in Traffic Obstruction: A person is assumed to be in a vehicle that has got stopped in traffic and the vehicle is next to a shipment (e.g., because of traffic slowdown). This receptor is assumed to be exposed unshielded at a distance of 3.3 ft for 30 minutes.

Person at Truck Service Station (Gas Stops): A person is assumed to be exposed at an average distance of 66 ft for a duration of two hours. This receptor could be a worker at a truck stop.

Person at Truck Service Station (Rest stops): A person is assumed to be exposed at an average distance of 66 ft for a duration of 30 minutes. This receptor could be a worker at a truck stop or nearby passenger vehicles.

The conservative vehicle dose rate assumption of 0.05 mSv/hr (5.00 mrem/hr), i.e., the average dose for empty products cylinders, at 3.3 ft was used for the public MEI dose calculation.

Worker MEI Dose

For any radioactive material type shipments, the crew member doses would be limited to 0.05 Sv (5.00 rem) per year, i.e., the limit for occupational exposures specified in 10 CFR Part 20. An MEI worker could receive a potential maximum dose of 0.05 Sv/yr (5.00 rem/yr).

Public MEI Dose

From other enrichment cycle analyses (DOE 1999), (DOE 2002) that use the above assumptions, the MEI exposure scenario exhibiting the maximum dose to the public is the Person in Traffic Obstruction. For any given facility using these same assumptions, the Person in Traffic Obstruction scenario would always yield the most conservative or maximum exposure for all public exposure scenarios. This is because the only other input to the calculation is the shipment dose rate, which is a constant across all shipment scenarios. For the Facility, the empty product cylinder shipments would yield the highest exposure. An exposure to empty product cylinder shipments of 0.05 mSv/hr (5.00 mrem/hr) at 3.3 ft for 30 minutes, equates to a public MEI dose of 0.025 mSv (2.50 mrem) for one encounter. In a scenario where a commuter would become stuck in traffic next to a cylinder truck every work day of the year, 260- days (52 weeks/year x 5 days/week), the MEI of the public could receive a potential maximum dose of 260 times 0.025 mSv/yr (2.50 mrem/yr) or 6.50 mSv/yr (0.65 rem/yr).

### 4.2.3 Non-Radiological Environmental Impacts

#### 4.2.3.1 Vehicle Emissions Fatality Risks

The non-radiological impact from incident-free transportation to/from the Facility was analyzed for fatality risk from vehicle emissions. The vehicle emissions are independent of source material and dependent on the class of vehicles. Consistent with other uranium enrichment cycle analyses such as those presented in NUREG-1790 (NRC 2005), DOE/ANL Transportation Impact Assessment for Shipment of Uranium Hexafluoride (DOE 2001) and the DOE Transportation Handbook (DOE 2002), the Vehicle Emission Unit Risk Factors for Transportation Risk Assessments risk analysis (Butler and Biwer 1999) is used as a vehicle emission rate source for the Facility analysis. The conservative Class VIIIB vehicle emission rate of 8.36 E-10 fatalities/km (1.35 E-09 fatalities/mi) per 1 person/km$^2$ was used to calculate the risk.

The risk for each link is the product of the annual round-trip distance, number of annual shipments, population density, and the vehicle emission rate, where:

> Risk = link distance x 2 (round-trip) x annual shipments x population density x vehicle emission rate

Table 4-12 summarizes the maximum route distances, population densities and subsequent emission risk by material type for workers and the public.

## Table 4-12 Non-Radiological Environmental Impacts from Vehicle Incidents

| Facility | Link | Distance [a] mi | Annual Shipments [b] | Population Density | | Annual Risk Fatalities | |
|---|---|---|---|---|---|---|---|
| | | | | Worker [c] crew/mi$^2$ | Public [a] person/mi$^2$ | Worker [d] | Public [d] |
| Feed | Rural | 467.00 | 1350 | 5.18 | 64.49 | 3.39E-03 | 4.22E-02 |
| | Suburban | 405.87 | | | 1571.29 | 2.95E-03 | 8.94E-01 |
| | Urban | 9.00 | | | 8723.08 [e] | 6.54E-05 | 1.10E-01 |
| | Totals: | 881.88 | | | | 6.41E-03 | 1.05E+00 |
| Product | Rural | 1912.00 | 440 | 5.18 | 53.90 | 4.53E-03 | 4.71E-02 |
| | Suburban | 371.00 | | | 1649.49 | 8.78E-04 | 2.80E-01 |
| | Urban | 19.00 | | | 4782.49 | 4.50E-05 | 4.15E-02 |
| | Totals: | | | | | 5.45E-03 | 3.68E-01 |
| Radioactive Waste | Rural | 1453.98 | 15 | 5.18 | 69.49 | 1.17E-04 | 1.57E-03 |
| | Suburban | 261.01 | | | 1565.78 | 2.11E-05 | 6.37E-03 |
| | Urban | 18.00 | | | 5196.79 | 1.45E-06 | 1.46E-03 |
| | Totals: | | | | | 1.40E-04 | 9.40E-03 |
| Empty Feed | Rural | 467.00 | 675 | 5.18 | 64.49 | 1.70E-03 | 2.11E-02 |
| | Suburban | 405.87 | | | 1571.29 | 1.47E-03 | 4.47E-01 |
| | Urban | 9.00 | | | 8723.08 [e] | 3.27E-05 | 5.51E-02 |
| | Totals: | | | | | 3.20E-03 | 5.23E-01 |
| Empty Product | Rural | 1912.00 | 440 | 5.18 | 53.90 | 4.53E-03 | 4.71E-02 |
| | Suburban | 371.00 | | | 1649.49 | 8.78E-04 | 2.80E-01 |
| | Urban | 19.00 | | | 4782.49 | 4.50E-05 | 4.15E-02 |
| | Totals: | | | | | 5.45E-03 | 3.68E-01 |
| Empty Depleted Uranium Tails | Rural | 467.00 | 600 | 5.18 | 64.49 | 1.51E-03 | 1.88E-02 |
| | Suburban | 405.87 | | | 1571.29 | 1.31E-03 | 3.98E-01 |
| | Urban | 9.00 | | | 8723.08 [e] | 2.91E-05 | 4.90E-02 |
| | Totals: | | | | | 2.85E-03 | 4.65E-01 |
| **Sum of Totals** | | | | | | **2.35E-02** | **2.78E+00** |

(a) From Table 4-7, WebTRAGIS Output
(b) From Table 4-4, Annual Radioactive Material and Quantities and Shipments
(c) From Table 4-9, RADTRAN Input
(d) Risk based on 8.36E-10 fatalities/km per 1 person/km2 (Butler and Biwer 1999). Distance is doubled for round-trip transport
(e) Population density for Canada is assumed to be equal to 2011 Census data for Toronto

#### 4.2.3.2 Accident, Fatality, and Injury Risk

The non-radiological impact from radioactive material transportation to/from the Facility was analyzed for vehicle accidents, accident fatalities, and accident injuries. The impact is given in terms of annual risk based on the weighted incident rate (i.e., weighted distance) and the maximum distance traveled per year. The incident rates are based on the rate data per individual state from State-Level Accident Rates of Surface Freight Transportation: A Reexamination, Table 4 (Saricks and Tompkins 1999). The distance traveled through each state is provided via a WebTRAGIS output. All road designations for incident rate data were for interstate travel only, since primary and secondary road distances were not significant contributors to the total route distance. Table 4-13 and Table 4-14 presents the weighted incident rate calculation for accidents, fatalities, and injuries for shipment of feed, empty feed, empty $DUF_6$ cylinders, product & empty product cylinders, radwaste, and $DUF_6$ cylinders, respectively. The weighted incident rates are multiplied by the total round-trip distances traveled for each respective route to yield risk per round-trip (route distance x 2). The total annual risk is the sum of all shipment risks per year.

Table 4-15 presents the risk per trip and subsequent annual total risk for transportation incidents given the maximum route distance for radioactive material transportation to/from the Facility.

### 4.2.4 Cumulative Impacts

The implementation of the TDOT recommendations to the intersection of SR-95 and Novus Drive will decrease the congestion at Novus Drive and the Access Road leading to the Site. As there is existing municipal road structure in place, construction of the Access Road will cause minimal impact to existing traffic. Construction of the Access Road will minimize the traffic volume associated with the construction of the Facility, and will have a projected less than 5 percent impact on the local traffic. Similarly, the Access Road, in addition to the traffic signal at the intersection of SR-95 and Novis Dr, is projected to have no more than 5.2 percent impact on the local traffic during operation of the Facility. Thus, it is determines that cumulative impacts to the transportation due to the Facility is SMALL.

**Table 4-13 Product and Empty Product Cylinders Non-Radiological Incident Risk**

| State | Accidents [a] (Accidents / trk-mi) | Incident Rate Fatalities[a] (Fatalities / trk-mi) | Injuries [a] (Injuries / trk-mi) | Route Distance[b] (mi) | Accidents | Risk Fatalities | Injuries |
|---|---|---|---|---|---|---|---|
| CO | 7.18E-07 | 1.83E-08 | 5.07E-07 | 233 | 1.67E-04 | 4.27E-06 | 1.18E-04 |
| ID | 4.75E-07 | 6.12E-09 | 4.94E-07 | 264 | 1.25E-04 | 1.42E-06 | 1.15E-04 |
| IL | 3.57E-07 | 1.34E-08 | 2.41E-07 | 158 | 5.64E-05 | 2.11E-06 | 3.81E-05 |
| KS | 4.57E-07 | 8.37E-09 | 4.09E-07 | 402 | 1.84E-04 | 1.95E-06 | 9.52E-05 |
| KY | 4.99E-07 | 2.06E-08 | 3.56E-07 | 85 | 4.24E-05 | 1.75E-06 | 3.02E-05 |
| MO | 7.47E-07 | 2.00E-08 | 5.05E-07 | 235 | 1.75E-04 | 4.65E-06 | 1.18E-04 |
| OR [c] | 3.48E-07 | 3.28E-08 | 2.19E-07 | 199 | 6.92E-05 | 6.53E-06 | 4.36E-05 |
| TN | 1.98E-07 | 1.61E-08 | 1.48E-07 | 190 | 3.76E-05 | 3.75E-06 | 3.45E-05 |
| UT | 4.67E-07 | 1.92E-08 | 4.07E-07 | 143 | 6.67E-05 | 2.74E-06 | 5.82E-05 |
| WA | 4.26E-07 | 2.90E-09 | 2.90E-07 | 41 | 1.75E-05 | 6.75E-07 | 6.75E-05 |
| WY | 1.08E-06 | 1.74E-08 | 5.20E-07 | 352 | 3.82E-04 | 6.12E-06 | 1.83E-04 |
| | | | | | | | |
| **Sum (per trip):** | | | | **2302** | **1.32E-03** | **3.60E-05** | **9.01E-04** |
| | | | | | | | |
| Annual Product Risk (risk/trip x 440 ship/yr x 2 round-trip/ship): | | | | | 1.16E+00 | 3.17E-02 | 7.93E-01 |
| | | | | | | | |
| Annual Empty Product Risk (risk/trip x 440 ship/yr x 2 round-trip/ship): | | | | | 1.16E+00 | 3.17E-02 | 7.93E-01 |

(a) From Table 4 (Saricks and Tompkins 1999)

(b) From WebTRAGIS

(c) From Table 4 (Saricks and Tompkins 1999), Oregon did not list "Interstate, Primary, and Other". Only provided "Total" rates. Data taken for Oregon is "Total"

**Table 4-14: Radwaste Shipments Non-Radiological Incident Risk**

| State | Accidents [a] (Accidents / trk-mi) | Incident Rate Fatalities [a] (Fatalities / trk-mi) | Injuries [a] (Injuries / trk-mi) | Route Distance[b] (mi) | Accidents | Risk Fatalities | Injuries |
|---|---|---|---|---|---|---|---|
| IA | 1.80E-07 | 1.51E-08 | 1.38E-07 | 11 | 1.98E-06 | 1.66E-07 | 1.52E-06 |
| IL | 3.57E-07 | 1.34E-08 | 2.41E-07 | 150 | 5.36E-05 | 2.00E-06 | 3.62E-05 |
| KY | 4.99E-07 | 2.06E-08 | 3.56E-07 | 85 | 4.24E-05 | 2.27E-07 | 3.91E-06 |
| MO | 7.47E-07 | 2.00E-08 | 5.05E-07 | 350 | 2.61E-04 | 6.98E-06 | 1.77E-04 |
| NE | 5.13E-07 | 2.20E-08 | 3.17E-07 | 432 | 2.22E-04 | 2.42E-07 | 3.49E-06 |
| TN | 1.98E-07 | 1.61E-08 | 1.48E-07 | 184 | 3.64E-05 | 1.77E-07 | 1.63E-06 |
| UT | 4.67E-07 | 1.92E-08 | 4.07E-07 | 137 | 6.39E-05 | 2.62E-06 | 5.58E-05 |
| WY | 1.08E-06 | 1.74E-08 | 5.20E-07 | 384 | 4.17E-04 | 6.67E-06 | 2.00E-04 |
| | | | | | | | |
| **Sum (per trip):** | | | | **1733** | **1.10E-03** | **1.91E-05** | **4.79E-04** |
| | | | | | | | |
| Annual Radwaste Risk (risk/trip x 15 ship/yr x 2 round-trip/ship): | | | | | 3.29E-02 | 5.73E-04 | 1.44E-02 |

**Table 4-15 Facility Non-Radiological Environmental Impact from Vehicle Incidents**

| Radioactive Material | Annual Risks [(a)] | | |
|---|---|---|---|
| | Accidents | Fatalities | Injuries |
| Feed | 1.42E+00 | 6.10E-02 | 1.03E+00 |
| Empty Feed | 7.09E-01 | 3.05E-02 | 5.14E-01 |
| Product | 1.16E+00 | 3.17E-02 | 7.93E-01 |
| Empty Product | 1.16E+00 | 3.17E-02 | 7.96E-01 |
| Empty $DUF_6$ | 3.29E-02 | 5.73E-04 | 1.44E-02 |
| Radioactive Waste | 5.12E+00 | 1.83E-01 | 3.60E+00 |
| **Sum** | **1.42E+00** | **6.10E-02** | **1.03E+00** |

(a) From Table 4-13 and Table 4-14.

## 4.3 GEOLOGY AND SOILS IMPACTS

This section summarizes known and potential geological impacts, mitigation measures and cumulative effects. Impacts to geology and soils were determined by assessing potential changes that could result from facility construction and operations under each of the alternatives.

### 4.3.1 Site Soils

#### 4.3.1.1 Proposed Action

The Facility consists of administration buildings, process buildings, and related supporting facilities.

Most of the area for proposed construction will require cut and fill operations to attain final grade. Actual fill and excavation depths will be determined based on final design.

Other details of the Proposed Action are described in described in Chapter 2.

##### 4.3.1.1.1 Construction

Up to approximately 300 ac. is disturbed under the Proposed Action. This area includes the area of construction as well as site clearing around the building site. Construction activities would entail excavation and grading within the project footprint Figure 4-2. Based on the preliminary grading analysis of the site, approximately 4 million $yd^3$ will be excavated to support construction activities. The excavated soil is assumed to be suitable for reuse as structural fill. Based on this assumption, construction of the project would require the off-site transport of approximately 200,000 $yd^3$ of excavated material.

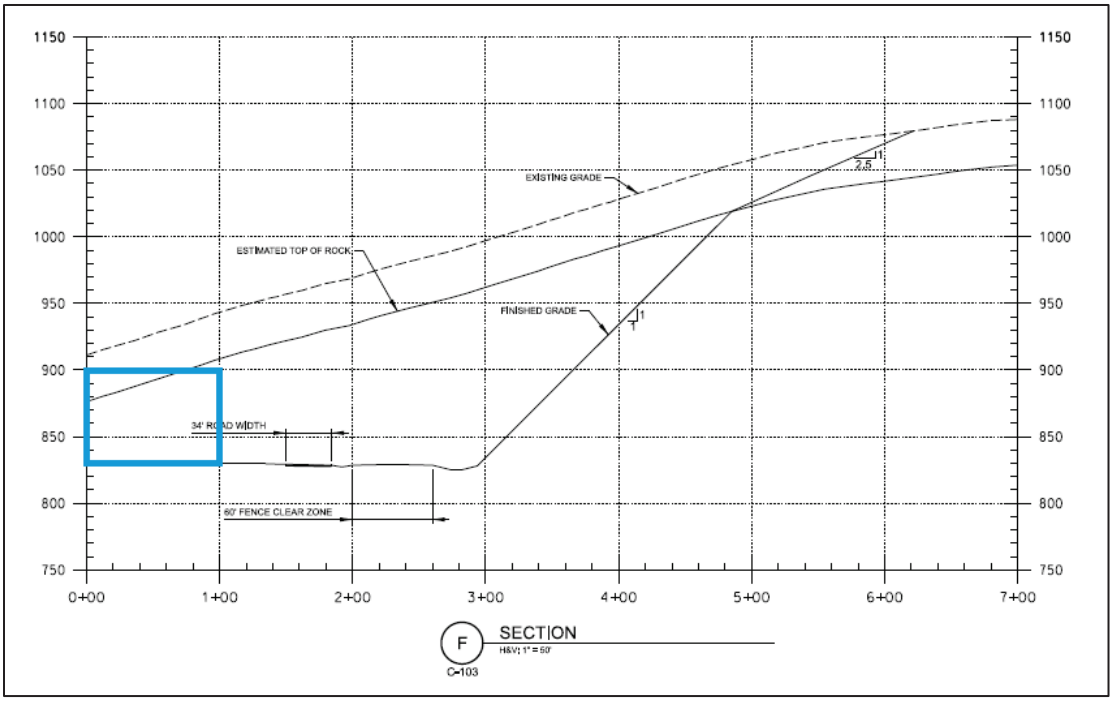



**Figure 4-2 Graphic Depicting the Existing Terrain of the Site with the Excavation Plans and the Corner of the Facility in Blue**

Soil disturbance is limited to the Facility and Best Management Practice (BMP)s, as listed in mitigation measures below, might be implemented to minimize soil erosion on the site, as needed. Therefore, impacts to soils are SMALL.

#### 4.3.1.1.2 Operation

Impacts to shallow soils after construction is complete and during operation of the Facility do not occur. Therefore, impacts to soils are SMALL during facility operation.

#### 4.3.1.1.3 Decommissioning

As described in Chapter 10 of the License Application, decommissioning of the Facility is conducted in accordance with NRC license termination requirements. Soil testing would also be conducted to identify the presence of areas potentially contaminated by site activities. Any soils having elevated levels of constituents of concern are addressed by excavation and removal or other mitigative measures as appropriate in accordance with NRC and U.S. Environmental Protection Agency (EPA) guidelines. Deactivation & Decommissioning (D&D) are also conducted to minimize soil erosion, compaction and alteration of on-site drainage patterns, to the extent practicable. Soils excavated and removed from the Facility are transported to an appropriate licensed disposal facility. Therefore, impacts to shallow soils upon completion of the D&D process are SMALL.

#### 4.3.1.2 Mitigation Measures

As previously stated, impacts to site soils are SMALL. The following practices and measures might be used as appropriate, to further control these impacts to soils during construction and to minimize residual impacts:

- Placement of soil materials within stockpiles utilizes generally level or only gently sloped lands to minimize erosion. Where slopes are steeper, appropriate erosion control measures including berms might be used to minimize erosion. Other BMPs that might be used include silt fences, straw bales, ditch check dams, geotextiles, riprap, sedimentation basin and storm drain inlet/outlet protection. BMPs are further described in Chapter 5 of this ER.
- Following completion of the Facility, the temporary construction laydown/parking area is graded as needed to reverse the effects of compaction and replanted with non-invasive herbaceous plant species.
- Any soils having elevated levels of constituents of concern are addressed by excavation and removal or other mitigative measures as appropriate in accordance with NRC and EPA guidelines.

Soils excavated from the Facility are transported to an appropriate licensed disposal facility.

- Establishment and implementation of an approved Decommissioning Plan for ultimate NRC release of the site for unrestricted use and license termination.

### 4.3.2 Geological Impacts

#### 4.3.2.1 Proposed Action

##### 4.3.2.1.1 Construction

Construction activities for the Proposed Action would potentially involve the cut and fill activities for placement of foundations. Construction will have minimal impact to the bedrock; therefore, the impacts to geology are SMALL.

Operation

Impacts to geological features after construction is complete and during operation of the Site do not occur. Therefore, impacts to geological features are SMALL during facility operation.

##### 4.3.2.1.2 Decommissioning

As described in Chapter 10 of the License Application, decommissioning of the Facility is conducted in accordance with applicable NRC license termination requirements. Geologic testing may also be part the process, as appropriate, to demonstrate that any residual impact meets NRC and EPA guidelines. Impacts to geologic features are SMALL upon completion of the decontamination and decommissioning process.

#### 4.3.2.2 Mitigation Measures

As previously indicated, potential geological impacts to and from the Facility are SMALL and are limited within the Facility. The facility is constructed and operated in accordance with appropriate geotechnical and structural specifications, engineering design criteria, applicable building codes, and relevant NRC Regulatory Guidance. These possible mitigation methods are also described in Chapter 5 of this ER.

### 4.3.3 Cumulative Impacts

The geographic area of interest for soil impacts is the Site as impacts are limited to the Site. All planned projects discussed in Section 2.3 would be constructed outside the limits of the Site and similarly, would result in localized effects to each project site. Because the identified past, present and reasonably foreseeable future activities would result in localized effects only, the cumulative effect of the Project, added to effects associated with past, present, or reasonably foreseeable future projects, is SMALL. Because the Project would not result in noticeable impacts to soils beyond the Site, the impact of the incremental contribution of either the preconstruction activities or the NRC-authorized activities related to construction, operation and decommissioning of the Site on soils is not a significant contributor to the SMALL cumulative impact. The cumulative impacts of the Site on soils during the construction and operation phases is SMALL and are controlled by engineering designs.

The geographic area of interest for geological impacts is the Site as impacts are limited to the Site. All planned projects discussed in Section 2.3 would be constructed outside the limits of the Site and similarly, would result in localized effects to each project site. Because the identified past, present and reasonably foreseeable future activities would result in localized effects only, the cumulative effect of the Project, added to effects associated with past, present, or reasonably foreseeable future projects, are SMALL. Because the Project would not result in noticeable impacts to geology beyond the Site, the impact of the incremental contribution of either the preconstruction activities or the NRC-authorized activities related to construction, operation and decommissioning of the Site on geology is not a significant contributor to the SMALL cumulative impact. The cumulative impacts of the Site on geology during the construction and operation phases are SMALL and are controlled by engineering designs.

## 4.4 WATER RESOURCES IMPACTS

### 4.4.1 Groundwater

#### 4.4.1.1 Proposed Action

##### 4.4.1.1.1 Construction

As noted in Section 3.3 and Section 3.4, groundwater was not encountered in the area of the Facility so direct contact and impact to groundwater is not anticipated. The use of construction materials and equipment can result in the release of liquids and potentially cause impacts to deep groundwater and groundwater quality. Such spills can include accidental releases of gasoline, diesel fuel, hydraulic lubricants, and other similar products used for construction equipment and materials. Proper engineering and design controls including development and following of BMPs such as concrete washout containment, and tire cleaning arrangement, and use of a Spill Prevention, Control, and Countermeasures (SPCC) plan reduces the potential impacts to groundwater during construction. In accordance with the SPCC plan, releases would also be avoided or minimized by regular maintenance and inspection of equipment and rapid response to clean-up spills that would contain and prevent contaminants from reaching soil, sediment, or water. Federal and State regulations and permit requirements also address management and control of all potential pollutants at the Facility through the use of structural and non-structural BMPs such that release of such materials to off- site waters is minimized. As such, the potential for surface release of contaminants to migrate downward to the groundwater aquifer resources is limited.

Implementation of engineering designs and controls including BMPs and a SPCC plan for construction would prevent water quality standards or limits from being exceeded; therefore, impacts to groundwater quality from construction of the Facility are SMALL.

##### 4.4.1.1.2 Operation Phase

The Facility obtains all potable and industrial water from the City of Oak Ridge, approximated to be 5.3 million gallons/year. Therefore, there are no impacts to groundwater levels, availability, or flow patterns associated with groundwater use. Potential impacts to groundwater quality during the operational phase are associated with large- scale releases of contaminants that are stored outdoors that could enter the subsurface. As noted in Section 4.12, for those chemicals stored within the process building, internal containment measures limit the potential for release to soils and groundwater.

The potential for groundwater impacts to potential users are dependent upon proximity of a given receptor with respect to the location of the Facility. As described in Section 3.4, there are no downgradient private or public water supply wells in proximity to the Facility. The potential for a surface release of contaminants to migrate downward to groundwater aquifer resources is also expected to be limited. In addition, topographic relief on the ORR is such that most active subsurface groundwater flow occurs at shallow depths in the upper 49 to 98 ft of the saturated zone in the ORR Aquitards. As a result, flow paths in the active-flow zones (particularly in the aquitards such as the bedrock at the Facility site) are relatively short, and nearly all groundwater

discharges to local surface water drainages on the ORR. For the Facility, groundwater likely discharges to surface springs and drainages associated with East Fork Poplar Creek.

An effluent monitoring program is established to manage effluent concentrations and ensure that non-radiological materials in plant effluents are maintained. An Emergency Plan required by the NRC will be submitted to the NRC for review, and a National Pollutant Discharge Elimination System (NPDES) permit will include a SPCC plan.

A groundwater monitoring program, including installation of new monitoring wells at the site, will be implemented upon completion of initial construction activities. Sampling of groundwater wells will be implemented prior to Facility operations to establish baseline groundwater conditions at the site. A groundwater monitoring plan will be completed identifying sampling analysis, analytical procedures and schedules for sampling. Sampling results are compared to background data collected. If groundwater is identified as being impacted based on comparison to background groundwater quality, appropriate mitigation measures are implemented in accordance with NRC and EPA guidelines.

Stormwater management associated with the Facility includes diversion of existing conveyances and collection systems and a stormwater management basin that would detain stormwater prior to release to the ground surface. The City of Oak Ridge Stormwater Management Ordinance 1- includes provisions that require all new development and redevelopment to retain the runoff of the first one-inch of rainfall, which is primarily a water quality control BMP but also benefits flow rates and durations for control of stream erosion, and includes with stipulations for no increase in the 2-year peak flow which serves to mitigate stream erosion potential (City of Oak Ridge 2016). Additionally, designs for stormwater management have incorporated relevant and appropriate provisions included in Tennessee Department of Environment and Conservation (TDEC)'s stormwater management guidance for planning, design, and construction (TDEC 2014) (TDEC 2012), and the City of Oak Ridge Stormwater Management Ordinance (City of Oak Ridge 2016) and development permit requirements, including relevant guidance for conditions for karst areas. Any additional management or mitigative measures are addressed in conjunction with final design and permitting by both TDEC and the City of Oak Ridge, as appropriate.

Concentrated runoff from the impervious surfaces and releases from the detention basin has the potential to result in locally increased levels of soil saturation and increased groundwater levels within proximity of the detention basin and immediate downgradient areas. However, with appropriate adherence to requirements of the City of Oak Ridge and the effective incorporation of TDEC stormwater management guidelines in conjunction with permitting and final design impacts to groundwater are SMALL.

Engineering design and controls in combination with effective management, monitoring and maintenance procedures ensure that potential impacts to groundwater from operation of the Facility are SMALL.

#### 4.4.1.1.3 Decommissioning

As described in Chapter 10 of the License Application, decommissioning of the Facility is conducted in accordance with applicable NRC license termination requirements. Groundwater sampling is conducted to evaluate whether groundwater is potentially contaminated by site activities. Any groundwater characteristics having elevated levels of constituents of concern are

addressed as appropriate in accordance with NRC and EPA guidelines. Any contaminated shallow soils that represent a potential source of contamination to groundwater are removed upon completion of the decontamination and decommissioning process. Additionally, BMPs similar to those required during the construction phase are used to mitigate potential impacts during the decommissioning phase. Therefore, the overall impact to groundwater quality from the decommissioning phase is SMALL.

#### 4.4.1.2 Mitigation Measures

Groundwater resource impacts resulting from the Facility are mitigated by measures that are planned to be incorporated into the Facility design. These mitigation measures include the following:

- Engineering and design controls.
- BMPs, as appropriate and relevant.
- SPCC Plan.
- Implementation of an appropriate groundwater monitoring plan as described in Section 6.1.2.

### 4.4.2 Surface Water

#### 4.4.2.1 Proposed Action

4.4.2.1.1 Water Hydrology

4.4.2.1.1.1 Construction

The construction of the Facility requires vegetation removal, excavation, placement of fill soil, grading and other land disturbing activities for the development footprint, including buildings, site roadways, parking areas and the stormwater management system that includes drainage ditches and stormwater detention system. Construction activities will result in impacts to identified regulatory surface water resources (streams including both relatively permanent waters and wet-weather conveyances, and wetlands). Construction activities result in land disturbance and the alteration of drainage areas and wetlands present on the Facility and as such have the potential to alter associated stormwater runoff conditions.

Construction activities include placement of fill on wet-weather conveyance (WWC-14) (Figure 4-3). In addition, intermittent/permanent stream STR-9 which feeds WWC-14 will be impacted. Construction activities will also include placement of fill over three small wetlands (WTL-G, WTL-J and WTL-K).

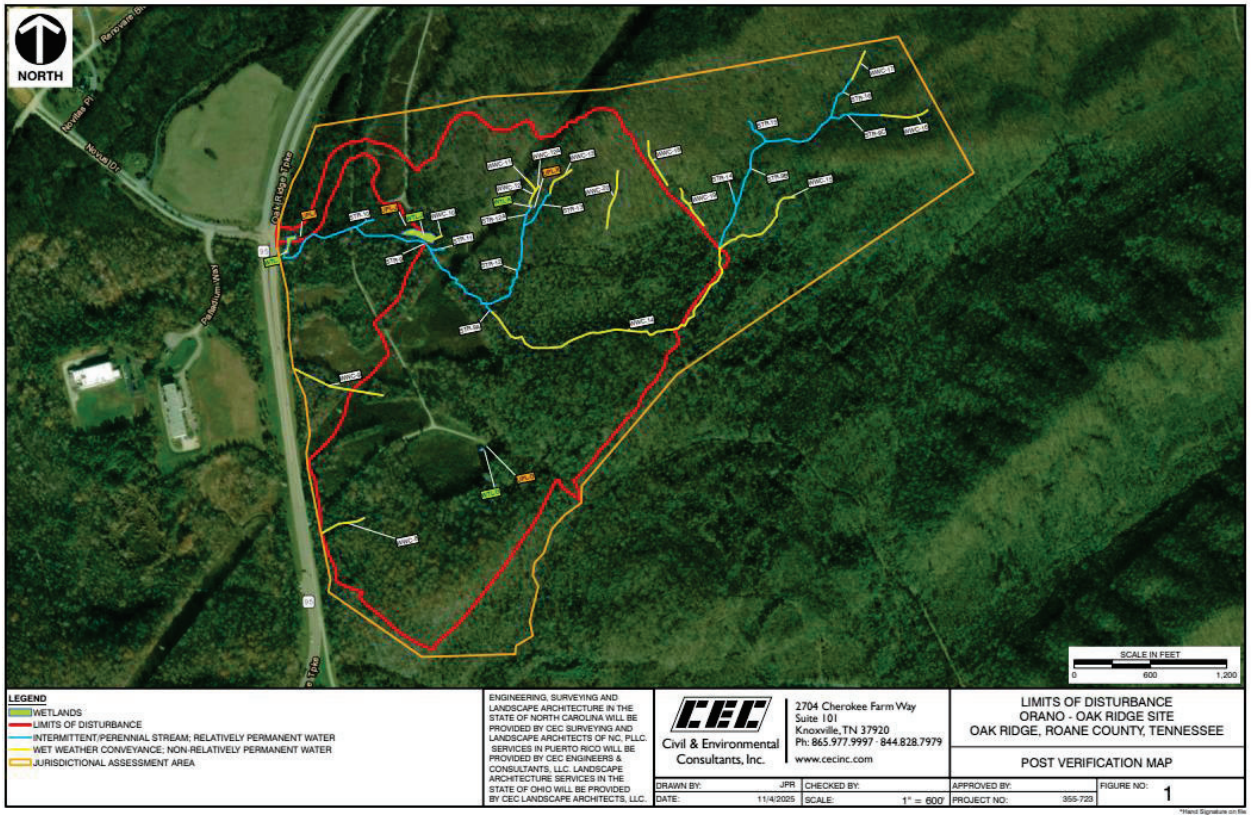



**Figure 4-3 Jurisdiction Waters Delineation at the Facility Site**

Construction phase erosion and sediment controls address stormwater inflows to the Facility as well as stormwater from on-site areas. Stormwater discharge controls will be implemented within the Facility drainage area in compliance with TDEC regulatory standards (TDEC 2012) and a TDEC general permit prior to the time of construction.

Erosion and sediment controls, and other construction-phase stormwater BMPs are implemented, as appropriate, to mitigate construction impacts on stormwater discharges from the construction area. Stormwater discharge permits for construction are obtained from TDEC and the City of Oak Ridge. Stormwater controls is compliant with regulatory standards, including TDEC (TDEC 2012) and the City of Oak Ridge Stormwater Management Ordinance (City of Oak Ridge 2016). Stormwater controls is comprehensively described in a Stormwater Pollution Prevention Plan (SWPPP) that is modified and updated throughout the changing conditions of construction.

With adherence to relevant guidelines and regulatory criteria from the site and construction planning phases through finished construction, the Proposed Action would not cause significant alterations in surface water hydrology. Any additional management or mitigative measures are addressed in conjunction with final design and permitting by both TDEC and the City of Oak Ridge, as appropriate.

Following these regulatory minimum criteria and best practices, and applicable management measures developed in conjunction with final design and permitting, impacts to surface water hydrology are expected to be SMALL.

#### 4.4.2.1.1.2 Operation

The Facility stormwater management system is designed and operated in compliance with stormwater permits from the City of Oak Ridge and from TDEC, including stormwater management system regulatory standards established by the City of Oak Ridge Stormwater Management Ordinance (City of Oak Ridge 2016) and TDEC guidelines (TDEC 2014) that are incorporated in the Ordinance by reference.

The Facility has an NPDES permit for discharge of stormwater from an industrial activity. The NPDES stormwater discharge permit is essentially a water quality permit, but stormwater quality and quantity are interdependent and best management practices are dependent upon stormwater quantity. Based on the above discussion, and the limited impact to surface water resources on the Facility, impacts to surface water hydrology are SMALL.

#### 4.4.2.1.1.3 Decommissioning

Decommissioning of the Facility would include cleaning and removal of radioactive and hazardous waste contamination that may be present on materials, equipment, and structures. The activities are detailed in a Decommissioning Plan prepared and submitted to the NRC. Some of the facilities, including buildings, drainage features, access roads, and parking areas built for the Facility, could remain in place after closure. Erosion-control BMPs similar to those required during the construction phase are used to mitigate potential impacts during the decommissioning phase. The stormwater management system would remain, functioning as it would during the operation phase. Therefore, no additional impacts would occur. As such, impacts from the decommissioning phase are SMALL.

#### 4.4.2.1.1.4 Mitigation Measures

Surface water hydrology resource impacts resulting from the construction, operation, and decommissioning of the Facility are mitigated by measures that are planned to be incorporated into the Facility design. The mitigation strategy will be finalized following the consultation of the U.S Army Corps of Engineers (USACE) and TDEC final determination on WWC-14. Through consultation, the USACE prefers that OE purchase bank credits in lieu of Permittee Responsible Mitigation.

### 4.4.2.1.2 Water Use

The Facility obtains water, for both potable and industrial use, from the City of Oak Ridge public water distribution system. All wastewater is discharged to the City of Oak Ridge municipal sanitary sewer collection system. As such there are no impacts to surface water use or water availability as a result of water use by the Facility. Therefore, the impacts to water use are SMALL.

#### 4.4.2.1.3 Water Quality

##### 4.4.2.1.3.1 Construction

As previously noted, there will be direct alteration of existing surface water resources The BMPs are used to ensure settlement of sediments from the collected runoff and discharge water meeting water quality requirements of TDEC and the City of Oak Ridge.

Potential indirect impacts to surface water quality include increased sediment loading to receiving streams as a result of vegetation clearing and land disturbing activities. These impacts are anticipated to be similar to those of construction of any typical industrial or commercial facility in the area. Localized temporary stockpiling of soils prior to transport to an off-site facility and site disturbance on unpaved areas may result in associated short-term erosion. Stockpiles of soils and materials are placed on generally level or only gently sloped lands to minimize erosion. Where slopes are steeper, appropriate erosion control measures are used to minimize erosion and sedimentation into receiving surface water features.

Erosion and sediment controls, and other construction-phase stormwater BMPs are implemented as appropriate to mitigate construction impacts on water quality of receiving water from the construction area. Stormwater discharge permits for construction will be obtained from TDEC and the City of Oak Ridge. Stormwater controls will be in compliance with regulatory standards, including TDEC (TDEC 2012) and the City of Oak Ridge Stormwater Management Ordinance (City of Oak Ridge 2016). Stormwater controls are comprehensively described in SWPPP that are modified and updated throughout the changing conditions of construction to maintain water quality.

BMPs such as slit fencing, straw wattles, concrete washout containment, construction entrance, and tire cleaning arrangement may be utilized throughout the construction phase. These measures minimize the potential for runoff of fuels, lubricants, oily wastes, chemical wastes, sanitary wastes, herbicides and pesticides. Releases are avoided or minimized by regular maintenance and inspection of equipment and rapid response to clean-up spills that would contain and prevent contaminants from reaching soil, sediment, or water. Additionally, Federal and State regulations and permit requirements address management and control of all potential pollutants at the Facility through the use of structural and non-structural BMPs such that release of such materials to off-site waters is minimized. Proper engineering and design controls including development and following of BMPs such as concrete washout containment, construction entrance, and use of a SPCC plan reduces the potential impacts to surface water during construction.

Impacts are minimized with the implementation of required sediment and erosion control measures that meet or exceed the regulatory requirements, including those in any NPDES stormwater permits and TDEC Stormwater Construction Permits. Therefore, no adverse impacts on surface-oriented designated water uses in receiving waters downstream of the Facility are anticipated.

With implementation of BMPs, construction of the Proposed Action would not cause water quality standards or limits to be exceeded; therefore, indirect impacts to water quality are SMALL.

#### 4.4.2.1.3.2 Operation

Sanitary wastewater from the Facility is discharged through the existing sanitary sewer system to be treated by the City of Oak Ridge. Liquid process waste is either treated on-site and evaporated or removed and treated off-site. As such, no liquid process waste will be discharged from the Facility.

During operation of the Facility, stormwater is collected and drained to the stormwater detention basin.

Stormwater collected during normal operations would contain pollutants typically associated with runoff collected from public streets and parking areas. All constituents within stormwater runoff are expected to be at or below the allowable limits set by TDEC.

Development of a SWPPP, use of BMPs, and adherence to requirements under the NPDES permit, limits run-off during normal operations. Furthermore, an SPCC plan is prepared for the operational phase to reduce the potential impacts to surface water associated with accidental releases or spills that may contain contaminants.

Therefore, no degradation of water quality is expected in the downstream receiving waters or surface-oriented water users. In summary, impacts to the quality of receiving surface waters from operation of the Facility are SMALL.

#### 4.4.2.1.3.3 Decommissioning

In conjunction with decommissioning, erosion-control BMPs similar to those required during the construction phase are used to mitigate potential impacts during the decommissioning phase. Transportation related activities associated with the Facility would also gradually decrease, further reducing any minimal downstream impact to receiving waters. Stormwater would continue to be routed from the Facility to the stormwater detention basin during and after the decommissioning phase; therefore, no additional impacts would occur. Furthermore, an SPCC plan is prepared for the decommissioning phase to reduce the potential impacts to surface water associated with accidental releases or spills that may contain and contaminants. The overall impact to surface water quality from the decommissioning phase is SMALL.

#### 4.4.2.1.3.4 Mitigation Measures

As previously indicated, potential water quality impacts to and from the Facility are SMALL and are limited to areas within the Facility. The facility is constructed utilizing appropriate erosion control measures and other designs and BMPs in accordance with State and Federal permits. During operations, the Facility would continue to use the on-site retention ponds to collect stormwater runoff and discharge from the site would continue to be monitored under the NPDES stormwater permit. BMPs are further described in Chapter 5 of this ER.

#### 4.4.2.1.3.5 Cumulative Impacts

The identified projects in Chapter 2 do not impact the water quality of the Site. Elevated levels of PCBs, mercury, and E. coli have been documented in the East Fork Poplar Creek (EFPC) as a result of municipal and industrial point source discharges. Flow from the stormwater retention basin would ultimately be discharged to the EFPC. As described above, impacts to surface water

quality associated with construction, operation and decommissioning of the Facility are SMALL and are limited to the Facility. However, the identified past activities have noticeably altered the surface water quality, the cumulative effect of the Proposed Action, added to effects associated with past, present, or reasonably foreseeable future projects, are MODERATE.

### 4.4.3 Floodplains

The operation, construction, and decommissioning of the Facility will not alter any water features that will cause any floodplain to be modified. Therefore, the impact to floodplains from the operation, construction, and decommissioning are SMALL.

### 4.4.4 Wetlands

As previously stated, construction activities will result in impacts to identified regulatory surface water resources to include wetlands. Construction activities result in land disturbance and the alteration of wetlands present on the Facility and as such have the potential to alter associated stormwater runoff conditions. Construction activities will include placement of fill over three small wetlands (WTL-G, WTL-J and WTL-K). The impact on these features is SMALL. The mitigation strategy will be finalized following the consultation of the USACE and TDEC final determination. Through consultation, the USACE prefers that OE purchase bank credits in lieu of Permittee Responsible Mitigation. Because the identified past activities within the geographic reference area have not noticeably altered the surface water hydrology, the cumulative effect of the Proposed Action, added to effects associated with past, present, or reasonably foreseeable future projects, are SMALL.

### 4.4.5 Cumulative Impacts

All of the identified projects in Section 2.3 in proximity to the Facility have been evaluated to have no impact on groundwater at the site. As described in Section 3.4, groundwater quality in the vicinity has been impacted by historical operations at the ORR.

Because the identified past activities have noticeably altered the groundwater quality downgrade of the Site, the cumulative effect of the Proposed Action, added to effects associated with past, present, or reasonably foreseeable future projects, are SMALL. Groundwater impacts associated with construction, operation and decommissioning are SMALL and are limited to the Facility.

Because the Facility groundwater is hydrogeologically isolated from most of the ORR groundwater contamination, and because the Proposed Action would not result in a noticeable change in groundwater quality, the impact of the incremental contribution of the NRC-authorized activities related to construction, operation and decommissioning of the Facility on groundwater quality are not a significant contributor to the SMALL cumulative impact.

Reasonably foreseeable future actions at other facilities in proximity to the Facility, summarized in Chapter 2, do not impact the Site’s surface water. Because the identified past activities within the geographic reference area have not noticeably altered the surface water hydrology, the cumulative effect of the Proposed Action, added to effects associated with past, present, or reasonably foreseeable future projects, are SMALL.

## 4.5 ECOLOGY IMPACTS

### 4.5.1 Proposed Action

#### 4.5.1.1 Biotic and Terrestrial Communities

Under the Proposed Action, the OE is constructed and operated at the Site. Details regarding site preparation and construction of the OE are provided in Figure 4-7.

##### 4.5.1.1.1 Construction

Construction of the plant will result in changes to the ecological resources in the area of the OE footprint and immediately surrounding area on the Site. A large portion of the Site will not be disturbed. Figure 4-7 shows the location of the OE relative to the remaining area on the Site.

The total area of land to be directly disturbed by construction and operation of the facilities will be approximately 300 ac. This area includes an access road, parking area, and lay-down areas. Figure 4-8 shows the locations of buildings. All of the disturbed lands ultimately will be used for buildings, support structures, parking, or landscaped areas. There are no areas that will be used on a short-term basis other than for temporary construction facilities.

The total area of the Facility represents approximately 40% of the land of the overall Site and 0.9% of the land on the entire ORR. The majority of the site will remain suitable for use by wildlife including an assortment of birds, mammals including bats, and selected reptiles (Section 3.5.2).

Noise from heavy equipment, traffic, and blasting (if required) during site preparation; from heavy equipment and traffic during construction; and other equipment, will result in reduced use of nearby onsite and offsite habitat for some species. Blasting and heavy equipment will have the largest noise footprints (Section 4.7) and will result in the greatest reduction in habitat use by wildlife. As defined in Section 4.5.2, OE will take actions to minimize impacts to migratory birds. Maximum noise levels will be about 95 dBA at (50 ft) and about 67 dBA at the nearest site boundary to the footprint of the Facility. This level is considered “clearly acceptable” based on the U.S. Department of Housing and Urban Development (HUD) land use compatibility guideline of 70 dBA for industrial uses (Table 3-37) Blasting will be limited and episodic. For comparison, thunder can generate sound levels of 120 dB.

Cranes will be used during construction. The tallest plant structure will be about 60 ft in height. Bird strikes are possible. However, the structure height is less than the 200 ft threshold that requires notifying the U.S. Federal Aviation Administration (FAA) and installing lights for aviation safety per 14 CFR Part 77; and no wires will be required to support the structure or cranes. In addition, the Site is not within a migration concentration area (e.g., near major water bodies or topographic features used for navigation). Therefore, bird strikes are much less likely to occur and the impacts will be small.

Although most construction work occurs during daytime hours, there is a chance that some work may occur during nighttime hours when artificial lighting may be required. Wildlife species have the potential to be affected by using artificial lighting. Nighttime construction activities will be limited to the maximum extent possible. Therefore, there is potential for minor, temporary impacts to wildlife due to use of artificial lighting during construction.

Presence of workers will result in avoidance of habitat immediately adjacent to construction and operation activities. Human presence will have the greatest impact during site preparation and construction, when workers are outside and using the most area within the Site. During operations, worker presence will be lower (i.e., fewer workers, less time outside) and animal populations will have adjusted during the first few years of plant construction. Presence of humans will be in part associated with noise impacts and the spatial extent of human activity will be limited to about 300 ac; therefore, impacts will be small.

Traffic and use of the onsite access road can result in vehicle-wildlife collisions. The one activity for which the site is used annually is the ORR deer reduction hunt. The Tennessee Wildlife Resources Agency (TWRA) and Oak Ridge National Laboratory (ORNL) have operated deer reduction harvests on the ORR that are intended to increase public safety through reduced deer-vehicle collisions, healthier ecosystems via healthier deer herds and reduced browse in natural areas, and protection of human health through reduced risk of zoonotic disease, as outlined in various management plans for the ORR. There is the potential for increased vehicle-deer collisions in this area once the managed deer hunts stop and with the increase in traffic on SR-95 during construction. Section 3.2.1 presents a list of recommended improvements at the intersection of SR-95 and Novus Drive including installation of a traffic signal that assist in controlling traffic flow in the immediate area of the Facility.

Dust emissions during construction may reduce vegetation productivity in the immediate vicinity of the disturbed areas. BMPs will be used to minimize dust. Some habitat loss (i.e., clearing of vegetation and trees) from site preparation and construction of the Facility will result in mobile animal species being displaced and loss of less mobile animals (e.g., small mammals). Mobile species moving through the area will likely avoid the disturbed area and facilities. The area on the Site that will be disturbed is 300 ac and is a small percentage of the available area on the ORR.

Under the Proposed Action, the common wildlife found in the affected area are expected to continue to use other available habitats within and adjacent to the Site. During active construction, most wildlife present avoid the construction sites and disperse to adjacent and/or similar habitats. Overall, the impacts during construction will be small given the (1) limited time of construction, (2) large portion of the Site will not be impacted, and (3) that the impacted area is less than one percent of the land on ORR. The one area where impacts are expected to increase somewhat is due to the increased traffic during construction, which is further discussed in Section 4.2.

#### 4.5.1.1.2 Operations

Noise from the Facility during operations and the vehicular noise from traffic during operations are anticipated to have minimal adverse impacts to wildlife species. The results from the analysis in Section 4.7.1.2 demonstrated that the expected noise level during operations, less than 47 dBA at the Facility boundary are expected to be somewhat less than the background noise levels in the 52 – 56 dBA range as measured at the TRISO-X and the KAIROS facilities.

Night lighting will be used during operation of the Facility. Lighting could reduce wildlife use of habitat adjacent to the Facility. Bats could be attracted to the lights since insects, a food source for many bat species, are also attracted to the lights. Lighting will be limited to the Facility and access roads. All lights will be directed or aimed downward to minimize the distance that lights could be observed. Therefore, impacts from nighttime lighting likely will be small.

Traffic will increase on SR-95 during operations, particularly at shift changes. Section 3.2.1 presents a list of recommended improvements at the intersection of SR-95 and Novus Drive including installation of a traffic signal that assist in controlling traffic flow in the immediate area of the Facility. Section 4.5.2 noted the potential for increased vehicle-wildlife collisions, particularly for vehicle-deer collisions. There is the potential for increased vehicle-deer collisions in this area once the managed deer hunts stop and with the increase in traffic on SR-95 during operations. With appropriate warning signs and traffic control measures noted in Section 3.2.1 impacts are expected to be small.

As discussed in Section 3.5.2 of this ER, some travel corridors may occur within the existing areas of the Site that are utilized by common species, such as white-tailed deer, to travel to and from forested habitats on areas of the ORR. Operation of the Facility does not substantially affect these species because of an abundance of alternative habitats in the immediate vicinity of the Site and ORR that would provide suitable travel corridors for wildlife species (see Figure 3-35).

Once construction is completed and operations commence, periodic maintenance of the area surrounding the Facility to control weedy species and any invasive plant species may be required. Operations and maintenance activities will avoid direct disturbance to any remaining on-site ecological communities. Operational impacts to biotic and terrestrial communities from these maintenance activities are expected to be SMALL.

In summary, during operations, noise and artificial lighting at the Facility are similar to other developments and highways in the vicinity. In addition, wildlife travel corridors are still available in the sizeable portion of the Site that will remain undisturbed and immediately beyond the Site, and maintenance activities of remaining vegetation on the site is periodic and performed per label application rates and safety precautions, Therefore, impacts to the biotic and terrestrial resources from operation and maintenance activities are SMALL.

#### 4.5.1.1.3 Decommissioning

Decommissioning activities will occur within the footprint and immediate environs of the Facility established during operations. BMPs are implemented to minimize erosion and sediment runoff. Disturbed areas are replanted in accordance with the regulations at the time of decommissioning. Overall impacts to biotic and terrestrial communities from decommissioning activities are similar to the impacts from construction and are expected to be SMALL.

### 4.5.1.2 Aquatic Resources

#### 4.5.1.2.1 Construction

During construction, the principal impact to aquatic resources affects water hydrology for the immediate area surrounding the Facility's footprint. The construction of the Facility requires vegetation removal, excavation, placement of fill soil, grading and other land disturbing activities for the development footprint, including buildings, site roadways, parking areas and the stormwater management system that includes drainage ditches and stormwater detention system. Construction activities will result in impacts to identified regulatory surface water resources such as streams including both relatively permanent waters and wet-weather conveyances, and wetlands. Construction activities result in land disturbance and the alteration

of drainage areas and wetlands present on the Facility and as such have the potential to alter associated stormwater runoff conditions.

Construction activities include placement of fill on wet-weather conveyance (WWC-14). In addition, stream 9 and 12 will be impacted. Construction activities will also include placement of fill over three small wetlands (WTL-G, WTL-J and WTL-K). The surveys conducted in support of the waters of jurisdiction report (CEC 2025) listed no species of fish were found in these two streams. The other streams on the Site as shown in Figure 3-34 (included in the yellow circles) that may contain Spotfin Chub are not expected to be impacted by the construction and operation of the Facility. See Section 4.4 for further discussion of impacts to these water resources. Following these regulatory minimum criteria and best practices, and applicable management measures developed in conjunction with final design and permitting, impacts to surface water hydrology and water related species are expected to be SMALL.

The retention and detention basins could be attractants to wildlife. The water quality of discharges to the basins will meet standards for stormwater and treated waste water. In addition, the retention and detention basins will be fenced to minimize the potential for wildlife to use the water. Impacts from retention and detention basins will be negligible to small.

#### 4.5.1.2.2 Operation

The Facility does not withdraw from any surface water body during operations as it obtains all potable and industrial water from the City of Oak Ridge. Therefore, there are no impacts associated with impingement or entrainment of aquatic biota. Furthermore, sanitary wastewater is discharged through the existing sanitary sewer system for treatment by the City of Oak Ridge. In addition, liquid process waste is either treated on-site and discharged through the existing sanitary sewer system or removed and treated off-site. As there are no direct discharges into surface water features, operations of the Facility avoid any pollutant or thermal effects to aquatic resources. Therefore, the impacts to aquatic resources from operations are SMALL.

#### 4.5.1.2.3 Decommissioning

Impacts from decommissioning are similar to those discussed for biotic and terrestrial communities for construction as discussed in Section 4.5.1.1.3 and are SMALL.

#### 4.5.1.3 Threatened, Endangered, or Sensitive Species

The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) for this site noted no critical habitats were identified nor does any “final critical habitat” overlap the site.

##### 4.5.1.3.1 Construction

Bats

Of particular concern is the potential presence of forest-dwelling bats that were identified on the Site based on past surveys, listings from ORNL’s annual site environmental report, the 2024 bat survey discussed in Section 3.5.

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

In discussions with USFWS (1.3-2), there is a time period identified as the “bat pup season” when potential roost trees for listed species may not be cut nor surrounding habitat disturbed. This window covers the time period from when bats are emerging from winter hibernaculum (caves), and through the tree roosting/maternity season and “swarming” season when bats mate and get ready to return to winter roosts. Another consideration for avoiding potential impacts is whether the area is within a distance specified by the USFWS from any caves used for hibernation by the listed species. The USFWS and Tennessee Ecological Services Field Office are developing a conservation strategy document to formalize goals and priorities regarding the conservation and recovery of forest dwelling bats in Tennessee that will be reviewed upon publication.

The Site encompasses approximately 600 acres (including those areas previously discussed that will not be transferred). Current plans for the Facility estimate that 300 acres of the site will be required to support the Facility operations including the actual footprint of the Facility, storage pads, parking lots, access road, water retention ponds, etc. Of these 300 acres, it is estimated that nominally 200 acres are forested to some extent and will require tree cutting. As shown in Figure 4-7, the Facility footprint and supporting infrastructure will be principally located in the southwest portion of the Site. Tree removal would be conducted once a final assessment is agreed upon with the USFWS and TDEC.

Provided that sufficient roosting, foraging, and travel habitat is maintained within a colony’s traditional home range (radio-telemetry studies have documented foraging up to 10 miles from a hibernaculum), it is unlikely that detectable adverse effects would occur as a result of removal or loss of habitat during the inactive season. For example, as Indiana bat maternity areas contain multiple primary roost trees, it is extremely unlikely that loss of any potential roost trees within the affected area of the Site would eliminate all primary roost trees within a traditional home range of an Indiana bat maternity colony. Similarly, loss of this magnitude is not likely to noticeably degrade the quality of a roosting or foraging area or render a travel corridor unsuitable.

OE will consider the installation of artificial bat roosting structures (e.g., rocket box and/or "Brandenbark" poles) at the site to potentially improve bat habitat. Additionally, OE will consult with the USFWS at the point it releases its updated Strategy for Bats for Tennessee with its new Programmatic Biological Opinion that is in the final stages of preparation as of August 2025.

Figure 3-32 shows the location of both the Site and SSP-2A within the 33,000 acres of the ORR (as adapted from corresponding figure in (DOE 2020). This figure also illustrates the considerable interior forested areas across the entire reservation. The loss of bat habitat due to construction of the Facility would be approximately 0.8 percent of the total forest land at ORR. Therefore, effects on bats listed in Table 3-7 from implementation of the Proposed Action are expected to be negligible.

Bald Eagles

It can be difficult to find bald eagles on the ORR from September through November. At least three bald eagle nests were confirmed on the reservation in 2023, all located along the Clinch River/Melton Hill Lake, between Gallaher Bend and Melton Hill Lake Dam (DOE 2024). This location is approximately 6 miles east of the Site. These three active bald eagle nests on ORR are protected by DOE in accordance with the Bald and Golden Eagle Protection Act.

The ORETTC Environmental Assessment (EA) (ORNL 2020) presents information on threatened, endangered, or sensitive animal species for both the ORR and the SSP-2A site. Consistent with the 2023 annual environmental report for the ORR (DOE 2024), the ORETTC EA notes there is both historical and contemporary indications of bald eagles being present on the ORR and would be expected to present on the ORR. However, for the SSP-2A site, which is adjacent to the Site, the ORETTC EA relative to bald eagles indicated:

- No historical indication,
- No expected occurrence,
- No contemporary indication, and
- No evidence of suitable habit exists.

The findings regarding presence of bald eagles from these two assessments (DOE 2024) and (ORNL 2020) are incorporated by reference here. Therefore, effects on bald eagles from implementation of the Proposed Action are expected to be negligible.

Migratory Birds

The results of the initial IPaC report of July 1, 2025, listed 13 birds of Conservation Concern (BCC). Review of surveys and information relevant to the Site regarding these 13 bird species found that:

- 11 were identified as species of concern reported in the ORR's 2023 annual environmental report (DOE 2024);
- 8 were identified as species observed or potentially occurring on or near the Horizon Center Site (HCS) (TRISO-X) (NRC 2022) located 1.0 miles northwest mile from the Facility; and
- 7 were listed on the threatened, endangered, or sensitive animal species on the SSP-2A site (ORETTC) (ORNL 2020).

Estimates indicate that 300 acres of the site will be required to support the Facility operations including the actual footprint of the Facility, storage pads, parking lots, access road, water retention ponds, etc. Of these 300 acres, it is estimated that nominally 200 acres are forested to some extent and will require tree cutting.

Review of the probability of presence and breeding time periods data for each of these 13 species shows that for 12 of the species there is essentially no indication of presence for the January through March time period and that their respective breeding time frames come one to two months later. The breeding time period for the Chimney Swift species is shown as starting March but "presence data" is not recorded until mid-April. Thus, the first quarter of the year to initiate early site preparations would expect to have minimal impact on these bird species of conservation concern. Longer term, the impact of any loss of natural habitat is expected to be minimal given the immediate availability of remaining portion of the Site that will remain undisturbed and the availability of the estimated 24,000 acres of forested land on the ORR overall.

Prior to any clearing/tree cutting activities, appropriate resources as presented in the IPaC for minimizing impacts to migratory birds shall be reviewed and appropriate measures taken as well as consulting USFWS and TDEC.

Therefore, effects on migratory birds from implementation of the Proposed Action are expected to be small.

Plants

Two plant species were listed on the IPaC as endangered – the Virginia spiraea and the White fringeless orchid.

The Virginia spiraea was (1) cited as "unlikely" to occur on the SSP-2A site, which is adjacent to the Site (ORNL 2020) and (2) not on the list of known or previously reported vascular plant species of concern reported on or near the ORR (DOE 2024). Thus, it was determined that the Site and immediate area surrounding it did not have a suitable habitat for the Virginia spiraea.

There are wetland areas that potentially include habitats conducive to supporting the White fringeless orchid, the Proposed Action in terms of the construction of the Facility at the specific location on the Site coupled with only those specific areas being transferred result in very limited impact, if at all.

The fen orchid and tuberculed rein orchid are found on the ORR and listed in the ORR 2023 annual report (DOE 2024) as threatened on the state list species of concern. The locations for these orchid species would be expected to be found in the same areas as the White fringeless orchid - not in the areas impacted by the Facility construction and outside the boundaries of the Site.

Therefore, effects on these orchid species from implementation of the Proposed Action are expected to be small.

#### 4.5.1.3.2 Operations

The impacts from operations for threatened, endangered, or sensitive species include several impacts listed under operations for biotic and terrestrial communities as discussed in Section 4.5.1.1 including:

- Increased traffic, particularly at shift changes,
- Nighttime lighting around the Facility, parking lots, perimeter locations, etc.,
- Wildlife corridors,
- Noise, and
- Maintenance and landscaping activities.

During operations, noise and artificial lighting at the Facility are similar to other developments and highways in the vicinity. In addition, wildlife travel corridors are still available in the sizeable portion of the Site that will remain undisturbed and immediately beyond the Site, and maintenance activities of remaining vegetation on the site is periodic and performed per label application rates and safety precautions, Therefore, impacts to threatened, endangered, and sensitive species from operations are SMALL.

#### 4.5.1.3.3 Decommissioning

Impacts from decommissioning are similar to those discussed for biotic and terrestrial communities (Section 4.5.1.1.3) and are SMALL.

### 4.5.2 Summary of Ecology Impacts

The potential impacts to wildlife including the bat species on the endangered and threatened federal and state list and migratory birds are minimized by (1) the balance of the Site that will remain undisturbed and (2) the considerable interior forested areas across the ORR. Under the Proposed Action, the common wildlife found in the affected area is expected to continue to use other available habitats within and adjacent to the Site. There were a considerable number of streams, wetlands, and wet-weather conveyances identified on the Site. The layout of the Facility will affect two streams (no fish present), three wetlands totaling less than 0.5 acres, and one wet-weather conveyance. The affected streams will be redirected to existing streams elsewhere on the site. Thus, a majority of these aquatic resources on the Site will remain undisturbed. Plants of interest are essentially either located in areas of the Site that will not be disturbed or in wetland areas outside of the Site boundaries on land that DOE will continue to control and manage. Therefore, overall impacts to ecological resources are small.

### 4.5.3 Mitigation Measures

Several practices and procedures have been designed to minimize adverse impacts to the ecological resources of the Site. These practices and procedures include the use of BMP's recommended by various state and federal management agencies, minimizing the construction footprint to the extent possible, avoiding all direct discharge (including stormwater) to any waters of the United States (i.e., the use of temporary detention ponds), and site stabilization practices to reduce the potential for erosion and sedimentation. The use of native plant species in disturbed area revegetation will enhance and maximize the opportunity for native wildlife habitat to be re-established at the site. In addition, OE has identified the following additional mitigations that may be used to reduce impacts to ecological resources:

- Dust suppression methods will be used to minimize dust emissions.
- Fence the stormwater discharge retention and detention basins to limit access by wildlife.
- Continue seasonal monitoring of habitat to confirm habitat use by sensitive species.
- Protect migratory birds during the construction and decommissioning of the Facility, including avoiding areas containing active nests of migratory birds
- Use low maintenance landscaping in and around the stormwater detention basin.
- Manage unused open areas (i.e. leave undisturbed), including areas of native plant species and vegetation for the benefit of wildlife.

### 4.5.4 Cumulative Impacts

Only 300ac of the SSP-2 parcel will be directly disturbed by construction and operational activities, leaving the remaining parcel suitable for use by wildlife. During construction, impacts to wildlife could come from nighttime lighting, if necessary for nighttime construction, and dust emissions, which will be mitigated and short term and therefore have SMALL impact. In addition, the construction area will be less than one percent of the ORR, allowing any wildlife to disperse without any major loss of habitat. Wildlife corridors will remain undisturbed in the Site vicinity and surrounding ORR.

DOE and the private sector companies currently engaged in citing major facilities on transferred land from DOE will need to continually monitor such development to ensure that ORR ecosystems are not adversely impacted. OE will engage both the USFWS and TDEC to support appropriate conservation and protective measures in the construction, operation, and eventual decommissioning of the Facility.

The TVA 161kV line relocation to the perimeter of the Site will add a few power line towers alongside SR-95, which is a common occurrence along SR-95 and SR-58. Given the location along the SR-95, the TVA line will not adversely impact the existing wildlife corridors or habitats along the ORR, the cumulative impacts on ecological resources are SMALL.

## 4.6 AIR QUALITY IMPACTS

This section describes the air quality impacts of the Proposed Action (construction, operation, and decommissioning of the Facility).

### 4.6.1 Regional Air Quality

As specified in NUREG-1748, Section 6.4.6 (NRC 2003), a:

> *"description of gaseous effluents (type, quantity, and origin) and table(s) comparing effluent concentrations to regional air quality parameters should be provided for both short- and long-term impacts".*

Therefore, for short-term impacts, these include emissions from construction of the Facility. Furthermore, as specified in NUREG–1748, Section 5.4.6 (NRC 2003), the NRC is required to document in their EIS, of the licensee's Environmental Report, "an analysis and evaluation of construction, operation and decommissioning activities in sufficient detail to determine the significance of potential air quality impacts and to recommend how these impacts should be treated in the process (e.g., consideration of alternative designs or practices that would mitigate adverse environmental impacts)."

Air quality impacts for site preparation for the Facility are assessed relative to emission factors and air quality dispersion. The federal Clean Air Act (CAA) (42 U.S.C. Chapter 85) (OLRC 2020) requires the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered to be harmful to public health and the environment (42 U.S.C, Chapter 85, §7409 and §7410). The standards are designed to primarily protect the general public, including sensitive populations such as asthmatics, children, and the elderly. They are also intended to safeguard public welfare by reducing effects such as decreased visibility and damage to animals, crops, vegetation, and buildings. EPA has established standards for six criteria of pollutants, including two size ranges for particulate matter ($PM_{2.5}$ which are particles < 2.5 microns and $PM_{10}$ which are particles < 10 microns). The state of Tennessee has partially adopted the federal NAAQS. Table 3-33 in Section 3.6.2 of the ER lists the ambient air quality standards as administered by the EPA and those administered by TDEC.

Emission rates of criteria pollutants were estimated for exhaust emissions from construction vehicles and for fugitive dust using emission factors provided in the EPA AP-42 Volume 1 (EPA 2025). The total emission rates were used to scale the output from the American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD) (OLRC 2020), based upon a unit source term as input to the model, to estimate both short-term and annual average ambient air concentrations at the Facility property boundary. AERMOD is a refined, steady-state, multi-source, Gaussian dispersion model that is EPA's preferred model for a wide range of regulatory applications in all types of terrain (OLRC 2020). The total emission rates for construction vehicles is based on the Motor Vehicle Emissions Simulator (MOVES5) calculations. MOVES5 is a state-of-the-science model designed by the EPA to estimate air pollution emissions from mobile sources in the United States. MOVES5 can be used to estimate exhaust and evaporative emissions as well as brake and tire wear emissions from all types of onroad vehicles. MOVES5 can also be used to estimate emissions from many kinds of nonroad equipment (including construction vehicles). The on road and nonroad modeling capabilities exist as separate modules in MOVES5 (EPA 2024b).

#### 4.6.1.1 Air Emissions Factors from Stationary Sources

##### 4.6.1.1.1 Selection of Dispersion Model

For this modeling analysis, the latest version of the EPA's AERMOD modeling system (Version 24142) (OLRC 2020) was used (EPA 2024a). AERMOD is a refined, steady-state, multi-source, Gaussian dispersion model that is EPA's preferred model for a wide range of regulatory applications in all types of terrain.

The AERMOD modeling system also includes the following major components:

- AERMET – The AERMOD system's general purpose meteorological preprocessor that organizes and processes meteorological data and estimates the boundary layer parameters necessary for dispersion calculations.
- AERMAP – The AERMOD system's terrain preprocessor module that processes digitized terrain elevation data files to produce terrain base elevations and hill height scale values for each receptor.
- AERSURFACE – A recently developed tool to aid in obtaining realistic and reproducible surface characteristic values for albedo, Bowen ratio, and surface roughness length for AERMET.

All modeling was performed using AERMOD's regulatory default option.

##### 4.6.1.1.2 Meteorological Data and Surface Characteristics

The AERMOD modeling analysis was performed using the most recent hourly surface meteorological data from the Oak Ridge National Laboratory, Oak Ridge Reservation Meteorology Towers (Towers A, B, C/D, E, F, K, L, M, S, W, Y) and from the Iowa State University, Iowa Environmental Mesonet for airports within 57 miles of the Site. The quantity of data from these two databases range from 3.2 years to 10 years as documented in Environmental Report Table 3-9.

AERMOD requires more detailed meteorological information than predecessor regulatory air quality models. In addition to surface meteorological and upper air sounding data, the AERMET preprocessor also requires values of surface characteristics, including albedo, Bowen ratio, and surface roughness[1] length, that are representative of conditions in the vicinity of the meteorological tower. To aid modelers in obtaining realistic and reproducible surface characteristic values, the AERSURFACE tool was developed by EPA. AERSURFACE requires the input of land cover data from the U.S. Geological Survey (USGS) Multi-Resolution Land Characteristics Consortium (MRLC) (MRLC 2024) in order to identify the land cover for a specific location (refer to Figure 4-4). Values of surface characteristics are then calculated based on the land cover data for the study area. For SSP-2, the majority of the site is deciduous forest with woody wetland areas and some pasture/grassland areas along the eastern side of SR-95 shown on Figure 4-4 as the red-line identified as developed, medium intensity.

[1] Key factors influencing the energy balance and temperature of the Earth's surface. Albedo, the reflectivity of a surface, affects how much solar radiation is absorbed or reflected. The Bowen ratio, the ratio of sensible to latent heat flux, indicates the availability of moisture for evaporation. Surface roughness influences wind speed and turbulence, affecting heat transfer. These factors interact to determine local climate and temperature variations.

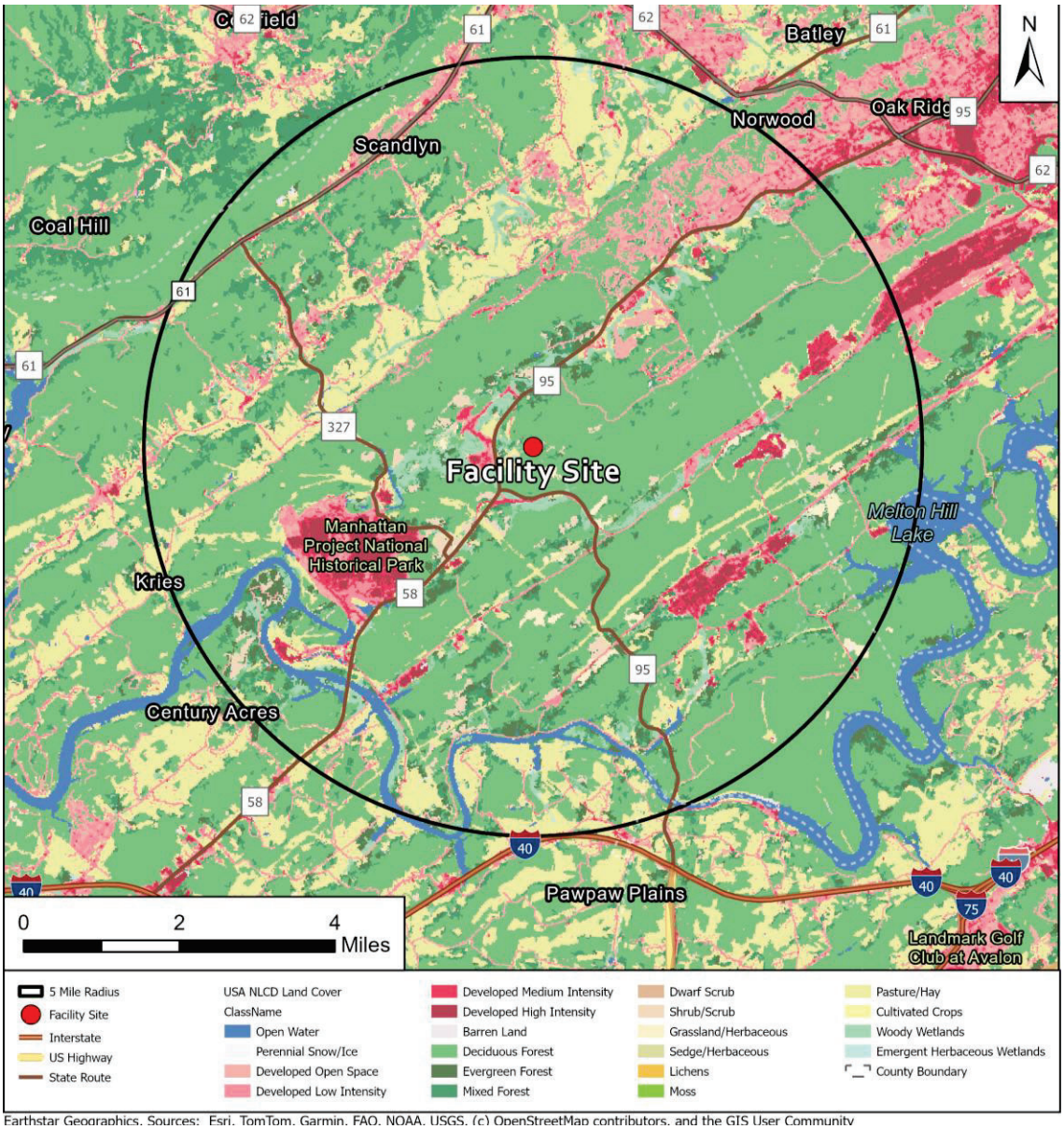



**Figure 4-4 USGS Multi-Resolution Land Characteristics Consortium for the Site**

An AERSURFACE analysis was performed for the Oak Ridge site location. Seasonal surface characteristics were determined for each of sixteen 22.5-degree sectors. Seasonal categories were assigned as follows, using AERSURFACE's default setting and details from Section 3.6 of the Environmental Report based on snow fall (Figure 3-43) and temperature estimates (Table 3-10):

- Seasonal Category 1: "Midsummer with lush vegetation" – May, June, July
- Seasonal Category 2: "Autumn with unharvested cropland" – August, September, October
- Seasonal Category 3: "Late Autumn/Winter, after frost and harvest, or winter with no snow" – November

- Seasonal Category 4: “Winter with snow on ground (with generally continuous snow cover) – December, January, February
- Seasonal Category 5: “Transitional spring with partial green coverage or short annuals” – March, April.

As recommended in EPA’s AERMOD Implementation Guide Section 3.1.2 (EPA 2024a), an upwind distance of 0.62 mi, relative to the location of the meteorological tower, was used to determine the effective surface roughness values for input to AERMET. Note: of the twelve towers, the closet two ORNL Meteorological Towers to the Site are approximately 2.5 miles away in opposite directions from the Site. Also recommended in EPA’s AERMOD Implementation Guide Section 3.1.2 (EPA 2024a), a domain of 6.2 mi by 6.2 mi was used for the determination of albedo and Bowen ratio.

#### 4.6.1.1.3 Land Use Classification

AERMOD contains algorithms for evaluating dispersion for source locations in both urban and rural areas. Based on the land use classification procedure described in the AERMOD modeling guidelines and on a review of topographic maps and aerial photographs, the land use in the area within 1.9 mi of the Facility is predominantly rural. This is also shown in Figure 4-4. This is consistent with the recommendation in EPA’s AERMOD Implementation Guide, Section 5.1 (EPA 2024a). Therefore, AERMOD was run using the rural dispersion option.

#### 4.6.1.1.4 Emission Source Data

The refined AERMOD dispersion modeling analysis for the construction site preparation activities included vehicle exhaust and fugitive dust generation. Fugitive dust is caused by vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing and to a lesser extent from wind erosion. Emission rates from vehicle exhaust and fugitive dust were estimated for a 10-hour workday assuming peak construction activity levels would be maintained throughout the day. Refined modeling was also conducted assuming peak construction activity would occur five days per week for the entire calendar year with no activity on weekends. For convenience, all model runs were performed assuming a unit emission rate of 7.9 lb/hr (1.0 g/s). Actual pollutant concentrations were then determined by multiplying the normalized AERMOD results by the actual emission rate of each pollutant. Construction activity was modeled as if emitted uniformly over the entire construction site area. Emission factors and assumptions specific to each of these two sources are discussed separately in the following sections.

Vehicle Exhaust

Vehicles that will be operating on the site during construction consist of support vehicles and construction equipment. The support vehicles will include fifty pickup trucks, forty gators (gas-powered carts), three fuel trucks, four stake body trucks and three mechanic’s trucks. Emission factors in MOVES5 (EPA 2024b) were used to estimate emissions of carbon monoxide and nitrogen oxides for these vehicles. Use of MOVES5 requires that highway mobile sources be categorized by vehicle size. The gators were assumed to be Light Duty Vehicles, the pickup trucks and the mechanic’s trucks Category I Light Duty Trucks (GVWR ≤ 8,500 lbs), the stakebody trucks Category II Light Duty Trucks (GVWR 8,500 to 10,000 lbs) and the fuel trucks were assumed to be Heavy Duty Trucks (GVWR 60,000 to 80,000 lbs). Baseline emission factors for each of the

vehicle categories were provided in MOVES5 as a function of the calendar year. Emission factors used included vehicle model years for the last 25 years.

It was assumed that each of the support vehicles would be in use each workday and would travel an average of 10 mi per day around the construction site. Emission rates (in g/s) for the entire workday for each vehicle were estimated by multiplying the MOVES5 emission factor (in g/mile) by 10 mi and dividing by the number of seconds in the workday (36,000).

Emission factors, in units of grams per hour of operation, provided in MOVES5 for diesel-powered construction equipment, were compiled. In calculating emissions, it was conservatively assumed that all the equipment would be in continuous operation throughout the 10-hour workday, 5 day a week.

The typical speed of construction equipment on a work site varies greatly depending on the specific type of equipment, the task being performed, site conditions, and safety regulations. However, for the estimate, it was assumed that the maximum speed of the equipment would not be greater than 15 mph. This is based on the following is a breakdown of common speeds:

- Excavators: While digging and loading, the focus is on cycle times rather than travel speed, according to For Construction Pros. Small excavators have faster cycle times than larger ones. Some models, like MCR excavators, can achieve travel speeds up to 6.2 mph.
- Dozers: These machines are designed for pushing and rolling material and perform best at speeds around 3 mph.
- Motor Graders: Speeds vary significantly depending on the task:
    - Finish grading: 0-2.5 mph
    - Heavy blading: 0-6 mph
    - Ditch repair: 0-3 mph
    - Ripping: 0-3 mph
    - Road maintenance: 3-9.5 mph
    - Haul road maintenance: 3-9.5 mph
- Forklifts: Maximum speeds typically range from 5-15 mph, though some models, like a 12,000 lb. warehouse forklift, can reach 13 mph. Speed limits are often set by the employer based on site conditions, with recommendations ranging from 3-8 mph in warehouses and high-traffic areas.
- Earth-moving haulage equipment: Vehicles like trucks, scrapers, and tractors with pneumatic tires that have a maximum speed exceeding 15 mph are required to have fenders on all wheels, according to the Occupational Safety and Health Administration (OSHA).
- Cranes: Lifting speeds vary based on the type of crane and the load being lifted, ranging from 10-100 meters per minute.

Thus, a bounding speed of 15 mph would be appropriate to use in the spreadsheet for the various construction equipment.

Fugitive Dust

Fugitive dust emissions are dependent on the area of land being worked on and also the level of construction vehicle operations occurring at any given time. A fugitive dust emission factor of 1.2 tons per acre per month of construction activity is provided in AP-42 Section 13.2.3.3 (EPA 2025) for heavy construction operation activities (EPA 2006). This factor includes all site-related sources of particulates. The value is most applicable to construction sites with: (1) medium activity level, (2) moderate silt content and (3) a semi-arid climate.

The AP-42 emission factor also assumes uncontrolled emissions, whereas the Facility construction site will employe measures to reduce fugitive dust emissions. It has been said that the EPA suggests that a twice daily watering program will reduce dust emissions by up to 90%; however, this suggestion is not factually based. Spray treatments of an excavation site with water and with water and water-extender solutions achieved dust suppression efficiencies of between 60 to 70 percent for particles less than 2.5 microns (Weston n.d.).

While a dust suppression efficiency of between 60 to 70 percent for particles less than 2.5 microns, (Weston n.d.) can be obtained, AP-42 did include a discussion regarding watering of the construction site. Note: AP-42 does not cite a reference or basis for the 90% efficiency that has been suggested. Figure 4-5 and Section 13.2.2.3 of AP-42 (EPA 2006) show a large increase in dust control efficiency occurs with moisture ratios between 1 and 2 and then increases more slowly thereafter. So increased watering beyond this point, while somewhat beneficial, has limited efficiency increases.

Fugitive dust will originate predominantly from vehicle traffic on unpaved surfaces, earth moving, on-site concrete batch plant operations, excavating and bulldozing, and to a lesser extent from wind erosion. Fugitive dust emissions were estimated using an AP-42 emission factor for construction site preparation that was adjusted to account for dust suppression measures and the fractions of total suspended particulate that are expected to be in the particulate matter less than 10 microns ($PM_{10}$) and particulate matter less than 2.5 microns ($PM_{2.5}$) size ranges (Table 4-16). As discussed below, higher dust emission rates were demonstrated not to exceed standards at the area where potential off-site exposures during construction are greatest (on SR-95). Dust emission rates that are lower than these were developed for potential property line exposures. For the potential property line exposures, it was assumed that no more than 166 ac of the construction site would be involved in construction work at any one time. The area limitation on construction activities is based on the need to maintain compliance with the 24-hour $PM_{10}$ ambient air quality standard. A more detailed discussion of this issue and a possible remedy to increase the percentage of allowable disturbed area is presented later in this section.

**Table 4-16 Fugitive Emissions during Construction**

| Pollutant | Averaging period | Modeled Maximum Concentration | Standard |
|---|---|---|---|
| PM10 | Annual | 27.3 µg/m$^3$ | 50 µg/m$^3$ |
| PM10 | 24-hour | 150 µg/m$^3$ | 150 µg/m$^3$ |
| PM2.5 | Annual | 7 µg/m$^3$ | 15 µg/m$^3$ |
| PM2.5 | 24-hour | 28 µg/m$^3$ | 35 µg/m$^3$ |

Note: Standard source from Environmental Report Table 3-33.

To quantitatively assess the amount of water that could be needed for dust suppression, the maximum amount of watering required to achieve the 90% goal, based on obtaining the 4.3 moisture ratio shown in Figure 13.2.2-2 of AP-42 (Figure 4-5), was estimated using a spreadsheet developed by the EPA (EPA 2006). The spreadsheet calculates moisture content of a road surface over time. Inputs into the spreadsheet include monthly Class A pan evaporation values, hourly meteorological data for precipitation and humidity, vehicle information and road surface material information. Meteorological data from the ORNL Meteorological Tower C/D was used in the spreadsheet. Vehicle information was based on support vehicle and construction equipment data discussed above. All other inputs were obtained from tables presented in AP-42 Chapter 13.2.2 (EPA 2006).

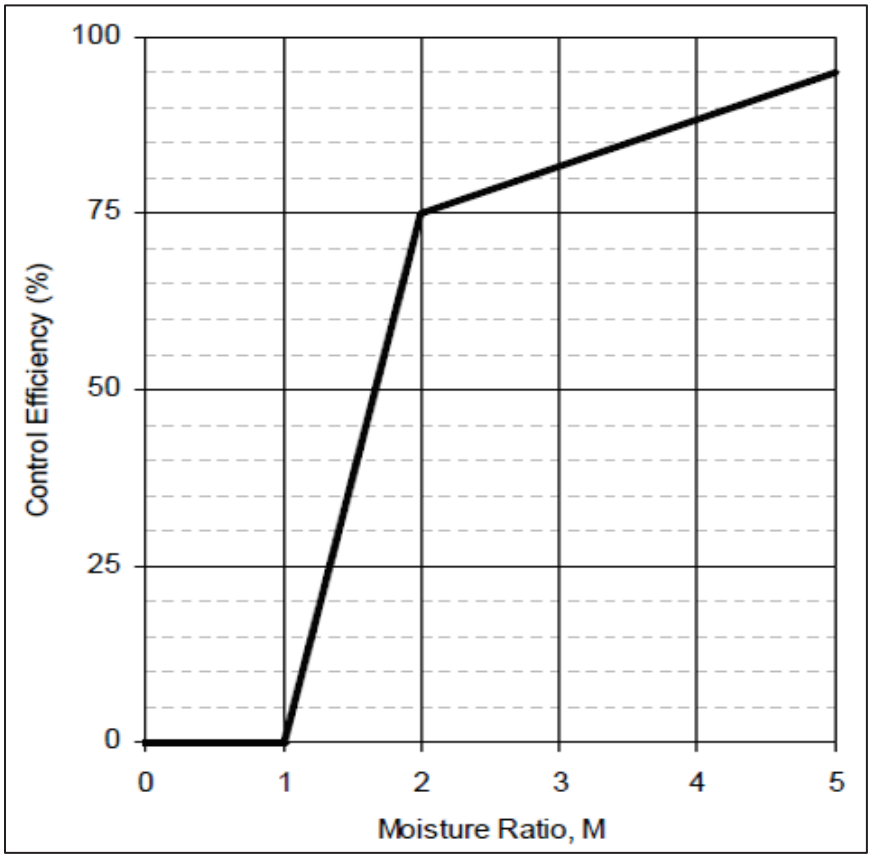



**Figure 4-5 Watering Control Effectiveness for Unpaved Surfaces from AP-42 (EPA 2006)**

Based on EPA National Stormwater Calculator for the Site, the majority of the site that will be excavated is composed of “moderately high – clay loam”, which means it's generally composed of 27–40% clay, 15-52% silt, and 20-45% sand, based on the U.S. Department of Agriculture classifications. AP-42 considers moderate silt content in the emission factor value; thus, a silt content correction factor was established by taking the ratio of the “moderately high – clay loam” silt content (15-52% silt).

For the property line receptor locations, the workday emission rate (in g/s) was calculated assuming approximately 166 acres of the construction site would be under construction at any given time and that emissions occur entirely within the 10-hour workday. This workday emission rate was assumed to occur 214 hours per month (i.e., 21.4 average work days/month x 10-hour work day) for the entire year.

#### 4.6.1.2 Air Pollutant Emission Factors - Mobile Sources

Emission rates from vehicle exhaust, as listed in Table 4-18, were estimated for a 10–hour workday assuming peak construction activity levels were maintained throughout the year.

Of the combustion sources, vehicle exhaust will be the dominant source. Fugitive volatile emissions will occur because vehicles will be refueled on-site. Estimated vehicles that will be operating on the site during construction will consist of two types: support vehicles and construction equipment. The support vehicles will include pickup trucks, gators (gas- powered carts), fuel trucks, stakebody trucks and mechanic trucks. Emission factors in EPA’s MOVES5 (EPA 2024b) (EPA 2024b) emission estimation model were used to estimate emissions of criteria pollutants and non-methane hydrocarbons for these vehicles.

The construction equipment that will be operating on the site during peak construction consists of heavy-duty and light-duty diesel vehicles. Emission factors, in units of grams per hour of operation, provided in MOVES5 (EPA 2024b) for diesel-powered construction equipment, were compiled. In calculating emissions, it was conservatively assumed that all equipment would be in continuous operation throughout the 10-hour workday, and heavy-duty diesel vehicle emission were assumed for all diesel vehicles.

### 4.6.2 Atmospheric Dispersion Characteristics

As specified in NUREG-1748, Section 6.4.6 (NRC 2003), a:

> *“description of gaseous effluents (type, quantity, and origin) and table(s) comparing effluent concentrations to regional air quality parameters should be provided for both short- and long-term impacts”.*

Therefore, for normal facility operations, onsite air quality will be impacted during operation due to the operation of the four standby generators and two smaller diesel generators (security diesel generator and fire pump diesel). Operation emission types, source locations, and emission quantities of the Facility standby diesel generators are presented in Table 4-17. These diesel generators will meet the EPA and TDEC air quality limits as described in Chapter 3.6 of the Environmental Report and TDEC issued permits.

The diesel generator are the major source of emissions during operation. Other minor emission sources, such as forklifts and other on-site light duty vehicles, will be present, but will be minimal sources of emissions in comparison to the diesel generator.

**Table 4-17 Standby Diesel Generator Air Emissions During Operations**

| Emission Type | Source Location | Quantity |
|---|---|---|
| Standby Diesel Generator Exhaust [1] | Electrical Services Building | 0.081 ton/yr of $PM_{10}$<br>11.07 ton/yr of $NO_x$<br>1.2 ton/yr of CO<br>0.241 ton/yr of VOC |

1. This emission category includes four (4) 2,500 kW standby diesel generators for the main facility and two (2) smaller diesel generators designated for security and fire pump use. For aggregate emissions calculations, it was conservatively assumed that each generator operates for testing purposes at 1.6 hours per week, 52 weeks per year.

During facility operation, offsite air quality will also be impacted by passenger vehicles of Facility workers commuting to the site, delivery trucks, ($UF_6$) cylinder shipment trucks, and waste removal trucks. Due to the lower amount of passenger vehicles and trucks during operations compared to construction, the emission rate is assumed to be bounded by the construction emission table. During the Construction phase, emission rates from passenger vehicle exhaust were estimated for a 50 mi roundtrip commute for a maximum of 980 vehicles per workday during peak construction and operations. No credit was taken for the use of car pools. It was assumed that there are 250 workdays per year (five-day work week and fifty-week work year). Emission rates from heavy-duty vehicles were estimated and presented in Table 4-18. Emission factors are based on MOVE5 (EPA 2024b) (EPA 2024b). The resulting emission factors, tons of daily emissions, number of vehicles and heavy-duty engines are provided in Table 4-18.

**Table 4-18 Off-Site Vehicle Air Emissions During Construction**

| Estimated Vehicle Type | Emission Factor (g/mi) | Estimated Daily Number of Vehicles | Estimated Daily Mileage mi | Daily Workday Emissions (g) |
|---|---|---|---|---|
| **NONMETHANE HYDROCARBONS** | | | | |
| Light Duty Vehicles (Gasoline) | 1.219 | 980 | 50 | 59,731 |
| Heavy Duty Trucks (Diesel) | 0.506 | 36 | 500 | 9,108 |
| Total | | | | 68,839 |
| **Daily Emissions** | | | | **7.6E-2 tons** |
| **CARBON MONOXIDE** | | | | |
| Light Duty Vehicles (Gasoline) | 20.35 | 980 | 50 | 997,150 |
| Heavy Duty Trucks (Diesel) | 2.56 | 36 | 500 | 46,080 |
| Total | | | | 1,043,230 |
| **Daily Emissions** | | | | **1.1E+0 tons** |
| **NITROGEN OXIDES** | | | | |
| Light Duty Vehicles (Gasoline) | 1.193 | 980 | 50 | 58,457 |
| Heavy Duty Trucks (Diesel) | 10.292 | 36 | 500 | 185,256 |
| Total | | | | 243,713 |
| **Daily Emissions** | | | | **2.7E-1 tons** |

| Estimated Vehicle Type | Emission Factor (g/mi) | Estimated Daily Number of Vehicles | Estimated Daily Mileage mi | Daily Workday Emissions (g) |
|---|---|---|---|---|
| **PM 2.5** | | | | |
| Light Duty Vehicles (Gasoline) | 0.01 | 980 | 50 | 490 |
| Heavy Duty Trucks (Diesel) | 0.02 | 36 | 500 | 360 |
| Total | | | | 850 |
| **Daily Emissions** | | | | **9.4E-4 tons** |
| **PM 10** | | | | |
| Light Duty Vehicles (Gasoline) | 0.03 | 980 | 50 | 1,279 |
| Heavy Duty Trucks (Diesel) | 0.05 | 36 | 500 | 940 |
| Total | | | | 2,219 |
| **Daily Emissions** | | | | **2.4E-3 tons** |

As specified in NUREG-1748, Section 5.6.2 (NRC 2003), the NRC is required to document in their EIS of the licensee's Environmental Report that baseline and operational physiochemical monitoring is occurring and meets regulator limits (both 10 CFR Part 20 and 10 CFR Part 70.61). It further states that the assessment accounts for atmospheric dispersion factors ($\chi$/Q's) be used to assess the environmental effects of normal plant operations and facility accidents [2]. The baseline $\chi$/Q's and D/Q's included in Table 4-19, Table 4-20, Table 4-21, and Table 4-22 are for normal plant operations, which supports the NRC's EIS. These values were obtained from XOQDOQ from NRC Dose3 Version 3 computer code using ORNL Met Tower D Stability data as documented in Environmental Report Chapter 3.6, since it is the closest meteorological tower with the appropriate Stability Data. Different $\chi$/Q's and D/Q's will be generated in support of the Integrated Safety Analysis (ISA) for accident analyses.

In the following subsections, information is presented about the gaseous effluents, the gaseous effluent control systems, and computer models and data used to calculate the atmospheric dispersion and deposition factors.

The air quality impacts from operation activities will be small, because:

- Emissions from the operation of four emergency generators will be small. These emission units are exempt from permitting requirements.
- Vehicular emissions are predicted to be extremely low in the vicinity of the site.

[2] χ/Q (Chi/Q) values represent a measure of the dilution of a released substance in the atmosphere as it travels downwind.

- For Normal Operations: represents routine or expected releases under typical operating conditions. Often involve continuous or planned releases of small amounts of substances over extended periods, with established and controlled emission points. Meteorological Data is typically based on averaged or historical meteorological data representative of normal atmospheric conditions (e.g., typical wind speeds, directions, and stability classes). Dispersion Modeling uses standard atmospheric dispersion models to estimate long-term average concentrations at downwind receptors, often evaluating compliance with routine release limits.
- For Accident Conditions: represents potential releases during upset conditions, malfunctions, or accidental events. Involves instantaneous, short-term, or larger-magnitude releases, often from uncontrolled or unexpected release points. Meteorological Data considers a range of meteorological conditions, including unfavorable ones (e.g., low wind speeds, stable atmospheres) that could lead to higher downwind concentrations, and potentially even consider short-term, worst-case scenarios. Dispersion Modeling involves using models to predict potential peak concentrations and doses under various accident scenarios, evaluating compliance with emergency response limits and potential health impacts.

- Emissions of hazardous air pollutants are predicted to be insignificant and are well below permitting thresholds.

#### 4.6.2.1 Calculation of Atmospheric Dispersion and Deposition Factors

As specified in NUREG-1748, Section 5.6.2 (NRC 2003), the NRC is required to document in their EIS of the licensee's Environmental Report that baseline and operational physiochemical monitoring is occurring and meets regulator limits (both 10 CFR Part 20 and 10 CFR Part 70.61). It further states that the assessment accounts for atmospheric dispersion factors ($\chi$/Q's) be used to assess the environmental effects of normal plant operations and facility accidents. The baseline $\chi$/Q's and D/Q's included in Table 4-19, Table 4-20, Table 4-21, and Table 4-22 are for normal plant operations, which supports the NRC's EIS. These values were obtained from XOQDOQ from NRCDose3 Version 3 computer code using ORNL Met Tower D Stability data as documented in Environmental Report Chapter 3.6, since it is the closest meteorological tower with the appropriate Stability Data. Different $\chi$/Q's and D/Q's will be generated in support of the ISA for accident analyses.

The largest $\chi$/Q was 1.300E-03 sec/m$^3$ on the site boundary at a distance of 0.32 mi in the west sector. The largest deposition factor was 5.858E-06 1/m$^2$ on the site boundary at a distance of 0.39 mi in the south-west sector. Table 4-20, Table 4-21, and Table 4-22 provide $\chi$/Q and D/Q out to a distance of 50 miles from the site, as specified in Regulatory Guide 1.111 for routine releases (NRC 1977a).

**Table 4-19 Summary of Maximum Annual Average Atmospheric Dispersion and Deposition Factors**

| Special Receptors | Sector Average Concentration, Undepleted, Undecayed χ/Q Values | | | Sector Average D/Q Values | | |
|---|---|---|---|---|---|---|
| | χ /Q, (sec/m$^3$) | Sector | Distance from Source, mi | D/Q, (1/m$^2$) | Sector | Distance from Source, mi |
| **Site Boundary** | 2.555E-04 | N | 0.61 | 6.659E-07 | N | 0.61 |
| **Site Boundary** | 1.460E-04 | NE | 1.00 | 4.264E-07 | NE | 1.00 |
| **Site Boundary** | 8.073E-05 | E | 0.67 | 7.944E-07 | E | 0.67 |
| **Site Boundary** | 1.663E-05 | SE | 0.66 | 2.414E-07 | SE | 0.66 |
| **Site Boundary** | 5.477E-05 | S | 0.51 | 6.263E-07 | S | 0.51 |
| **Site Boundary** | 9.471E-04 | SW | 0.39 | 5.858E-06 | SW | 0.39 |
| **Site Boundary** | 1.300E-03 | W | 0.32 | 4.732E-06 | W | 0.32 |
| **Site Boundary** | 4.626E-04 | NW | 0.44 | 1.123E-06 | NW | 0.44 |
| **ORNL Carbon Fiber Technology** | 6.728E-04 | W | 0.49 | 2.409E-06 | W | 0.49 |
| **Nearest Resident Cherry Oak Drive** | 9.676E-05 | NE | 1.19 | 2.733E-07 | NE | 1.19 |
| **ORETTC / SNRAF** | 1.373E-04 | NNE | 0.86 | 3.569E-07 | NNE | 0.86 |
| **TRISO-X FFF** | 1.035E-04 | NW | 1.00 | 2.231E-07 | NW | 1.00 |

## Table 4-20 Sector Average Concentration, Undepleted, Undecayed $\chi$/Q Values (sec/m$^3$) for Grid Receptors

| | 0.25 mi | 0.50 mi | 0.75 mi | 1.00 mi | 1.50 mi | 2.00 mi | 2.50 mi | 3.00 mi | 3.50 mi | 4.00 mi | 4.5 mi |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 9.966E-04 | 3.451E-04 | 1.845E-04 | 9.224E-05 | 3.655E-05 | 1.978E-05 | 1.258E-05 | 8.829E-06 | 6.611E-06 | 5.186E-06 | 4.210E-06 |
| NNE | 1.038E-03 | 3.594E-04 | 1.914E-04 | 9.537E-05 | 3.764E-05 | 2.032E-05 | 1.290E-05 | 9.035E-06 | 6.756E-06 | 5.293E-06 | 4.292E-06 |
| NE | 1.637E-03 | 5.578E-04 | 2.945E-04 | 1.459E-04 | 5.716E-05 | 3.069E-05 | 1.940E-05 | 1.355E-05 | 1.010E-05 | 7.894E-06 | 6.388E-06 |
| ENE | 1.436E-03 | 4.657E-04 | 2.403E-04 | 1.174E-04 | 4.522E-05 | 2.400E-05 | 1.505E-05 | 1.043E-05 | 7.740E-06 | 6.022E-06 | 4.855E-06 |
| E | 4.949E-04 | 1.374E-04 | 6.580E-05 | 3.088E-05 | 1.146E-05 | 5.935E-06 | 3.654E-06 | 2.499E-06 | 1.833E-06 | 1.413E-06 | 1.131E-06 |
| ESE | 2.557E-04 | 6.748E-05 | 3.201E-05 | 1.508E-05 | 5.741E-06 | 3.031E-06 | 1.896E-06 | 1.314E-06 | 9.748E-07 | 7.591E-07 | 6.128E-07 |
| SE | 1.165E-04 | 2.872E-05 | 1.295E-05 | 5.925E-06 | 2.196E-06 | 1.138E-06 | 7.021E-07 | 4.811E-07 | 3.537E-07 | 2.732E-07 | 2.191E-07 |
| SSE | 1.503E-04 | 4.266E-05 | 2.114E-05 | 1.021E-05 | 3.960E-06 | 2.115E-06 | 1.333E-06 | 9.294E-07 | 6.925E-07 | 5.411E-07 | 4.380E-07 |
| S | 2.188E-04 | 5.693E-05 | 2.630E-05 | 1.212E-05 | 4.447E-06 | 2.284E-06 | 1.397E-06 | 9.508E-07 | 6.945E-07 | 5.335E-07 | 4.255E-07 |
| SSW | 7.405E-04 | 2.141E-04 | 1.043E-04 | 4.929E-05 | 1.832E-05 | 9.477E-06 | 5.824E-06 | 3.974E-06 | 2.908E-06 | 2.236E-06 | 1.785E-06 |
| SW | 2.034E-03 | 6.211E-04 | 3.093E-04 | 1.478E-04 | 5.530E-05 | 2.874E-05 | 1.773E-05 | 1.213E-05 | 8.898E-06 | 6.857E-06 | 5.482E-06 |
| WSW | 2.240E-03 | 7.363E-04 | 3.816E-04 | 1.870E-04 | 7.229E-05 | 3.845E-05 | 2.414E-05 | 1.676E-05 | 1.244E-05 | 9.685E-06 | 7.812E-06 |
| W | 1.951E-03 | 6.526E-04 | 3.416E-04 | 1.684E-04 | 6.540E-05 | 3.490E-05 | 2.196E-05 | 1.527E-05 | 1.135E-05 | 8.850E-06 | 7.145E-06 |
| WNW | 1.309E-03 | 4.483E-04 | 2.371E-04 | 1.176E-04 | 4.613E-05 | 2.480E-05 | 1.569E-05 | 1.097E-05 | 8.184E-06 | 6.401E-06 | 5.184E-06 |
| NW | 1.098E-03 | 3.841E-04 | 2.065E-04 | 1.035E-04 | 4.108E-05 | 2.226E-05 | 1.417E-05 | 9.948E-06 | 7.454E-06 | 5.849E-06 | 4.750E-06 |
| NNW | 8.209E-04 | 2.856E-04 | 1.522E-04 | 7.586E-05 | 2.993E-05 | 1.615E-05 | 1.025E-05 | 7.178E-06 | 5.367E-06 | 4.203E-06 | 3.408E-06 |
| | **5.00 mi** | **7.50 mi** | **10.00 mi** | **15.00 mi** | **20.00 mi** | **25.00 mi** | **30.00 mi** | **35.00 mi** | **40.00 mi** | **45.00 mi** | **50.00 mi** |
| N | 3.510E-06 | 1.861E-06 | 1.236E-06 | 7.346E-07 | 5.103E-07 | 3.856E-07 | 3.072E-07 | 2.537E-07 | 2.151E-07 | 1.860E-07 | 1.635E-07 |
| NNE | 3.576E-06 | 1.889E-06 | 1.251E-06 | 7.407E-07 | 5.132E-07 | 3.871E-07 | 3.078E-07 | 2.539E-07 | 2.150E-07 | 1.858E-07 | 1.631E-07 |
| NE | 5.312E-06 | 2.786E-06 | 1.836E-06 | 1.081E-06 | 7.458E-07 | 5.608E-07 | 4.450E-07 | 3.663E-07 | 3.097E-07 | 2.672E-07 | 2.343E-07 |
| ENE | 4.026E-06 | 2.096E-06 | 1.375E-06 | 8.059E-07 | 5.564E-07 | 4.186E-07 | 3.323E-07 | 2.737E-07 | 2.315E-07 | 1.999E-07 | 1.753E-07 |
| E | 9.346E-07 | 4.848E-07 | 3.179E-07 | 1.875E-07 | 1.312E-07 | 9.971E-08 | 7.985E-08 | 6.627E-08 | 5.644E-08 | 4.902E-08 | 4.323E-08 |
| ESE | 5.107E-07 | 2.738E-07 | 1.835E-07 | 1.109E-07 | 7.818E-08 | 5.980E-08 | 4.812E-08 | 4.010E-08 | 3.426E-08 | 2.985E-08 | 2.639E-08 |
| SE | 1.820E-07 | 9.697E-08 | 6.475E-08 | 3.891E-08 | 2.730E-08 | 2.081E-08 | 1.671E-08 | 1.390E-08 | 1.187E-08 | 1.033E-08 | 9.129E-09 |
| SSE | 3.652E-07 | 1.950E-07 | 1.302E-07 | 7.816E-08 | 5.471E-08 | 4.161E-08 | 3.333E-08 | 2.766E-08 | 2.356E-08 | 2.046E-08 | 1.805E-08 |
| S | 3.512E-07 | 1.821E-07 | 1.193E-07 | 7.024E-08 | 4.891E-08 | 3.708E-08 | 2.963E-08 | 2.456E-08 | 2.089E-08 | 1.813E-08 | 1.598E-08 |
| SSW | 1.469E-06 | 7.470E-07 | 4.824E-07 | 2.780E-07 | 1.909E-07 | 1.431E-07 | 1.133E-07 | 9.317E-08 | 7.872E-08 | 6.789E-08 | 5.951E-08 |
| SW | 4.517E-06 | 2.299E-06 | 1.485E-06 | 8.560E-07 | 5.875E-07 | 4.401E-07 | 3.483E-07 | 2.861E-07 | 2.415E-07 | 2.081E-07 | 1.823E-07 |
| WSW | 6.478E-06 | 3.367E-06 | 2.206E-06 | 1.290E-06 | 8.889E-07 | 6.677E-07 | 5.294E-07 | 4.356E-07 | 3.681E-07 | 3.175E-07 | 2.783E-07 |
| W | 5.930E-06 | 3.089E-06 | 2.026E-06 | 1.187E-06 | 8.183E-07 | 6.150E-07 | 4.877E-07 | 4.013E-07 | 3.392E-07 | 2.927E-07 | 2.566E-07 |
| WNW | 4.313E-06 | 2.268E-06 | 1.497E-06 | 8.841E-07 | 6.121E-07 | 4.614E-07 | 3.668E-07 | 3.024E-07 | 2.561E-07 | 2.212E-07 | 1.942E-07 |
| NW | 3.962E-06 | 2.102E-06 | 1.396E-06 | 8.308E-07 | 5.776E-07 | 4.368E-07 | 3.481E-07 | 2.877E-07 | 2.440E-07 | 2.111E-07 | 1.856E-07 |
| NNW | 2.839E-06 | 1.498E-06 | 9.911E-07 | 5.863E-07 | 4.059E-07 | 3.059E-07 | 2.432E-07 | 2.005E-07 | 1.697E-07 | 1.466E-07 | 1.286E-07 |

## Table 4-21 Sector Average Concentration, Depleted, Decayed $\chi$/Q Values (sec/m$^3$) for Grid Receptors

| | 0.25 mi | 0.50 mi | 0.75 mi | 1.00 mi | 1.50 mi | 2.00 mi | 2.50 mi | 3.00 mi | 3.50 mi | 4.00 mi | 4.5 mi |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 9.428E-04 | 3.149E-04 | 1.643E-04 | 8.061E-05 | 3.097E-05 | 1.633E-05 | 1.015E-05 | 6.980E-06 | 5.131E-06 | 3.956E-06 | 3.161E-06 |
| NNE | 9.818E-04 | 3.280E-04 | 1.704E-04 | 8.336E-05 | 3.190E-05 | 1.677E-05 | 1.041E-05 | 7.143E-06 | 5.244E-06 | 4.038E-06 | 3.223E-06 |
| NE | 1.549E-03 | 5.090E-04 | 2.621E-04 | 1.275E-04 | 4.843E-05 | 2.533E-05 | 1.566E-05 | 1.071E-05 | 7.840E-06 | 6.023E-06 | 4.797E-06 |
| ENE | 1.359E-03 | 4.250E-04 | 2.139E-04 | 1.026E-04 | 3.832E-05 | 1.982E-05 | 1.214E-05 | 8.251E-06 | 6.007E-06 | 4.594E-06 | 3.645E-06 |
| E | 4.682E-04 | 1.254E-04 | 5.857E-05 | 2.699E-05 | 9.713E-06 | 4.900E-06 | 2.949E-06 | 1.976E-06 | 1.423E-06 | 1.078E-06 | 8.492E-07 |
| ESE | 2.419E-04 | 6.158E-05 | 2.849E-05 | 1.319E-05 | 4.865E-06 | 2.502E-06 | 1.530E-06 | 1.039E-06 | 7.566E-07 | 5.792E-07 | 4.602E-07 |
| SE | 1.102E-04 | 2.621E-05 | 1.153E-05 | 5.179E-06 | 1.861E-06 | 9.397E-07 | 5.665E-07 | 3.803E-07 | 2.744E-07 | 2.084E-07 | 1.644E-07 |
| SSE | 1.422E-04 | 3.892E-05 | 1.882E-05 | 8.923E-06 | 3.355E-06 | 1.746E-06 | 1.076E-06 | 7.349E-07 | 5.376E-07 | 4.129E-07 | 3.289E-07 |
| S | 2.070E-04 | 5.195E-05 | 2.342E-05 | 1.059E-05 | 3.768E-06 | 1.886E-06 | 1.128E-06 | 7.517E-07 | 5.390E-07 | 4.070E-07 | 3.194E-07 |
| SSW | 7.006E-04 | 1.954E-04 | 9.282E-05 | 4.308E-05 | 1.552E-05 | 7.824E-06 | 4.700E-06 | 3.142E-06 | 2.257E-06 | 1.706E-06 | 1.340E-06 |
| SW | 1.924E-03 | 5.668E-04 | 2.753E-04 | 1.292E-04 | 4.686E-05 | 2.373E-05 | 1.431E-05 | 9.592E-06 | 6.906E-06 | 5.232E-06 | 4.116E-06 |
| WSW | 2.119E-03 | 6.719E-04 | 3.396E-04 | 1.634E-04 | 6.125E-05 | 3.174E-05 | 1.948E-05 | 1.325E-05 | 9.655E-06 | 7.389E-06 | 5.866E-06 |
| W | 1.846E-03 | 5.955E-04 | 3.041E-04 | 1.471E-04 | 5.541E-05 | 2.881E-05 | 1.772E-05 | 1.208E-05 | 8.812E-06 | 6.752E-06 | 5.365E-06 |
| WNW | 1.238E-03 | 4.091E-04 | 2.110E-04 | 1.028E-04 | 3.908E-05 | 2.047E-05 | 1.266E-05 | 8.670E-06 | 6.352E-06 | 4.883E-06 | 3.892E-06 |
| NW | 1.039E-03 | 3.505E-04 | 1.838E-04 | 9.044E-05 | 3.481E-05 | 1.837E-05 | 1.143E-05 | 7.866E-06 | 5.785E-06 | 4.462E-06 | 3.567E-06 |
| NNW | 7.766E-04 | 2.606E-04 | 1.355E-04 | 6.630E-05 | 2.536E-05 | 1.333E-05 | 8.271E-06 | 5.675E-06 | 4.165E-06 | 3.207E-06 | 2.559E-06 |
| | **5.00 mi** | **7.50 mi** | **10.00 mi** | **15.00 mi** | **20.00 mi** | **25.00 mi** | **30.00 mi** | **35.00 mi** | **40.00 mi** | **45.00 mi** | **50.00 mi** |
| N | 2.597E-06 | 1.297E-06 | 8.176E-07 | 4.465E-07 | 2.891E-07 | 2.055E-07 | 1.548E-07 | 1.215E-07 | 9.823E-08 | 8.123E-08 | 6.838E-08 |
| NNE | 2.645E-06 | 1.316E-06 | 8.274E-07 | 4.501E-07 | 2.907E-07 | 2.062E-07 | 1.551E-07 | 1.216E-07 | 9.815E-08 | 8.107E-08 | 6.817E-08 |
| NE | 3.929E-06 | 1.942E-06 | 1.215E-06 | 6.568E-07 | 4.225E-07 | 2.988E-07 | 2.243E-07 | 1.755E-07 | 1.414E-07 | 1.167E-07 | 9.800E-08 |
| ENE | 2.978E-06 | 1.461E-06 | 9.098E-07 | 4.899E-07 | 3.153E-07 | 2.231E-07 | 1.675E-07 | 1.311E-07 | 1.058E-07 | 8.728E-08 | 7.334E-08 |
| E | 6.913E-07 | 3.378E-07 | 2.102E-07 | 1.139E-07 | 7.422E-08 | 5.304E-08 | 4.017E-08 | 3.166E-08 | 2.570E-08 | 2.133E-08 | 1.801E-08 |
| ESE | 3.778E-07 | 1.908E-07 | 1.214E-07 | 6.734E-08 | 4.424E-08 | 3.181E-08 | 2.420E-08 | 1.915E-08 | 1.560E-08 | 1.298E-08 | 1.099E-08 |
| SE | 1.345E-07 | 6.752E-08 | 4.278E-08 | 2.359E-08 | 1.541E-08 | 1.104E-08 | 8.373E-09 | 6.611E-09 | 5.373E-09 | 4.465E-09 | 3.775E-09 |
| SSE | 2.702E-07 | 1.359E-07 | 8.618E-08 | 4.750E-08 | 3.099E-08 | 2.216E-08 | 1.679E-08 | 1.324E-08 | 1.075E-08 | 8.922E-09 | 7.536E-09 |
| S | 2.597E-07 | 1.268E-07 | 7.890E-08 | 4.263E-08 | 2.765E-08 | 1.969E-08 | 1.488E-08 | 1.171E-08 | 9.487E-09 | 7.864E-09 | 6.635E-09 |
| SSW | 1.087E-06 | 5.206E-07 | 3.191E-07 | 1.689E-07 | 1.081E-07 | 7.618E-08 | 5.705E-08 | 4.456E-08 | 3.588E-08 | 2.957E-08 | 2.483E-08 |
| SW | 3.341E-06 | 1.602E-06 | 9.825E-07 | 5.200E-07 | 3.326E-07 | 2.343E-07 | 1.754E-07 | 1.369E-07 | 1.101E-07 | 9.071E-08 | 7.610E-08 |
| WSW | 4.792E-06 | 2.346E-06 | 1.459E-06 | 7.838E-07 | 5.034E-07 | 3.556E-07 | 2.667E-07 | 2.085E-07 | 1.680E-07 | 1.385E-07 | 1.163E-07 |
| W | 4.386E-06 | 2.152E-06 | 1.341E-06 | 7.213E-07 | 4.636E-07 | 3.276E-07 | 2.458E-07 | 1.922E-07 | 1.549E-07 | 1.278E-07 | 1.073E-07 |
| WNW | 3.190E-06 | 1.580E-06 | 9.905E-07 | 5.372E-07 | 3.467E-07 | 2.458E-07 | 1.848E-07 | 1.448E-07 | 1.169E-07 | 9.651E-08 | 8.115E-08 |
| NW | 2.931E-06 | 1.465E-06 | 9.239E-07 | 5.050E-07 | 3.273E-07 | 2.328E-07 | 1.755E-07 | 1.378E-07 | 1.115E-07 | 9.220E-08 | 7.764E-08 |
| NNW | 2.100E-06 | 1.044E-06 | 6.557E-07 | 3.563E-07 | 2.299E-07 | 1.630E-07 | 1.226E-07 | 9.600E-08 | 7.748E-08 | 6.398E-08 | 5.379E-08 |

## Table 4-22 Sector Average D/Q Values ($1/m^2$) for Grid Receptors

| | 0.25 mi | 0.50 mi | 0.75 mi | 1.00 mi | 1.50 mi | 2.00 mi | 2.50 mi | 3.00 mi | 3.50 mi | 4.00 mi | 4.5 mi |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 2.727E-06 | 9.221E-07 | 4.734E-07 | 2.251E-07 | 8.085E-08 | 4.010E-08 | 2.361E-08 | 1.546E-08 | 1.088E-08 | 8.061E-09 | 6.212E-09 |
| NNE | 2.923E-06 | 9.885E-07 | 5.075E-07 | 2.413E-07 | 8.667E-08 | 4.298E-08 | 2.531E-08 | 1.657E-08 | 1.166E-08 | 8.642E-09 | 6.660E-09 |
| NE | 5.163E-06 | 1.746E-06 | 8.964E-07 | 4.261E-07 | 1.531E-07 | 7.591E-08 | 4.470E-08 | 2.927E-08 | 2.059E-08 | 1.526E-08 | 1.176E-08 |
| ENE | 6.240E-06 | 2.110E-06 | 1.083E-06 | 5.150E-07 | 1.850E-07 | 9.175E-08 | 5.402E-08 | 3.537E-08 | 2.489E-08 | 1.845E-08 | 1.421E-08 |
| E | 3.783E-06 | 1.279E-06 | 6.568E-07 | 3.123E-07 | 1.122E-07 | 5.563E-08 | 3.275E-08 | 2.145E-08 | 1.509E-08 | 1.118E-08 | 8.618E-09 |
| ESE | 2.129E-06 | 7.201E-07 | 3.697E-07 | 1.758E-07 | 6.314E-08 | 3.131E-08 | 1.844E-08 | 1.207E-08 | 8.495E-09 | 6.295E-09 | 4.851E-09 |
| SE | 1.121E-06 | 3.791E-07 | 1.947E-07 | 9.255E-08 | 3.324E-08 | 1.649E-08 | 9.707E-09 | 6.356E-09 | 4.472E-09 | 3.315E-09 | 2.554E-09 |
| SSE | 1.012E-06 | 3.422E-07 | 1.757E-07 | 8.354E-08 | 3.001E-08 | 1.488E-08 | 8.762E-09 | 5.737E-09 | 4.037E-09 | 2.992E-09 | 2.306E-09 |
| S | 1.913E-06 | 6.471E-07 | 3.322E-07 | 1.579E-07 | 5.673E-08 | 2.814E-08 | 1.657E-08 | 1.085E-08 | 7.633E-09 | 5.657E-09 | 4.359E-09 |
| SSW | 4.958E-06 | 1.677E-06 | 8.609E-07 | 4.093E-07 | 1.470E-07 | 7.291E-08 | 4.293E-08 | 2.811E-08 | 1.978E-08 | 1.466E-08 | 1.130E-08 |
| SW | 1.165E-05 | 3.941E-06 | 2.023E-06 | 9.620E-07 | 3.455E-07 | 1.714E-07 | 1.009E-07 | 6.607E-08 | 4.649E-08 | 3.445E-08 | 2.655E-08 |
| WSW | 9.007E-06 | 3.046E-06 | 1.564E-06 | 7.435E-07 | 2.671E-07 | 1.324E-07 | 7.799E-08 | 5.106E-08 | 3.593E-08 | 2.663E-08 | 2.052E-08 |
| W | 6.902E-06 | 2.334E-06 | 1.198E-06 | 5.697E-07 | 2.047E-07 | 1.015E-07 | 5.976E-08 | 3.913E-08 | 2.753E-08 | 2.041E-08 | 1.572E-08 |
| WNW | 4.087E-06 | 1.382E-06 | 7.096E-07 | 3.374E-07 | 1.212E-07 | 6.009E-08 | 3.538E-08 | 2.317E-08 | 1.630E-08 | 1.208E-08 | 9.311E-09 |
| NW | 2.702E-06 | 9.136E-07 | 4.691E-07 | 2.230E-07 | 8.011E-08 | 3.973E-08 | 2.339E-08 | 1.532E-08 | 1.078E-08 | 7.987E-09 | 6.155E-09 |
| NNW | 2.233E-06 | 7.550E-07 | 3.877E-07 | 1.843E-07 | 6.620E-08 | 3.283E-08 | 1.933E-08 | 1.266E-08 | 8.907E-09 | 6.601E-09 | 5.087E-09 |
| | **5.00 mi** | **7.50 mi** | **10.00 mi** | **15.00 mi** | **20.00 mi** | **25.00 mi** | **30.00 mi** | **35.00 mi** | **40.00 mi** | **45.00 mi** | **50.00 mi** |
| N | 4.935E-09 | 2.192E-09 | 1.328E-09 | 6.713E-10 | 4.063E-10 | 2.724E-10 | 1.952E-10 | 1.466E-10 | 1.140E-10 | 9.103E-11 | 7.430E-11 |
| NNE | 5.291E-09 | 2.350E-09 | 1.424E-09 | 7.196E-10 | 4.355E-10 | 2.920E-10 | 2.093E-10 | 1.571E-10 | 1.222E-10 | 9.759E-11 | 7.965E-11 |
| NE | 9.344E-09 | 4.151E-09 | 2.514E-09 | 1.271E-09 | 7.692E-10 | 5.157E-10 | 3.696E-10 | 2.775E-10 | 2.158E-10 | 1.723E-10 | 1.407E-10 |
| ENE | 1.129E-08 | 5.017E-09 | 3.039E-09 | 1.536E-09 | 9.297E-10 | 6.233E-10 | 4.466E-10 | 3.354E-10 | 2.608E-10 | 2.083E-10 | 1.700E-10 |
| E | 6.847E-09 | 3.042E-09 | 1.842E-09 | 9.313E-10 | 5.637E-10 | 3.779E-10 | 2.708E-10 | 2.033E-10 | 1.581E-10 | 1.263E-10 | 1.031E-10 |
| ESE | 3.854E-09 | 1.712E-09 | 1.037E-09 | 5.242E-10 | 3.173E-10 | 2.127E-10 | 1.524E-10 | 1.145E-10 | 8.899E-11 | 7.109E-11 | 5.802E-11 |
| SE | 2.029E-09 | 9.014E-10 | 5.461E-10 | 2.760E-10 | 1.670E-10 | 1.120E-10 | 8.026E-11 | 6.026E-11 | 4.686E-11 | 3.743E-11 | 3.055E-11 |
| SSE | 1.832E-09 | 8.137E-10 | 4.929E-10 | 2.491E-10 | 1.508E-10 | 1.011E-10 | 7.244E-11 | 5.440E-11 | 4.230E-11 | 3.379E-11 | 2.758E-11 |
| S | 3.463E-09 | 1.538E-09 | 9.319E-10 | 4.710E-10 | 2.851E-10 | 1.912E-10 | 1.370E-10 | 1.028E-10 | 7.997E-11 | 6.388E-11 | 5.214E-11 |
| SSW | 8.974E-09 | 3.986E-09 | 2.415E-09 | 1.221E-09 | 7.387E-10 | 4.953E-10 | 3.549E-10 | 2.665E-10 | 2.072E-10 | 1.655E-10 | 1.351E-10 |
| SW | 2.109E-08 | 9.370E-09 | 5.676E-09 | 2.869E-09 | 1.736E-09 | 1.164E-09 | 8.342E-10 | 6.264E-10 | 4.871E-10 | 3.891E-10 | 3.176E-10 |
| WSW | 1.630E-08 | 7.242E-09 | 4.387E-09 | 2.217E-09 | 1.342E-09 | 8.998E-10 | 6.448E-10 | 4.841E-10 | 3.764E-10 | 3.007E-10 | 2.454E-10 |
| W | 1.249E-08 | 5.550E-09 | 3.362E-09 | 1.699E-09 | 1.028E-09 | 6.895E-10 | 4.941E-10 | 3.710E-10 | 2.885E-10 | 2.304E-10 | 1.881E-10 |
| WNW | 7.397E-09 | 3.286E-09 | 1.990E-09 | 1.006E-09 | 6.089E-10 | 4.083E-10 | 2.926E-10 | 2.197E-10 | 1.708E-10 | 1.364E-10 | 1.114E-10 |
| NW | 4.890E-09 | 2.172E-09 | 1.316E-09 | 6.651E-10 | 4.026E-10 | 2.699E-10 | 1.934E-10 | 1.452E-10 | 1.129E-10 | 9.020E-11 | 7.362E-11 |
| NNW | 4.041E-09 | 1.795E-09 | 1.087E-09 | 5.496E-10 | 3.327E-10 | 2.230E-10 | 1.598E-10 | 1.200E-10 | 9.331E-11 | 7.454E-11 | 6.084E-11 |

#### 4.6.2.2 Description of Gaseous Effluents

$UF_6$ will be the radioactive effluent for gaseous pathways. Average source term releases to the atmosphere are estimated to be 120 µCi per year for a 1.5 million separative work units (SWU) facility for the purposes of bounding routine operational impacts based on Section 2.3.4.1 of NUREG-1484 (NRC 1994). For the Facility, that would equate to 592 µCi per year. European experience indicates that uranium discharges from gaseous effluent ventilation systems are less than 10 g (0.35 ounces) per year or 28 µCi for facilities with similar designs and throughput (NRC 1994). Again, for the Facility, this would equate to 49 g per year or 137 µCi.

Therefore, 592 µCi is a very conservative estimate and is consistent with an NRC estimate documented in Section 2.3.4.1 of NUREG-1484 (NRC 1994) for a 1.5 million SWU plant that has been scaled for the 7.4 million SWU Facility.

Nonradioactive gaseous effluents such as hydrogen fluoride (HF) and methylene chloride are reported in Table 4-56. The values listed in the table were derived from NRC's review of the Claiborne Enrichment Center (NRC 1994).

In addition, on-site diesel engines include standby diesel generators. Their use will be administratively controlled (i.e., only run a limited number of hours per year to limit emissions) and are exempt from air permitting requirements by TDEC under Chapter 120003-09 (TDEC 2024).

#### 4.6.2.3 Description of Gaseous Effluent Ventilation Systems and Exhaust Filtration System

The principal functions of the gaseous effluent ventilation system (GEVS) is to protect both the operator during connection/disconnection of $UF_6$ process equipment, and the environment, by collecting and cleaning all potentially hazardous gases from the plant prior to release to the atmosphere. Releases to the atmosphere will be in compliance with regulatory limits.

Additional information are listed in Section 4.13.2.

### 4.6.3 Visibility Impacts

Visibility impacts from construction will be limited to fugitive dust emissions. Fugitive dust will originate predominantly from vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing, and to a lesser extent from wind erosion. There are no anticipated visibility impacts from operation of the Facility since there are no cooling towers that would produce visible plumes. Visibility impacts from decommissioning will be limited to fugitive dust. Fugitive dust will originate predominantly from building demolition, bulldozing, and vehicle traffic on unpaved surfaces. As specified in TDEC 1200-03-08.1 (TDEC 2018):

> *"No person shall cause, suffer, allow, or permit any materials to be handled, transported, or stored; or a building, its appurtenances, or a road to be used, constructed, altered, repaired, or demolished without taking reasonable precautions to prevent particulate matter from becoming airborne. Such reasonable precautions shall include, but not be limited to, the following:*

*(a) Use, where possible, of water or chemicals for control of dust in demolition of existing buildings or structures, construction operations, grading of roads, or the clearing of land;*

*(b) Application of asphalt, water, or suitable chemicals on dirt roads, material stock piles, and other surfaces which can create airborne dusts;*

*(c) Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials. Adequate containment methods shall be employed during sandblasting or other similar operations."*

### 4.6.4 Air quality Impacts from Decommissioning

Air quality impacts will occur during the decommissioning work, such as fugitive dust, vehicle exhaust, portable generator exhaust, air compressor exhaust, cutting torch fumes, and solvent fumes. Fugitive dust and vehicle exhaust during decommissioning are assumed to be bounded by the emissions during construction. The air quality impacts from decommissioning activities will be small, because these impacts are similar to and bounded by the air quality impacts associated with the construction of the Facility. The construction impacts were determined to be small.

### 4.6.5 Mitigative Measures for Air Quality Impacts

Air concentrations of criteria pollutants for vehicle emissions and fugitive dust will be below the NAAQS. Particulate matter and visibility impacts from fugitive dust emissions will be minimized with the use of water and water-extender solutions sprayed on the site at least twice daily (when needed) during the construction phase to suppress dust emissions.

Mitigation measures will be considered to minimize potential impact on air quality. These may include the following items:

- The GEVS is designed to collect and clean all potentially hazardous gases from the plant prior to release into the atmosphere. Instrumentation is provided to detect and signal via alarm all non-routine process conditions, including the presence of radionuclides or HF in the exhaust system that will trip the system to a safe condition in the event of effluent detection beyond routine operational limits.
- The HVAC System is designed to collect and clean all potentially hazardous gases from the serviced areas prior to release into the atmosphere.
- Construction Best Management Practices will be applied to minimize fugitive dusts.
- Applying gravel to the unpaved surface of haul roads.
- Imposing speed limits on unpaved haul roads.
- Applying an environmentally safe chemical soil stabilizer or chemical dust suppressant to the surface of the unpaved haul roads.
- The use of water spray bars at drop and conveyor transfer points.
- Limiting the height and disturbances of stockpiles.
- Applying water to the surface of stockpiles.

- Air concentrations of the criteria pollutants resulting from vehicle emissions and fugitive dust during construction will be below NAAQS.

### 4.6.6 Cumulative Air Quality Impacts

The cumulative impacts to the regional air quality, as documented herein, is limited to those resulting from construction and operation of the Facility. While OE is aware of private development plans within 10 mi of the Facility, namely the TRISO-X Fuel Fabrication Facility (1 mi NW of the Facility) and the HERMES Test Demonstration Facility (2.75 mi WSW of the Facility), OE is unaware of the significance of these two facilities on the cumulative air quality impact.

Section 3.6.2 provides an emissions inventory of other emission sources in the eight-county region surrounding the Facility. The inventory consists of 16 sources. Due to their distance from the Facility site, it is unlikely that these sources, in combination with emissions from the Facility site, will result in significant cumulative impacts, namely these other contributors' output will far exceed that from the Facility. Nevertheless, the air quality impact analysis described in Section 4.6.1 does incorporate background concentrations that are added to potential Facility impacts to simulate cumulative impacts. The cumulative impact to the regional air quality will be SMALL.

## 4.7 NOISE IMPACTS

Acoustical characteristics and ambient noise levels for the site are described in ER Section 3.7 (Noise). This section discusses noise impacts associated with construction, operation, and decommissioning of the Orano facility on the surrounding environment.

### 4.7.1 Proposed Action

#### 4.7.1.1 Construction Impacts

The Facility construction activities would occur primarily in an area in the southwest portion of the Site. Construction of the highway entrance is currently planned off SR-95 at the point Novus Drive intersects SR-95 creating an intersection as shown in Figure 4-1. A construction staging and laydown area is planned just north of the entrance just east of SR-95 and the electric transmission lines. The ORNL Carbon Test Facility is the closest facility located to the Facility approximately 1,330 ft from the southwest corner of the site where the Facility footprint and site boundary are nearly collocated.

Construction activities would require the use of heavy equipment for clearing, excavating, grading, and construction of the buildings. A representative list of construction equipment that may be used on-site and estimated attenuated noise levels for each piece of equipment at various distances are provided in Table 4-23. Noise generated from these types of equipment, blasting, and alarms would range from 80 to 95 dBA at approximately 50 ft (FHWA 2006). Most of the construction activities, including blasting, would occur during weekday daylight hours; however, construction may continue during nights and weekends, when necessary to maintain the construction schedule.

**Table 4-23 Attenuated Noise Levels Expected for Operation of Representative Construction Equipment**

| | Attenuated Noise Levels (dBA) | | | |
|---|---|---|---|---|
| **Source** | **50 ft.** | **98 ft.** | **197 ft.** | **394 ft.** |
| Air Compressor | 80 | 74 | 68 | 62 |
| Backhoe | 80 | 74 | 68 | 62 |
| Compactor | 80 | 74 | 68 | 62 |
| Concrete Pump | 82 | 76 | 70 | 64 |
| Concrete Saw | 90 | 84 | 78 | 72 |
| Crane | 85 | 79 | 73 | 67 |
| Dozer | 85 | 79 | 73 | 67 |
| Dump Truck | 84 | 78 | 72 | 66 |
| Excavator | 85 | 79 | 73 | 67 |
| Flat Bed Truck | 84 | 78 | 72 | 66 |
| Front End Loader | 80 | 74 | 68 | 62 |
| Generator | 82 | 76 | 70 | 64 |
| Lift | 85 | 79 | 73 | 67 |
| Paver | 85 | 79 | 73 | 67 |
| Pickup Truck | 55 | 49 | 43 | 37 |
| Welding Equipment | 73 | 67 | 61 | 55 |
| All Other Equipment >5 Horsepower | 85 | 79 | 73 | 67 |

Reference: (NRC 2022)

Note: Distances shown are the distances from the noise source

#### 4.7.1.1.1 Sources of Noise and Predicted Noise Levels

Construction activities would require the use of heavy equipment for clearing, excavating, grading, and construction of the buildings. A representative list of construction equipment that may be used on-site and estimated attenuated noise levels for each piece of equipment at various distances are provided in Table 4-23. Increased traffic noise to and from the facility is also anticipated during the construction phase, due to construction workforce vehicle traffic, truck deliveries, and off-site shipments of construction debris.

#### 4.7.1.1.2 Community Impacts

Primary noise receptors in the vicinity of the OE Facility are the ORETTC facility the borders the site to the north and the industrial and commercial businesses (the Philotechnics facility and CROET offices) associated with the Horizon Center Industrial Park to the west. There are no other recreational facilities, schools, churches, or other sensitive noise receptors adjacent to the facility that are vulnerable to noise impacts from the OE Facility. Additionally, the nearest residences are approximately 1.2 mi. to the north and separated from the site by a heavily forested ridge which provides a natural noise barrier.

During construction of the OE Facility, the majority of construction activity would occur near the center of the site. Thus, noise levels from construction equipment operated in this area would attenuate to levels below those listed for distances of 394 ft. in Table 4-23 (72 A-weighted decibels [dBA] or less) at adjacent properties and would not exceed the City of Oak Ridge Zoning Ordinance maximum noise level of 80 dBA (City of Oak Ridge 2025).

Increased traffic noise from construction workforce vehicle traffic, truck deliveries, and off-site shipments of construction debris would also contribute to increased noise during the construction period. Increased traffic noise to and from the site is also anticipated during construction of the Facility, due to the increase in vehicle traffic associated with the construction workforce and trucking associated onsite shipment of construction materials. As vehicles would access the site from Tennessee Highway 95, noise sensitive receptors along local/collector roadways and residential streets are avoided. Thus, noise impacts from construction traffic are SMALL.

Use of construction equipment may occasionally and temporarily result in noise levels at adjacent property boundaries that exceed the maximum limits established in the City of Oak Ridge Zoning Ordinance. However, construction noise would generally be intermittent over the approximately seven-year construction period and would only be perceptible to receptors in the immediate vicinity of the OE Facility where moderate noise levels are compatible with the industrial zoning designation (City of Oak Ridge 2025). Overall, noise impacts associated with construction on the land surrounding the Facility are temporary and SMALL.

### 4.7.1.1 Operational Impacts

The development of the Facility would generally increase noise levels, although the amount of the increase would depend on many factors, including the number of employees and the amount of increased vehicular traffic. Vehicular traffic would be increased on SR-95 during operations, but due to the vehicle traffic already present, maximum noise levels would not increase. However, the duration of these increased noise levels would be longer because of the increased duration of the peak commute time as compared to non-peak commute time periods.

An operational noise survey was performed at the Almelo Enrichment Plant in Almelo, Netherlands, at the border of the site boundary during a 24-hour period (AREVA 2011). The Almelo Enrichment Plant design is comparable to the design of the Facility. The noise results obtained during the survey ranged from 30 to 47 dBA, with an average of 39.7 dBA. The main sources of operational noise were from the Separation Building Modules that house the many centrifuges that are arranged in long multi-stage rows, the cooling fans, and the cooling towers. The minimum distance from the cascade halls to the Almelo site boundary was about 262 ft, while the cooling towers and cooling fans were about 394 ft from the site boundary.

The Almelo Enrichment Plant site is much smaller compared to the Facility site. Sound levels recorded at the Almelo Enrichment Plant boundary would represent a conservative upper bound for noise levels for the Facility. The estimated maximum noise levels during normal operations of the Facility would be less than 47 dBA as recorded at the Almelo boundary. The closest facility to the boundary-footprint area at the southwest corner for the Facility is the CFTF at approximately 1,330 feet as compared to the 262 and 394 cases cited above for Almelo.

Therefore, the Facility would be in compliance with the HUD guidelines of 60 dBA for residential use (HUD 1985) as presented in Table 3.7-3 and the EPA criteria of 55 dBA. Although the noise from the plant and the additional traffic would generally be noticeable, the operational noise from the plant is not expected to have an impact on nearby facilities.

#### 4.7.1.2 Decommissioning Impacts

Noise levels during decommissioning would be similar to those during construction at the Facility and therefore range from 80 to 95 dBA. These noise levels would diminish to about 52 to 67 dBA at the nearest facility (CFTF) located approximately 1330 feet from the Facility boundary/footprint area at the southwest corner of the site as described above. The attenuated lower value of 52 dBA meets the “clearly acceptable” limit for HUD Guideline (HUD 1985) for the above-noted industrial land use category at 70 dBA and does not exceed the EPA goal of 55 dBA for outside spaces (EPA 1974).

The maximum construction noise level of 95 dBA cited above that diminishes to 67 dBA is clearly acceptable for industrial facilities under the HUD guideline (HUD 1985) of 70 dBA. However, the 67 dBA value would exceed the EPA-defined goal of 55 dBA. Decommissioning activities at the southwest corner of the Facility will represent only a limited portion of the entire decommissioning period and a small impact on the CFTF for a limited time.

OE will minimize and manage noise and vibration impacts during decommissioning using methods described in Section 4.7.5. Therefore, decommissioning of the Facility would have a small impact on the area surrounding the Site.

### 4.7.2 Noise Sources

Noise point sources for the Facility during operation would include SBMs, coolers, rooftop fans, air conditioners, evaporators, transformers, and traffic from delivery trucks, employee vehicles, and site vehicles. Noise line sources for the plant during operation would consist only of vehicular traffic entering and leaving the site. Ambient background noise sources in the area include vehicular traffic along Highway 95, nearby industrial sources, and wind gusts.

### 4.7.3 Noise Level Standards

HUD guidelines, as detailed in Table 3-37, (HUD 1985) set the acceptable Day-Night Average Sound Level (Ldn) for areas of industrial, manufacturing, and utilities at 70 to 80 dBA as “normally acceptable.” Under these guidelines for construction (38-53 dBA) and operation (below 47 dBA), the Facility would not (1) result in a change to sound levels to the closest residence and (2) would not exceed the 60-65 dBA range considered “normally acceptable” for the land use category of residential (HUD 1985). The EPA goal of 55 dBA for Ldn in outdoor spaces, as detailed in the EPA Levels Document (EPA 1974) would not be exceeded relative to the nearest resident at 1.25 miles from the Facility. These diminished values just cited do not include any consideration of the attenuation of the noise due to the forested area between the Site and the nearest resident that would result in further reducing any noise associated with the construction and operation of the Facility.

The calculated construction noise levels at the closet facility from the nearest footprint-boundary area of the site from the construction areas would be at levels defined as “clearly acceptable” or “normally acceptable” by HUD (HUD 1985) and EPA (24 CFR 51.101(a)(8). Operational noise levels would be below both the HUD and EPA guidelines. There are no Roane County nor state of Tennessee environmental noise ordinances or regulations applicable to the Facility. Sound levels during construction and operation of the Facility would not be harmful to the public's life and health nor a disturbance of public peace and welfare.

The City of Oak Ridge has established quantitative noise level limits based on adjacent property uses, as codified in Article XII of the City's Zoning Ordinance (City of Oak Ridge 2025). For properties with adjacent business uses, the zoning ordinance sets a maximum noise limit of 80 dBA during both daytime and nighttime hours. Additionally, the sound level should not exceed 70 dBA for more than 50 percent of the survey period or 75 dBA for more than 10 percent of the survey period. These restrictions are specific to outdoor spaces, at the lot boundary (City of Oak Ridge 2025). The projected noise levels during construction, operations, and decommissioning as discussed are well within the City of Oak Ridge noise level limits.

### 4.7.4 Potential Impacts to Sensitive Receptors

Potential impacts to local schools, churches, hospitals, and residences would be small. Nearby schools, churches, and hospitals are located several miles away from Facility closer to “downtown” Oak Ridge, nominally 6 miles away. The George Jones Memorial Baptist Church, while approximately 1.23 miles from the center of the Facility, is a historical site and not an “active” church. The nearest residence is part of a small subdivision 1.25 miles away. Table 4-24 shows that the maximum construction (and decommissioning) noise levels would be diminished in the range of 38 to 53 dBA, meeting HUD, EPA, and City of Oak Ridge guidelines. These diminished values do not include any consideration of noise attenuation due to the forested area between the Site and the nearest resident further reducing any noise associated with construction, operation, and decommissioning of the Facility. Homes located along SR-95 may be affected by the vehicle noise during peak traffic times. Most of the heavy tractor-trailer vehicle traffic will come from south of the Facility from I-40 via SR-95 and 58, areas with sparse population.

**Table 4-24 Noise Receptors/Facilities Near Facility Site**

| Nearby Facilities/Receptors | Distance from Facility Center Point (mi) | Diminished Value (80 dBA max) | Diminished Value (95 dBA max) |
|---|---|---|---|
| Carbon Fiber Test Facility | 0.48 | 46 | 61 |
| Philotechnics | 0.86 | 41 | 56 |
| Oak Ridge Enhanced Training & Test Center (ORETTC) | 0.88 | 41 | 56 |
| TRISO-X (Fuel Fab Facility) | 1.08 | 39 | 54 |
| George Jones Memorial Baptist Church (Historical Site) | 1.23 | 38 | 53 |
| Nearest Residence | 1.25 | 38 | 53 |
| DOE NNSA Office of Secure Transportation | 1.60 | 36 | 51 |
| Kairos (Hermes Reactor Sites) | 2.77 | 31 | 46 |

In a report (USFWS 2024) documenting a biological opinion on potential impacts on bats on the ORR from a new disposal facility project, the effects of noise from construction were reviewed. It was concluded that given that "construction equipment noise usually ranges from 100-120 dB at 1-foot distance," establishing a 560-ft buffer around the project footprint would attenuate down to 65 dB. With this noise buffer, "it was assumed the effects of noise and lighting do not extend beyond this buffer." Thus, the cleared buffer for the Facility footprint will likely be more than the 560-ft and the construction time limited, it is expected that any noise impacts for bats will be minimal.

The USFWS report also noted:

- It has been reported that loud noise (e.g., construction equipment, live-fire ranges, aircraft noise) can disturb Indiana bat maternity colonies and suggested that loud activities around or near maternity colonies should be regulated when the species is using the roost. OE will work with TDEC and USFWS to minimize any construction noise as discussed below that has the potential to impact the bats.
- Other studies cited suggest that bats avoid noisy areas. Noise effects on bat foraging and other behaviors will vary in relation to volume, proximity, and duration of noise. Effects from noise attenuate with distance; for example, two studies found no or insignificant effects of traffic noise to bats when bats were more than 50-150 m from the noise source.

The estimated maximum noise levels during normal operations of the Facility is expected to be less than 47 dB, well below the 65 dB threshold for the 560-ft buffer zone. Therefore, the Facility would have no impact on sensitive receptors near the Site.

### 4.7.5 Mitigation

Mitigation of operational noise sources that would occur primarily from the Facility design, such as cooling systems, valves, transformers, pumps, generators, and other Facility equipment would generally be located inside Facility structures. The buildings themselves would absorb most of the noise generated within. Natural land contours, vegetation, trees, and site buildings and structures would mitigate noise from equipment located outside of the Facility structures. Distance from the noise source is also a key factor in the control of noise levels to area receptors. It is generally true that the sound pressure level from an outdoor noise source decreases 6 dB per doubling of distance. Thus, a noise that measures 80 dBA at 50 ft away from the source would measure 74 dB at 100 ft, 68 dB at 200 ft, and 62 dB at 400 ft. As noted previously, the nearest noise receptor is the CFTF. While meeting the HUD guidelines, the projected noise levels at the high end of the range (61 dBA) for maximum noise during construction exceeded EPA's guideline of 55 dBA.

To minimize traffic noise impacts during construction of the entrance and overall Facility, heavy truck and earth moving equipment usage would be restricted after daytime hours through early morning hours to minimize noise impacts to the CFTF and other nearby facilities.

OE will minimize and manage noise, and vibration impacts during construction and decommissioning by:

- Performing construction or decommissioning activities with the potential for noise or vibration at residential areas that could have a negative impact on the quality of life during the day-time hours. If it is necessary to perform an activity that could result in excessive noise or vibration in a residential area after hours, the community will be notified in accordance with the site procedures.
- Engineered and administrative controls for equipment noise abatement, including the use of equipment and vehicle mufflers, acoustic baffles, shrouding, barriers and noise blankets.
- Sequencing construction or decommissioning activities to minimize the overall noise and vibration impact (e.g., establishing the activities that can occur simultaneously or in succession).
- Utilizing blast mats, if necessary.
- Creating procedures for notifying State and local government agencies, residents, and businesses of construction or decommissioning activities that may produce high noise or vibration that could affect them.
- Posting appropriate state highway signs warning of blasting.
- Creating a Complaint Response Protocol for dealing with and responding to noise or vibration complaints, including entering the complaint into the site's Corrective Action Program.

### 4.7.6 Cumulative Impacts

Cumulative noise sources would include the Facility, other nearby industrial facilities, existing traffic along SR-95, and environmental noise (e.g., wind, thunder). The Facility site is part of the larger ORR for which DOE has historically maintained responsibility. The area surrounding the site is a part of DOE's ORR and can be characterized as industrial with a large portion of the area being greenfield sites. More recently, DOE has initiated efforts to make tracts of land within the ORR available for industrial development. Examples include the following, which are either planned or currently under development within a three-mile radius of the Facility location:

- TRISO-X fuel fabrication facility (planned and undergoing NRC licensing review) – 1.08 miles away.
- Kairos' Hermes test and demonstration reactors (have received NRC construction permits and early construction has started) – 2.77 miles away; and
- DOE National Nuclear Security Administration (NNSA) Simulated Nuclear and Radiological Activities Facility (planned facility for future addition at the ORETTC site) – 0.74 miles away.

Cumulative impacts from all noise sources at the Facility footprint would generally remain at or below HUD guidelines of 70 dBA Ldn (HUD, 1985) for the industrial land use category, during construction and decommissioning, and below 70 dBA Ldn (HUD 1985) and the EPA guidelines of 55 dBA Ldn (EPA 1974) during operations.

Potentially affected facilities along SR-95 near the Facility site would receive cumulative noise impacts from the highway and construction of the Facility. Maximum cumulative noise levels during construction of the highway entrance/access road and visitor center would exceed 70 dBA. The cumulative effects would be temporary because construction of the highway entrance/access road and visitor center are scheduled to be completed within 12 months. As noted previously, the CFTF is the closet noise receptor to the highway entrance at approximately 1,500 feet. Construction noise at the entrance would diminish from about 80-95 dBA to 46 – 61 dBA at the CFTF. These noise levels are considered "clearly acceptable" for the industrial uses (HUD 1985). Therefore, construction noise may be audible at the CFTF during construction of portions of the SR-95 entrance/access and visitor center.

Overall noise levels are not likely to increase; however, the duration of peak noise levels associated with commuting may increase. Therefore, cumulative noise impacts from the Facility will be SMALL.

## 4.8 HISTORICAL AND CULTURAL RESOURCES IMPACTS

As described in Section 3.8, a cultural resource survey was conducted to identify potential occurrences of archaeological and historical resources potentially eligible for the National Register of Historic Places on and near the Site. A total of seven archaeological sites were recorded during the survey (Figure 4-6).Of the seven sites only 40RE650, 40RE651 and 40RE655 were recommended for as potentially eligible for listing in the National Register of Historic Places (NHRP). The sites correspond to rural domestic homesites that were occupied at the time of the government acquisition of the land in the 1940s. OE is in the process of completing the phase II study based on Consultation with the SHPO to confirm if the three references sites need to be recorded.

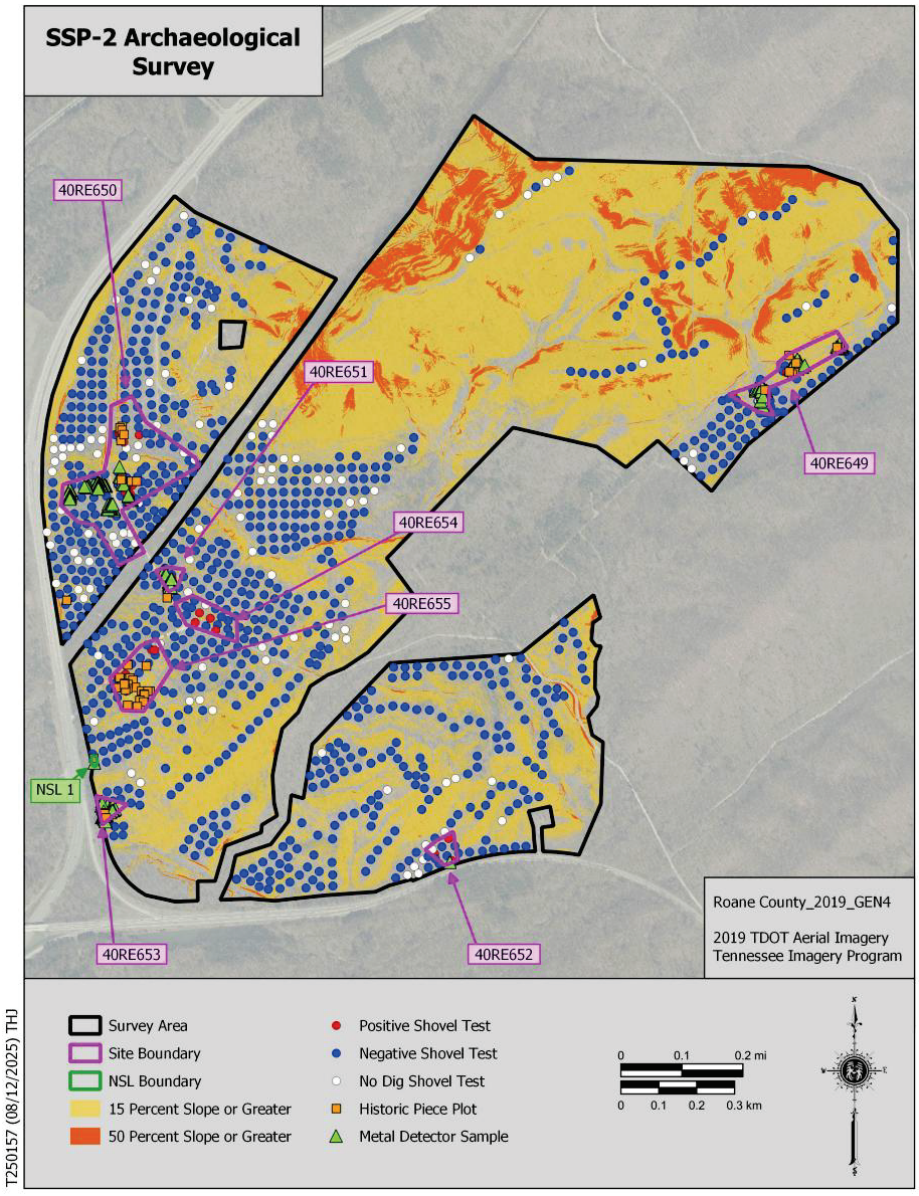



**Figure 4-6 Results from the archaeological study.**

Based on a lack of structural remains, the low density of artifacts recovered, and the disturbed context of the artifacts, none of the archaeological sites meet the NRHP criteria for significance. The sites lack integrity and preservation, and because they do not have the potential to yield significant new information pertaining to the history of the area, these sites are not considered eligible for listing in the National Register of Historic Places (NRHP).

The Tennessee State Historic Preservation Office (SHPO) has reviewed the findings of the survey and has concluded that no further consultation is required.

### 4.8.1 Proposed Action

Under the Proposed Action, the Facility is constructed and operated on the Site.

#### 4.8.1.1 Construction

The three potential sites are located within the PE and will be disturbed during construction activities. However, a phase II will be completed and it is believed that these sites will not be considered eligible for listing on the NRHP. Therefore, the impacts due to construction at this time are considered SMALL.

#### 4.8.1.2 Operation

During the operation of the Facility, there is no impact as the sites will not be registered with the NRHP.

#### 4.8.1.3 Decommissioning

Ground disturbing activities associated with decommissioning are limited to the same areas of disturbance as construction and as such impacts to cultural resources are avoided. There are no visual effects to known NRHP listed historic properties as a result of decommissioning activities Therefore, impacts to cultural and historical resources associated with decommissioning activities are SMALL.

#### 4.8.1.4 Mitigation Measures

The impacts to historical and cultural resources are small, therefore no mitigation measures are required.

There are two known cemeteries on the SSP-2 parcel: Smith (Gallaher) Cemetery and Hembree Cemetery. Neither will be included in the land transfer and will remain under DOE ownership. The Hembree Cemetery is on Tract B and is not near the proposed affected area. The Gallaher cemetery is on Tract A but is still outside the APE. OE will work with subcontractors to create a buffer around these areas and also have in place actions in accordance with local, state and federal agencies should any remains be found within the APE. Based on best management practices these areas will not be impacted by the construction, operation, or decommissioning of the Facility and there should not be any potential to find human remains on the site, and thus no mitigation measures are required. As part of the Phase II archeological survey, the chosen

subcontractor is providing a standard discovery plan that OE plans to adopt as a procedure for this and future activities that involve excavation.

### 4.8.2 Cumulative Impacts

The construction, operation, and decommissioning of the Facility will not impact any eligible archaeological site. As such, the cumulative impacts to historic and cultural resources are SMALL.

## 4.9 VISUAL/SCENIC RESOURCES IMPACTS

The visual and scenic characteristics of the Facility on the Site and its vicinity are described in Section 3.9 and photographs of the site are shown in Figure 3-88. This section describes the potential impacts on visual and scenic resources resulting from the Proposed Action.

### 4.9.1 Proposed Action

Under the Proposed Action, the Facility is constructed and operated on the Site. Figure 4-7 and Figure 4-8 present an aerial photograph of the Site overlayed with an outline of the Facility. Figure 4-9 shows external renderings of the proposed action.

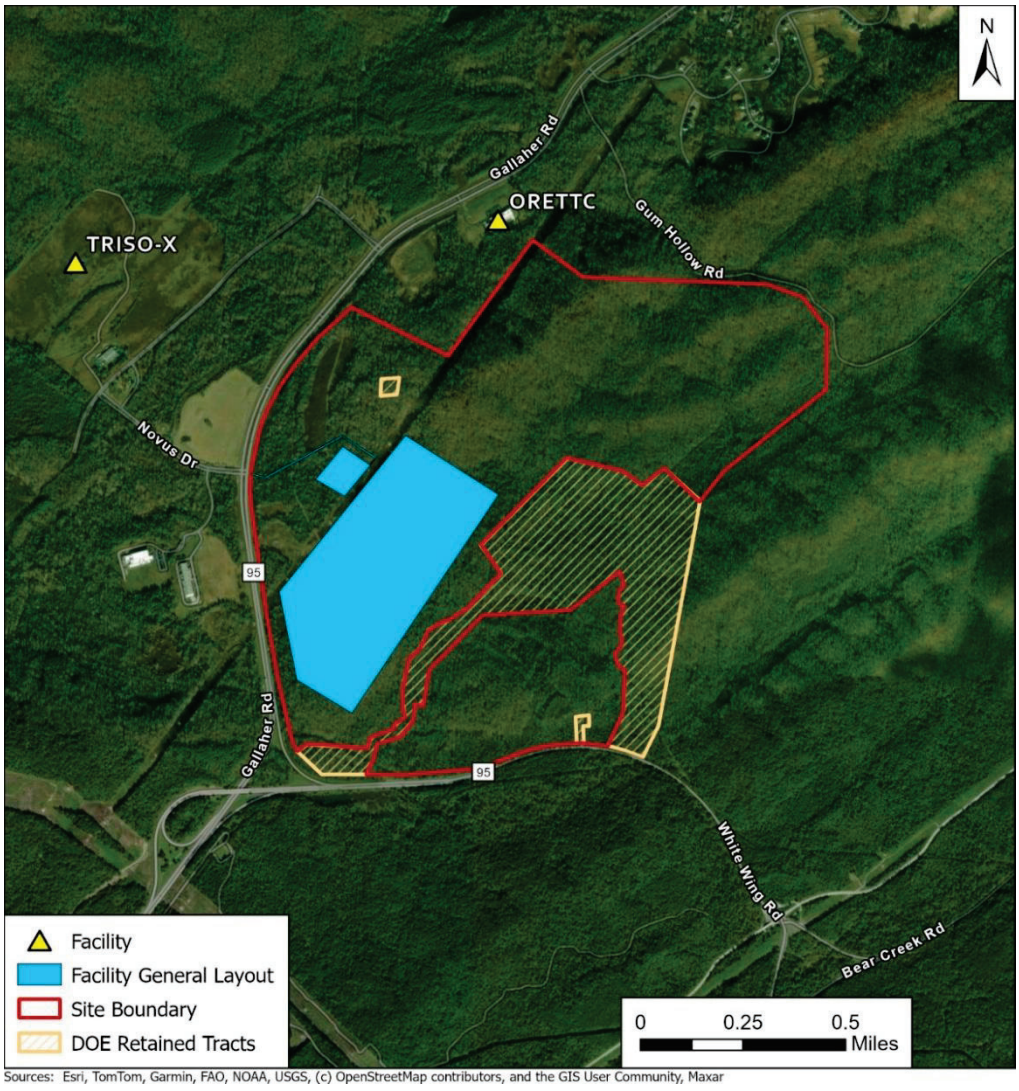



**Figure 4-7 Location of the Facility on the Site**

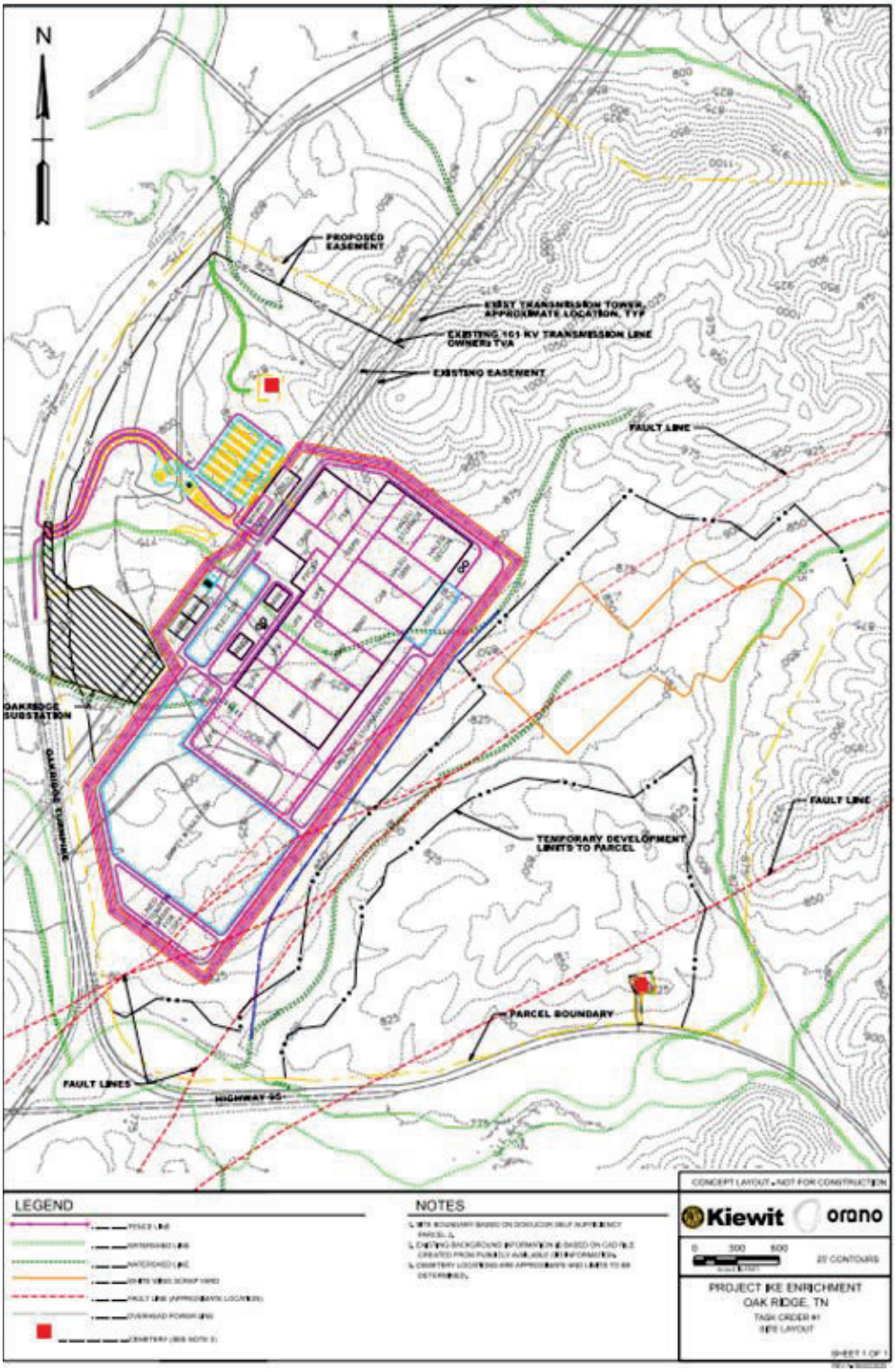



**Figure 4-8 Site Area and Facility Layout**



**Figure 4-9 External Renderings of the Facility**



**Figure 4-9 B  External Renderings of the Facility**

#### 4.9.1.1 Construction

Construction of the Facility will require clearing of woody vegetation from the interior of the site. Some tree removal from the perimeter of the site will be required for the development of a perimeter security path and fencing. Heavily forested areas on the site away from the Facility will remain, including a visual buffer between the Facility construction site and the Oak Ridge Turnpike.

In addition, temporary visual intrusions to the landscape may result from the use of tall cranes and other large construction equipment at the site. Because the impacts of construction activities on visual resources are temporary and localized, and a visual buffer between the site and sensitive visual receptors in the vicinity is maintained, visual/scenic resource impacts resulting from construction of the Facility is SMALL.

#### 4.9.1.2 Operation

The layout of the Facility is shown in Figure 4-8. Exterior renderings of the Facility are shown in Figure 4-9. As shown in these figures, the largest and most dominant structure associated with the Facility is the process building. The tallest point on the Facility is approximately 65 ft. The highest point of the site reaches approximately 1150 ft along East Poplar Ridge therefore the tallest part of the Facility will remain well below with an approximated sea-level height of approximately 900 ft. A 161-kV transmission line currently runs along East Poplar Ridge on the Site but will be relocated roadside to accommodate the Facility.

Public visibility of the Facility will be limited due to vegetation and terrain; however, some portions of the taller Facility structures may be visible from some points of nearby roads and surrounding properties including the small portions of the North Boundary Trail.

Lighting associated with the Facility has the potential to create visual intrusion for the surrounding landscape, particularly at night. Lighting will be required around the parking lot, building entrances, loading docks, and the security perimeter. The visual intrusions from the Facility on adjacent land uses are minimal due to two main factors: (1) the vegetation and terrain surrounding the Facility will reduce the intrusions, and (2) the main receptor of the intrusions would be the HCS which houses industrial facilities which are less sensitive to light intrusions.

The Facility structures are not out of character with the developments surrounding the Site including the HCS and the ORETTC. None of the Facility structures or operations typically produce significant noise emissions that exceed established noise level limits (see Section 4.7) or create significant atmospheric elements such as large emissions plumes that would be visible from surrounding areas.

The impacts on visual and scenic resources from the operation of the Facility for viewpoints outside the areas immediately adjacent to the Site are minimized by the terrain and the presence of forested vegetation, as discussed in Section 3.9.10. The Facility structures are not out of character with surrounding developments and will not produce significant noise or atmospheric emissions. Therefore, the visual and scenic resource impacts resulting from operation of the Facility are SMALL

#### 4.9.1.3 Decommissioning

Decommissioning of the Facility includes cleaning and removal of radioactive and hazardous waste contamination that may be present on materials, equipment, and structures. The activities are detailed in a Decommissioning Plan prepared and submitted to the NRC. Some of the facilities, including buildings, drainage features, access roads, and parking areas built for the Facility, could remain in place after closure. Similar to the construction phase, visual intrusions to the landscape may result from the use of large construction equipment on the Site during decommissioning, though these impacts are temporary and localized. Therefore, the visual/scenic resource impacts resulting from decommissioning of the Facility are SMALL.

### 4.9.2 Mitigation Measures

Due to the Facilities higher elevation in comparison to the surrounding area, the forested land being maintained, and the surrounding areas being comprised of industrial structures, the visual impact on the surrounding area is small.

Due to the limited visibility of the Facility and the incorporation of all design standards and requirements of the City of Oak Ridge into the Facility design, no further mitigation measures are warranted. Voluntary mitigation measures are discussed in Chapter 5.

### 4.9.3 Cumulative Impacts

Development activities within the geographic area of interest have resulted in localized impacts to visual/scenic resources. The construction of the Facility and other ongoing local projects are all in a commercialized industrial area, and thus the impacts of these past and ongoing actions in conjunction with the effects of the Proposed Action and other reasonably foreseeable future actions on visual and scenic resources are SMALL.

Public visibility of the Facility from off-site areas within the vicinity is minimal. Therefore, the impact of the incremental contribution of the NRC-authorized activities related to construction, operation and decommissioning of the Facility on visual resources are not significant contributors to the SMALL cumulative impact.

The TVA 161kV line relocation to the perimeter of the Site will add a few power line towers alongside SR-95, which is a common occurrence along SR-95 and SR-58. Given the limited extent and number of power line towers, the cumulative impacts on visual and scenic resources are SMALL.

## 4.10 SOCIOECONOMIC IMPACTS

This section describes the socioeconomic impacts to the community surrounding the Facility, including impacts from the influx of the construction and operation workforces to schools, housing, and social services. Transportation impacts are described in Section 4.2.

### 4.10.1 Facility Construction

#### 4.10.1.1 Jobs, Income, and Worker Population

Construction of the Facility is scheduled to start in 2028 and last for approximately 8 years (2028-2035). The total cost to construct Facility is estimated to be $5 billion.

Table 4-25 lists the estimated average annual number of construction employees working on the Facility during construction and the average salary wage. As shown in that table, a peak craft construction workforce of about 860 workers are anticipated from 2029 through 2035. During the early construction stages of the project, the workforce is expected to consist primarily of structural crafts from the local area. As construction progresses, there would be a transition to predominantly mechanical and electrical crafts. The bulk of this labor force is expected to come from the ROI. The available labor pool is expected to correlate with the required educational skills needed for the construction workforce.

**Table 4-25 Local Labor Headcount by Calendar Year**

| Activity | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | Avg. Annual Wage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Construction | 35 | 71 | 864 | 864 | 864 | 862 | 862 | 862 | 862 | 862 | 70,423 |
| Operations | 0 | 0 | 16 | 47 | 92 | 156 | 202 | 244 | 276 | 305 | 74,914 |
| **Grand Total** | **35** | **71** | **880** | **911** | **956** | **1,018** | **1,064** | **1,106** | **1,138** | **1,167** | **71,143** |

#### 4.10.1.2 Community Characteristic Impacts

The major impact of Facility construction on human activities is expected to be a result of the influx of labor into the area on a daily or semi-permanent basis. A conservative estimate is that 100% of the peak labor force moves into Roane County for the construction and operation of the Facility. This estimate would see a 2.2% increase in the population of Roane County. Thus, the overall change in population density and characteristics in Roane County due to the construction efforts of the Facility would be SMALL.

In 2023, Roane County had 3,016 vacant housing units (11.8%), the Region of Influence (ROI) as a whole, including Roane County, had 27,254 vacant housing units (8.8%). Even if all of the in-migrating construction workforce were to reside in Roane County, it would represent a reduction of 39% in the number of vacant housing units available in 2023. If they were to reside in the five-county ROI, it would represent a 4.3% reduction in available housing units that were available in 2023. Accordingly, the impact to housing in the ROI is SMALL.

### 4.10.2 Facility Operation

#### 4.10.2.1 Jobs, Income, and Worker Population

Operation of the Facility during the 40 year lifetime would lead to an increase in employment, income, and population in the area. If all of the operational workers were from outside the area, this would only represent less than 0.1% increase in the total employed labor force of 350,639 within the ROI in 2023, and about 1% increase in the 29,946-manufacturing employment in the ROI (Tables 3-44 & 3-45).

The Facility's annual operating payroll would be approximately $29 million for the operational workforce, or about $94,595 per worker per year (in 2025 constant dollars) per Table 4-26. This average salary is approximately 42% more than the $66,218 median household income in Roane County in 2023 (Table 3-47).

A significant increase in the area's population due to the construction and operation of the Facility is unlikely because most of the workforce would likely come from the existing local workforce. If it were to occur, Roane County and Anderson County would receive most of the new worker population due to the location of the Facility. The overall population change in Roane County, Anderson County, and the ROI as a whole due to the operation of the Facility would not be significant.

#### 4.10.2.2 Community Characteristic Impacts

The impacts to community characteristics are including in Section 4.10.1.2.

### 4.10.3 Regional Impact Due to Construction and Operation

The regional impact due to construction and operations is provided in Sections 4.10.

The estimated tax revenue and estimated allocations to the State of Tennessee and Roane County resulting from the construction and operation of the Facility are provided in Table 4-27.

The total estimated labor wages to be paid to workers during construction and operations is approximately $156M per year at its peak. Assuming 75% of the income is spent within Tennessee, the sales tax generated by the State and County will be about $10M per year on average. This considers 7% State sales tax and County tax that is between 2% (minimum) and 2.75% (maximum).

The total socioeconomic impact due to the construction and operation of the Facility will be SMALL.

**Table 4-26 Total Local Labor Wages (in $1,000)**

| Activity | CY 2026 | CY 2027 | CY 2028 | CY 2029 | CY 2030 | CY 2031 | CY 2032 | CY 2033 | CY 2034 | CY 2035 |
|---|---|---|---|---|---|---|---|---|---|---|
| Construction | 2,465 | 5,000 | 60,846 | 60,846 | 60,846 | 60,705 | 60,705 | 60,705 | 60,705 | 60,705 |
| Operations | 0 | 0 | 1,199 | 3,521 | 6,892 | 11,687 | 15,133 | 18,279 | 20,676 | 22,849 |
| **Grand Total** | **2,465** | **5,000** | **62,044** | **64,367** | **67,738** | **72,392** | **75,838** | **78,984** | **81,381** | **83,554** |

**Table 4-27 Average State and County Sales Tax Revenue (in $1,000)**

| Activity | CY 2026 | CY 2027 | CY 2028 | CY 2029 | CY 2030 | CY 2031 | CY 2032 | CY 2033 | CY 2034 | CY 2035 |
|---|---|---|---|---|---|---|---|---|---|---|
| Construction | 345 | 699 | 8,517 | 8,517 | 8,517 | 8,497 | 8,497 | 8,497 | 8,497 | 8,497 |
| *Min Sales Tax* | *330* | *670* | *8,157* | *8,157* | *8,157* | *8,138* | *8,138* | *8,138* | *8,138* | *8,138* |
| *Max Sales Tax* | *359* | *729* | *8,877* | *8,877* | *8,877* | *8,856* | *8,856* | *8,856* | *8,856* | *8,856* |
| Operations | 0 | 0 | 100 | 295 | 579 | 982 | 1,271 | 1,536 | 1,737 | 1,920 |
| *Min Sales Tax* | *0* | *0* | *96* | *283* | *554* | *940* | *1,218* | *1,471* | *1,664* | *1,839* |
| *Max Sales Tax* | *0* | *0* | *105* | *308* | *603* | *1,023* | *1,325* | *1,601* | *1,811* | *2,001* |
| **Grand Total** | **345** | **699** | **8,617** | **8,813** | **9,096** | **9,479** | **9,769** | **10,033** | **10,235** | **10,417** |

### 4.10.4 Decommissioning

Decontamination and decommissioning of the Facility is expected to take 8 years to complete. This would provide ongoing employment opportunities for other county and regional residents. Expenditure on salaries and materials would contribute to the area economy. In addition, the State of Tennessee and Counties would continue to benefit from sales tax revenues.

A detailed description of the decommissioning process and costs including workforce sizes, salaries, and other expenditures, is provided in Chapter 10, Decommissioning, of the License Application. The socioeconomic impact of decommissioning activities will be SMALL.

### 4.10.5 Cumulative Impacts

Due to the influx of labor during the construction and operation of the Facility, and it is estimated that the population increase will have an overall positive impact to the ROI. Despite the other projects potentially increasing the stress on the local real-estate, based on discussion with officials from Roane County (Appendix 1A), there is not anticipated to be a real-estate shortage within the ROI. Along with the other projects within the area identified in Chapter 2, there is a positive overall cumulative economic impact.

## 4.11 ENVIRONMENTAL JUSTICE

In accordance with Executive Order No. 14148, Environmental Justice has been removed from this ER (NRC 2025).

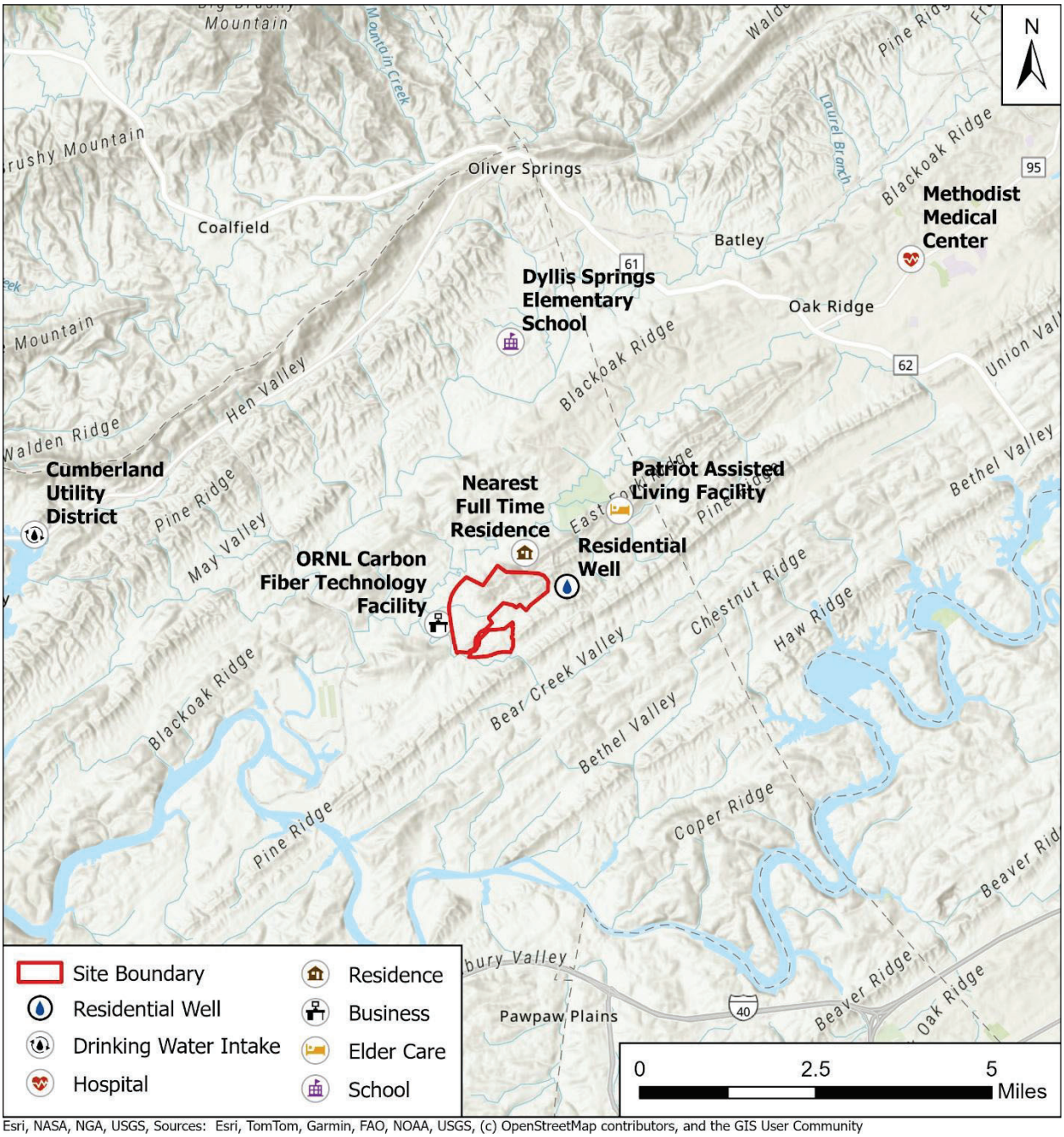
## 4.12 PUBLIC AND OCCUPATIONAL HEALTH IMPACTS

### 4.12.1 Proximity to Potential Receptors

The potential for public health impacts is related both to proximity of a given receptor with respect to the location of the Facility and the characteristics of non-radiological constituents, hazards, and preventative measures associated with the Facility. Figure 4-10 shows the location and distance to the nearest sensitive receptor populations relative to the Facility. These receptor populations include:

- The nearest full-time residence: located 1.2 mi.to the north-northeast.
- The nearest business: ORNL Carbon Fiber Technology Facility, is located 0.49 mi. to the west.
- The nearest elder-care facility: Patriot Assisted Living of Oak Ridge, is located 2.61 mi. to the northeast.
- The nearest school: Dyllis Springs Elementary School, is located 3.95 mi. to the north-northeast.
- The nearest residential well: located 1.43 mi. to the north-northwest.
- The nearest hospital: Methodist Medical Center, is located 8.01 mi. to the northeast.

- The nearest drinking water intake: the Cumberland Utility District intake located 6.31 mi. to the west-northwest.




Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

**Figure 4-10 Vicinity Sensitive Receptor Map**

### 4.12.2 Non-Radiological Impacts

Sources of non-radiological exposure to the public and to facility workers are characterized below. Non-radiological effluents have been evaluated and do not exceed criteria in 40 CFR 50, 59, 60, 61, 122, 129, or 141. In addition, all regulated gaseous effluents will be below regulatory limits as specified by TDEC.

Radionuclides, hydrogen fluoride, and methylene chloride are governed as National Emission Standards Hazardous Air Pollutants. Details of radiological gaseous effluent impacts and controls are described in Section 4.12.3. A detailed list of the chemicals that will be used at the Facility is listed in Table 2-1.

#### 4.12.2.1 Impacts of Construction

Construction of the Facility results in fugitive dust emissions (from construction activities and vehicular traffic along unpaved portions of the site) and vehicle emissions. Fugitive dust emissions from excavation and grading during construction may be controlled using BMPs and dust-suppression methods (e.g., water sprays and speed limits on unpaved roadways). Emissions from heavy construction equipment and vehicles generally do not affect ambient air quality but could result in a temporary local increase in emissions. Therefore, impacts to public health due to construction related air emissions are SMALL.

Precautions may be taken during construction to avoid soil erosion. Engineering controls and best management and construction practices may be implemented to minimize the extent of excavations and grading. Standard soil-erosion and sedimentation-control methods (e.g., silt fencing) may be used to minimize or prevent runoff from disturbed areas into any nearby waterbodies. All disturbed areas are permanently surfaced with either asphalt, grass, or concrete. Runoff collected from these areas is expected to have very minor sediment and other pollutants such as automobile oil, bacteria, nutrients, and pesticides. All of these pollutants are expected to be at concentrations equal to or lower than the allowable limits set by the TDEC. Impacts to public health resulting from soil erosion are SMALL during construction because preventative measures are taken to prevent the removal and erosion of soils.

Additionally, accidental discharges of fuel, waste, and sewage are also controlled by the use of safety procedures, adherence to a SPCC plan, and use of spill-response equipment in accordance with federal and State laws, which minimize the likelihood and magnitude of impacts from accidental discharges, should they occur. Use of these BMPs implemented during construction of the Facility, therefore, reduce exposure and potential effects to workers and the surrounding public. As such, potential effects of waste and accidental discharges on human health are SMALL.

As described in Section 4.4.2, erosion and sediment controls, and other construction-phase stormwater BMPs are implemented, NPDES Permit for construction is obtained from the TDEC and the City of Oak Ridge and stormwater controls are described in a SWPPP that are modified and updated throughout the changing conditions of construction. As such, impacts to surface water quality in conjunction with operation of the Facility are SMALL. Therefore, adverse health impacts to nearby residents or workers in conjunction with surface water quality are SMALL.

As described in Section 4.4.1, in conjunction with the use of best management and construction practices, impacts to groundwater quality expected to occur in conjunction with the construction, operation or decommissioning of the Facility are SMALL. No off-site residential groundwater wells in the immediate vicinity of the Facility are used for drinking water supply (see Section 3.4.1). Therefore, adverse health impacts to nearby residents or workers in conjunction with groundwater quality are SMALL.

Construction activities for the Facility require construction-related personnel, see Section 4.10. Construction activities are subject to OSHA construction regulations (29 CFR Part 1926) and any local ordinances, as appropriate.

The 2020 recordable injury and illness rates for the construction industry were 2.5 per 100 full-time workers (national average) (BLS 2020a) and 2.8 per 100 full-time workers (Tennessee average) (BLS 2020b). Based upon these average recordable injury and illness rates, and an anticipated construction workforce, recordable injuries and illnesses reported during the construction of the Facility could potentially range from 21.5 to 24.1 incidents annually. Similarly, the 2020 fatal occupational injury rate for the construction industry was 10.2 per 100,000 full-time equivalent workers (national average) (BLS 2020c) and 18.3 per 100,000 full-time equivalent workers (Tennessee average) (BLS 2020d). Based upon these average fatality rates applied to the anticipated construction workforce, the potential for construction-related fatalities is extremely low, on the order of 0.09 to 0.16 fatalities annually.

Proper adherence to the construction health and safety plan, including the use of personnel protective equipment, reduces the likelihood of construction-related recordable injuries and illness during the construction phase. As such, potential impacts associated with construction are SMALL.

#### 4.12.2.2 Impacts of Operation

##### 4.12.2.2.1 Routine Gaseous Effluent

Routine gaseous effluents from the Facility are listed in Table 4-56. The primary material in use at the Facility is $UF_6$. When released to the atmosphere, gaseous $UF_6$ combines with humidity to form a cloud of particulate $UO_2F_2$ and HF fumes.

In addition to being radioactive, $UO_2F_2$ can have toxic chemical effects (primarily on the kidneys) if it enters the bloodstream by means of ingestion or inhalation. In general, the chemotoxicity of uranium inhalation/ingestions is of more significance than radiation dose resulting from internal U exposure. The exposure severity limit of soluble uranium is described in ER Section 3.11.4.

At 10 wt% enrichment, the maximum allowable U concentration value for a 24-hour average concentration is 2.3 $mg/m^3$ according to 10 CFR 70-61. The average uranium release is estimated to be less than 20 $\mu g/m^3$ based on activity release at the Georges Besse 2 (GB2) Enrichment Facility (Orano 2025).

HF is an extremely corrosive gas that can damage the lungs and cause death if inhaled at high enough concentrations. As described in ER Section 3.11.4, there is a wide range of regulatory limits. The OSHA limit to worker exposure, for example, is 2.0 $mg/m^3$ for an 8-hr workday (OSHA 2025). By comparison, the annual expected average HF concentration emission from the OE Facility is less than 4 $\mu g/m^3$ at the point of discharge (rooftop) without atmospheric dispersion taken into consideration (based on fluoride compounds release in European enrichment facility).

This was determined by the annual quantity of Fluoride released at GB2 North and REC2, which has a similar capacity as the OE Facility, divided by the exhaust flow rate of the French facilities.

This demonstrates that the Facility gaseous emissions (even at rooftop without dispersion considered) will be well below any existing standard and, as a result, will have a negligible environmental and public health impact.

All chemicals at the Facility will be used in accordance with the manufacturer's recommendations, health and safety regulations and under formal procedures. OE will investigate the use of alternate solvents and/or apply control technologies as required. Mitigation measures to control chemical release are described in Section 5.12. The remaining effluents listed in Table 4-55 and Table 4-56, will have no significant impact on the public because they will be used in de minimis levels or are nonhazardous by nature. All regulated gaseous effluents will be below regulatory limits as specified by the TDEQ Air Quality Division.

Worker exposure to in-plant gaseous effluents listed in Table 4-56, will be minimal. No exposures exceeding 29 CFR 1910, Subpart Z are anticipated. Leaks in $UF_6$ components and piping would cause air to leak into the system and would not release effluent. All maintenance activities utilize mitigative features including local flexible exhaust hoses connected to the GEVS, thereby minimizing any potential for occupational exposure. Laboratory and maintenance operations activities involving hazardous gaseous or respirable effluents will be conducted with ventilation control and/or with the use of respiratory protection as required.

#### 4.12.2.2.2 Routine Liquid Effluent

Routine liquid effluents are described in Section 4.13.

Worker exposure to liquid in-plant effluents shown in Table 4-53 and Table 4-54 will be minimal. No exposures exceeding 29 CFR 1910, Subpart Z are anticipated. Additionally, handling of all chemicals and wastes will be conducted in accordance with the site Environment, Health, and Safety Program which will conform to 29 CFR 1910 and specify the use of appropriate engineered controls, including personnel protective equipment, to minimize potential chemical exposures. As a result, no worker acute or chronic (cumulative) impact is expected from routine liquid effluents.

### 4.12.2.3 Impacts of Decommissioning

During decommissioning, the non-radioactive material will be removed, handled and disposed in similar fashion as during operations. The impacts to the public are bounded by the operation of the Facility and are SMALL. The impacts to the public from the demolition and/or remediation activities are bounded by the construction of the Facility and are SMALL.

## 4.12.3 Radiological Impacts

The general public and the environment may be impacted by radiation and radioactive material from the Facility in two primary ways. Potential radiological impacts may occur from (1) gaseous discharges associated with controlled releases, and (2) direct radiation exposure associated with transportation and storage of cylinders.

### 4.12.3.1 Pathway Assessment

There are several exposure pathways to members of the public that can be associated with plant effluent, including: (1) direct radiation due to deposited radioactivity on the ground surface (ground plane exposure), (2) direct exposure from suspended material in a passing airborne cloud, (3) inhalation of airborne radioactivity from a passing effluent plume, and (4) ingestion of food products that were contaminated by plant effluent radioactivity.

The radiological impacts from routine gaseous effluents were estimated for all exposure pathways including inhalation and immersion in the effluent plume, direct dose from ground plane deposition, and ingestion of food products (stored and fresh vegetables, milk and meat) assumed to be grown or raised at the nearest resident location. For all exposure pathways, the Exposure-to-Dose conversion factors (DCFs) were taken from ICRP-2 for compliance with 10 CFR Part 50, Appendix I and 40 CFR Part 190 and were applied for both the committed organ dose equivalent and the committed effective dose equivalent as included in the NRCDose3 Code (NRC 2024). The pathway factors are based on the default Regulatory Guide 1.109 environmental transport and exposure assumptions as included in the NRCDose3 Code.

The key receptor locations (critical populations) for determining dose impacts included the site boundary with the most restrictive atmospheric dispersion factors (depleted X/Q and deposition factor, D/Q) as well as boundary locations where direct doses from fixed sources are predicted to be the highest (Table 4-28 and Table 4-29). A resident was also assumed to be present full-time in the sectors with the most limiting dispersion factors at an 0.32-mile distance.

**Table 4-28 Annual Average Effluent Air Concentrations at Critical Receptors**

| Location | Annual Average Depleted X/Q (Sec/m) | Isotope | Annual Average Release Rate (µCi/sec) | Average Airborne Concentration (uCi/m$^3$) |
|---|---|---|---|---|
| Maximum Site Boundary (W) | 1.22E-03 | U-234 | 1.76E-05 | 2.14E-08 |
| | | U-235 | 4.59E-07 | 5.58E-10 |
| | | U-236 | 2.24E-08 | 2.72E-11 |
| | | U-238 | 6.41E-07 | 7.80E-10 |
| Nearest Resident 1.19 mi (NE) | 8.35E-05 | U-234 | 1.76E-05 | 1.47E-09 |
| | | U-235 | 4.59E-07 | 3.83E-11 |
| | | U-236 | 2.24E-08 | 1.87E-12 |
| | | U-238 | 6.41E-07 | 5.36E-11 |
| Maxi Off-site Business 0.49 mi (W) | 6.15E-04 | U-234 | 1.76E-05 | 1.08E-08 |
| | | U-235 | 4.59E-07 | 2.82E-10 |
| | | U-236 | 2.24E-08 | 1.38E-11 |
| | | U-238 | 6.41E-07 | 3.94E-10 |

**Table 4-29 40 Years Accumulative Soil Concentrations at Critical Receptors**

| Location | Annual Average Deposition D/Q ($1m^2$) | Isotope | Annual Average Release Rate (uCi/yr) | 40 Year Soil Deposition ($uCi/m^2$) |
|---|---|---|---|---|
| Maximum Site Boundary (W) | 4.73E-06 | U-234 | 556.58 | 1.05E-01 |
| | | U-235 | 14.48 | 2.74E-03 |
| | | U-236 | 0.71 | 1.34E-04 |
| | | U-238 | 20.24 | 3.83E-03 |
| Nearest Resident 1.19 mi (NE) | 2.73E-07 | U-234 | 556.58 | 6.09E-03 |
| | | U-235 | 14.48 | 1.58E-04 |
| | | U-236 | 0.71 | 7.73E-06 |
| | | U-238 | 20.24 | 2.21E-04 |
| Maxi Off-site Business 0.49 mi (W) | 2.41E-06 | U-234 | 556.58 | 5.36E-02 |
| | | U-235 | 14.48 | 1.39E-03 |
| | | U-236 | 0.71 | 6.80E-05 |
| | | U-238 | 20.24 | 1.95E-03 |

The annual average atmospheric dispersion factors used in the radiological impacts assessment were calculated as described in Section 4.6 and are provided in Table 4-19 through Table 4-22. The meteorological data used for calculating the atmospheric dispersion is captured in Section 3.6.

Three groups of individuals (members of the public) or exposure scenarios were evaluated for both potential and real receptors located at or beyond the site boundary.

For the first group, the dose impact to the nearest (and highest potentially impacted) residence (assumed at 1.2 mi NE) was evaluated for all exposure pathways. The analysis included equivalent assessments for all four age groups (adults, teens, children, and infants) for these pathways. The occupancy time was assumed to be continuous for a full year, along with a conservative residential shielding factor of 1.0 for direct radiation exposures. This location provides for an assessment of doses to real members of the public.

The second group of individuals (critical populations) are those associated with the nearest business situated near the Facility. The nearest business location is at 0.49 miles to the W. This is the location for the most limiting dispersion for a non-facility worker. At this distance, the direct dose contribution from fixed radiation sources, i.e., all cylinder storage pads, is not a significant contributor to the total dose when compared to the gaseous effluent pathways. Since these are outdoor businesses, the annual occupancy is taken as 2,000 hours, along with a residential shielding factor of 1.0 (i.e., no shielding credit). In addition, only the inhalation and plume immersion pathways along with direct dose equivalent from ground plane deposition are applied (no food product consumption - gardens or animals - is associated with the performance of the business activity). The age group of interest is taken as adult.

The third group of postulated individuals (critical populations) is associated with transient populations who come right up to the site boundary and are assumed to stay for the equivalent of a standard work year (2,000 hours). This high occupancy time maximizes the dose impacts for activity on land bordering the site boundary. This also provides an estimate for on-site dose

equivalents (Facility occupational dose equivalents) for that portion of the Facility staff whose jobs take them into the general area of the Facility property away from the buildings. The residential shielding factor is set at 1.0 (no shielding credit) since any activity is assumed to take place outdoors. In addition, only the gaseous release exposure pathways of inhalation and plume immersion along with direct dose equivalent from ground plane deposition are applied (no food product ingestion pathways are expected to exist along the site boundary line). The total impact for the site boundary also includes direct radiation from the Cylinder Storage Pads on-site. The age group of interest is taken as adults as these locations are associated with worker related activities.

In addition to the above noted critical groups for members of the public, a bounding assessment was performed by assuming a hypothetical residence was located at the highest impacted site boundary (West (W) to Southwest (SW)). All the potential exposure pathways including direct radiation from cylinder storage pads, plume inhalation, and plume immersion, direct dose from ground plane deposition, and ingestion of food products (made up of fresh and stored vegetables, milk, and meat postulated to be grown or raised at the maximally impacted site boundary location) were assumed. The analysis included dose equivalent assessments for all four age groups (adults, teens, children, and infants) for these pathways, and 100% occupancy time for a full year, along with a conservative residential shielding factor of 1.0 for direct radiation exposures. The use of a hypothetical residence for all pathways and age groups places an upper bound on the dose impact that might be associated with changes in land use around the facility over its operating life.

Transit time for an accidental gaseous release (involving uranic or HF materials) ranges from a few minutes (to the boundary) to hours (to the nearest resident) for the critical populations discussed above.

#### 4.12.3.1.1 Routine Gaseous Effluent

Per Section 4.6, the total amount of uranium released to the environment via airborne effluent discharges from the Facility will be less than 592 µCi per year. Due to the anticipated low volume of contaminated liquid waste and the effectiveness of treatment processes, no waste in the form of liquid effluent discharges are expected. In addition, the radiological impacts associated with direct radiation from indoor operations from a relatively small number of $UF_6$ cylinders at any time are not expected to be a significant contributor. However, the outdoor accumulation of cylinders on all the cylinder storage pads may present the highest potential for direct radiation impact to the public at or beyond the Facility fence line.

Overall, the combined potential radiological impacts are expected to be a small fraction of the general public dose limits established in 10 CFR 20 and within the uranium fuel cycle standards established in 40 CFR.

#### 4.12.3.1.2 Routine Liquid Effluent

The design of the Facility includes liquid waste processing to remove uranic material from the waste stream by precipitation, filtration and evaporation. Section 2.1.2 provides an overview of the liquid effluent treatment system. From an effluent standpoint, an important design feature of

the liquid effluent treatment system is that there is no direct discharge of liquid effluents off-site. The source term for gaseous releases bounds the liquid pathway as well.

#### 4.12.3.1.3 Direct Radiation Impacts

Storage of uranium cylinders at the Facility may have an impact due to direct and scatter (sky shine) radiation to the site boundary, and to lesser extents, off-site locations.

The following paragraphs provide the details of the base analysis for the direct radiation doses from product and tails cylinders storage pad. The direct radiation for the Facility is then estimated using the equivalent dose versus distance developed from the base analysis and the Facility projected storage pad capacity and distance to the fence. The complete analysis of the Facility will be provided subsequently.

The base analysis evaluated a tails storage pad of 18,100 cylinders. The MCNP5 computer code (LANL 2008) was used to calculate the direct dose equivalent from the cylinder storage pads.. The storage pad included full-feed cylinders (356 48in cylinders, not stacked), full tails cylinders (16,819 48in cylinders, stacked), empty feed cylinders (356 48in, stacked), empty product cylinders (258 48in cylinders, stacked), and empty cylinders waiting to be filled with tails (311 48in cylinders, stacked). The empty feed cylinders were included because they contain radioactively decaying residual material. These empty cylinders produce a higher dose equivalent than full cylinders due to the absence of self-shielding from the $UF_6$ feed material. The empty cylinders waiting to be filled with tails were conservatively treated as empty feed cylinders with regards to the decaying residual materials. Direct dose from product cylinders (516 30in) were also included in the analysis. Values used for full tails cylinders and empty tails cylinders waiting to be filled are greater than the calculated number of cylinders, therefore, the environmental impact due to direct radiation is conservative.

The photon source intensity and spectrum were calculated using the ORIGEN-2 computer code (ORNL 1983). The generation of photons in $UF_6$ from beta particles emitted by the decay of uranium (i.e., Bremsstrahlung) is conservatively treated as if the material was $UO_2$ by the ORIGEN-2 code based on density differences between $UO_2$ and $UF_6$.

In addition to the photon source term, there is a two-component neutron source term from the cylinders. The first component of the neutron source term is due to spontaneous fission by uranium. For this component a fission spectrum for $^{252}Cf$, as taken from the Monte Carlo N-particle (MCNP) manual (LANL 2000), is assumed. The second component is due to neutron emission by fluorine after alpha particle capture ("alpha-n reaction"). ORIGEN-S from the SCALE 5.1 package was used to determine the neutron spectrum from the alpha-n reaction. ORIGEN-S also provided the source intensity for both components of the neutron source term.

The regulatory dose equivalent limit to members of the public for areas beyond the Facility fence boundary is 0.25 mSv (25 mrem) per year (including direct and effluent contributions). The evaluation of the Cylinder Storage Pads contribution to the off-site dose equivalent was based upon a site design criterion of no more than 0.20 mSv (20 mrem) at the site boundary to account for uncertainties in the calculation and to provide conservatism. The annual dose equivalents for the actual nearest off-site work location and at the nearest real residence were also calculated.

The dose equivalent at the maximum impacted Facility site boundary (South West) is 0.165 mSv/yr (16.5 mrem/yr) assuming 2,000 hours per year occupancy using the base analysis and appropriate distance. Table 4-30 summarizes the annual dose equivalents from fixed radiation sources at different locations of interest.

**Table 4-30 Direct Radiation Annual Dose Equivalent by Source**

| Location | Annual Occupancy (hrs/yr) | Cylinder Storage Pads mSv/yr | Cylinder Storage Pads mrem/yr |
|---|---|---|---|
| Site Fence (0.3 mi) | 2,000 | 0.165 | 16.5 |
| Closest Business (W 0.49mi) | 2,000 | <0.001 | <0.1 |
| Closest resident (NE 1.19mi) | 8,766 | <1E-6 | <1E-4 |

#### 4.12.3.1.4 Population Dose Equivalents

The local area population distribution was derived based estimated 2050 population data from the University of Tennessee (Tennessee State Data Center 2024), University of Kentucky (University of Kentucky n.d.), and the North Carolina Office of State Budget and Management (NCOBSM n.d.). The population distribution was projected based on the geographical area of each county inside 10 concentric bands at 0 to 1 mi, 1 to 2 mi, 2 to 3 mi, 3 to 4 mi, 4 to 5 mi, 5 to 10 mi, 10 to 20 mi, 20 to 30 mi, 30 to 40 mi, and 40 to 50 mi, and 16 directional sectors, each consisting of 22 ½ degrees, centered on the Facility site. The population distribution is presented in Table 4-31.

The age distribution (adults-71%, teens-11%, children-18%, infants-2%) from Regulatory Guide 1.109 was applied to the total population for all exposure pathways including the determination of annual committed dose equivalent from ingestion and inhalation where age also affects the amount of annual intake (air and food).

The collective dose equivalent from gaseous effluents are calculated for the 50 mi population based on all pathways calculated for the nearest resident, applied to the general population. For the ingestion of food products, it was assumed that the 50 mi area produced sufficient volume to supply the entire population with their needs. This is supported by the regional food production (vegetables, milk and meat) data shown on Table 4-32 through Table 4-34. Individual total effective dose equivalents were determined for each age group by pathway and organ using the NRCDose3 code. The collective dose by sector and distance shown in Table 4-35 and Table 4-36 was then calculated by distributing the dose by pathway and organ over the population distribution within the 50 mi radius of the Facility site in units of Person-Sieverts and Person-rem, respectively. Table 4-37 provides a summary of the various organ dose equivalents to the same 50 mi population from all airborne release pathways of exposure.

Table 4-38 through Table 4-47 summarizes the annual dose estimates for the potential and real receptors by age group.

**Table 4-31 Population Data (All Ages) for the Year 2050 within 50 Mi.**

| Sector | 0-1 mi | 1-2 mi | 2-3 mi | 3-4 mi | 4-5 mi | 5-10 mi | 10-20 mi | 20-30 mi | 30-40 mi | 40-50 mi | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 708 | 708 | 708 | 2549 | 10964 | 4806 | 7588 | 6061 | 34094 |
| NNE | 0 | 0 | 708 | 708 | 708 | 3553 | 12346 | 8684 | 10068 | 9438 | 46214 |
| NE | 0 | 0 | 708 | 708 | 708 | 3553 | 14540 | 18451 | 11670 | 12758 | 63097 |
| ENE | 0 | 0 | 708 | 708 | 708 | 4127 | 40853 | 109922 | 88271 | 20180 | 265479 |
| E | 0 | 0 | 708 | 708 | 708 | 7816 | 67028 | 103596 | 101419 | 34495 | 316479 |
| ESE | 0 | 0 | 708 | 708 | 708 | 16227 | 60917 | 45299 | 40084 | 37379 | 202031 |
| SE | 0 | 0 | 708 | 708 | 708 | 7327 | 28155 | 28146 | 41544 | 14831 | 122127 |
| SSE | 0 | 0 | 708 | 708 | 708 | 3968 | 16629 | 22501 | 14165 | 9874 | 69263 |
| S | 0 | 0 | 708 | 708 | 708 | 2864 | 15294 | 10909 | 11512 | 14601 | 57304 |
| SSW | 0 | 0 | 708 | 708 | 708 | 2214 | 11451 | 14332 | 19416 | 23118 | 72657 |
| SW | 0 | 0 | 708 | 708 | 708 | 11468 | 13428 | 9192 | 4492 | 5121 | 45826 |
| WSW | 0 | 0 | 708 | 708 | 708 | 9500 | 20346 | 9811 | 460 | 3947 | 46189 |
| W | 0 | 0 | 708 | 708 | 708 | 18003 | 16819 | 8830 | 233 | 212 | 46223 |
| WNW | 0 | 0 | 708 | 708 | 708 | 4282 | 8623 | 4324 | 2714 | 9013 | 31081 |
| NW | 0 | 0 | 708 | 708 | 708 | 499 | 1850 | 2905 | 4517 | 1668 | 13564 |
| NNW | 0 | 0 | 708 | 708 | 708 | 499 | 4295 | 3638 | 5597 | 6583 | 22738 |
| **Ring Totals** | 0 | 0 | 11333 | 11333 | 11333 | 98451 | 343539 | 405345 | 363751 | 209281 | 1454367 |
| **Cum. Totals** | 0 | 0 | 11333 | 22667 | 34000 | 132451 | 475990 | 881335 | 1245086 | 1454367 | |

**Table 4-32: Estimated Vegetable (Below Ground) Production (lbs/yr) within 50 Miles**

| Sector | 0·1 mi | 1·2 mi | 2-3mi | 3-4mi | 4-5mi | 5-10 mi | 10·20 mi | 20·30 mi | 30-40 mi | 40-50 mi | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 1,119,692 | 4,449,059 | 4,087,466 | 6,813,645 | 18,396,491 | 35,248,835 |
| NNE | 15,299 | 45,898 | 76,496 | 182,249 | 325,300 | 1,349,245 | 4,636,841 | 2,850,223 | 3,077,415 | 12,083,130 | 24,642,097 |
| NE | 15,299 | 45,898 | 161,933 | 295,815 | 380,334 | 1,349,245 | 5,521,213 | 8,040,051 | 15,749,989 | 14,671,555 | 46,231,333 |
| ENE | 15,299 | 45,898 | 172,355 | 295,815 | 380,334 | 1,368,872 | 4,958,719 | 6,701,410 | 15,282,155 | 19,888,532 | 49,109,388 |
| E | 15,299 | 45,898 | 98,064 | 295,815 | 380,334 | 428,432 | 3,674,315 | 5,678,834 | 8,828,962 | 14,718,819 | 34,164,772 |
| ESE | 15,299 | 45,898 | 76,496 | 182,249 | 311,398 | 889,515 | 3,539,911 | 3,897,047 | 6,181,587 | 9,942,695 | 25,082,096 |
| SE | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 1,383,735 | 3,643,595 | 3,324,091 | 4,906,435 | 11,356,958 | 24,997,296 |
| SSE | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 1,890,193 | 7,751,938 | 8,404,046 | 9,268,133 | 13,717,515 | 41,414,307 |
| s | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 1,542,464 | 7,146,614 | 7,819,749 | 10,980,640 | 14,458,811 | 42,330,760 |
| SSW | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 1,400,938 | 6,174,207 | 10,591,191 | 23,250,265 | 27,810,563 | 69,609,645 |
| SW | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 10,841,900 | 10,866,661 | 7,685,321 | 5,604,280 | 6,342,749 | 41,723,394 |
| WSW | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 5,034,308 | 12,393,928 | 5,260,197 | 995,552 | 8,541,364 | 32,607,832 |
| w | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 5,126,245 | 5,834,901 | 2,258,868 | 56,520 | 383,055 | 14,042,070 |
| WNW | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 1,427,680 | 3,292,036 | 2,781,206 | 2,185,971 | 67,760,815 | 77,830,191 |
| NW | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 439,667 | 1,628,983 | 2,557,928 | 3,652,981 | 1,210,040 | 9,872,081 |
| NNW | 15,299 | 45,898 | 76,496 | 107,095 | 137,694 | 439,667 | 2,876,334 | 5,691,440 | 8,709,212 | 14,512,572 | 32,611,708 |
| **Totals** | 244,789 | 734,366 | 1,426,806 | 2,429,989 | 3,292,329 | 36,031,797 | 88,389,257 | 87,629,069 | 125,543,743 | 255,795,663 | 601,517,806 |

**Table 4-33: Estimated Milk Production (gallons/yr) within 50 Mi**

| Sector | 0·1 mi | 1·2 mi | 2-3mi | 3-4mi | 4-5mi | 5-10 mi | 10·20 mi | 20·30 mi | 30-40 mi | 40-50 mi | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 317 | 952 | 1,586 | 2,220 | 2,855 | 26,293 | 102,107 | 123,018 | 198,122 | 97,881 | 555,351 |
| NNE | 317 | 952 | 1,586 | 3,779 | 6,745 | 27,975 | 105,394 | 139,922 | 198,523 | 207,031 | 692,223 |
| NE | 317 | 952 | 3,357 | 6,133 | 7,886 | 27,975 | 114,475 | 177,572 | 360,761 | 351,212 | 1,050,639 |
| ENE | 317 | 952 | 3,574 | 6,133 | 7,886 | 28,382 | 102,812 | 138,945 | 409,725 | 994,966 | 1,693,691 |
| E | 317 | 952 | 2,033 | 6,133 | 7,886 | 8,883 | 76,182 | 117,743 | 218,421 | 750,597 | 1,189,147 |
| ESE | 317 | 952 | 1,586 | 3,779 | 6,456 | 18,443 | 78,896 | 119,572 | 181,547 | 213,425 | 624,974 |
| SE | 317 | 952 | 1,586 | 2,220 | 2,855 | 28,690 | 90,258 | 117,767 | 173,826 | 46,609 | 465,080 |
| SSE | 317 | 952 | 1,586 | 2,220 | 2,855 | 39,191 | 160,726 | 610,107 | 2,032,418 | 1,624,259 | 4,474,631 |
| s | 317 | 952 | 1,586 | 2,220 | 2,855 | 31,981 | 148,175 | 1,361,995 | 2,394,821 | 2,994,637 | 6,939,540 |
| SSW | 317 | 952 | 1,586 | 2,220 | 2,855 | 29,047 | 128,014 | 1,352,669 | 4,261,964 | 5,089,876 | 10,869,500 |
| SW | 317 | 952 | 1,586 | 2,220 | 2,855 | 224,792 | 225,306 | 205,963 | 200,579 | 402,538 | 1,267,109 |
| WSW | 317 | 952 | 1,586 | 2,220 | 2,855 | 129,473 | 291,681 | 126,978 | 109,034 | 935,458 | 1,600,554 |
| w | 317 | 952 | 1,586 | 2,220 | 2,855 | 189,095 | 217,495 | 94,487 | 2,357 | 51,003 | 562,368 |
| WNW | 317 | 952 | 1,586 | 2,220 | 2,855 | 56,518 | 140,052 | 119,958 | 87,836 | 168,843 | 581,137 |
| NW | 317 | 952 | 1,586 | 2,220 | 2,855 | 19,065 | 70,638 | 110,920 | 147,325 | 43,632 | 399,510 |
| NNW | 317 | 952 | 1,586 | 2,220 | 2,855 | 19,065 | 84,085 | 126,164 | 186,984 | 205,336 | 629,566 |
| **Totals** | 5,075 | 15,226 | 29,583 | 50,383 | 68,262 | 904,867 | 2,136,297 | 5,043,779 | 11,164,244 | 14,177,303 | 33,595,020 |

**Table 4-34 Estimated Meat Production (lbs/yr) within 50 Mi**

| Sector | 0·1 mi | 1·2 mi | 2-3mi | 3-4mi | 4-5mi | 5-10 mi | 10·20 mi | 20·30 mi | 30-40 mi | 40-50 mi | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 84 | 253 | 422 | 590 | 759 | 7727 | 23152 | 19775 | 30679 | 46519 | 129962 |
| NNE | 84 | 253 | 422 | 939 | 1629 | 6684 | 25339 | 34809 | 49728 | 136556 | 256443 |
| NE | 84 | 253 | 818 | 1465 | 1884 | 6684 | 27351 | 47666 | 135816 | 270519 | 492542 |
| ENE | 84 | 253 | 866 | 1465 | 1884 | 6915 | 31679 | 58622 | 153174 | 317039 | 571981 |
| E | 84 | 253 | 522 | 1465 | 1884 | 3834 | 32881 | 50820 | 79429 | 190146 | 361319 |
| ESE | 84 | 253 | 422 | 939 | 1565 | 7960 | 41362 | 103123 | 144671 | 91054 | 391433 |
| SE | 84 | 253 | 422 | 590 | 759 | 14721 | 65869 | 115729 | 170818 | 59022 | 428267 |
| SSE | 84 | 253 | 422 | 590 | 759 | 23606 | 101580 | 143633 | 180870 | 142927 | 594724 |
| s | 84 | 253 | 422 | 590 | 759 | 14231 | 93150 | 134079 | 178486 | 221259 | 643313 |
| SSW | 84 | 253 | 422 | 590 | 759 | 7724 | 56813 | 125840 | 218187 | 258106 | 668779 |
| SW | 84 | 253 | 422 | 590 | 759 | 87875 | 78480 | 65566 | 68022 | 73594 | 375646 |
| WSW | 84 | 253 | 422 | 590 | 759 | 72838 | 137516 | 59222 | 14706 | 126174 | 412565 |
| w | 84 | 253 | 422 | 590 | 759 | 151535 | 152093 | 80753 | 2089 | 5503 | 394083 |
| WNW | 84 | 253 | 422 | 590 | 759 | 40755 | 93913 | 62761 | 88845 | 248175 | 536558 |
| NW | 84 | 253 | 422 | 590 | 759 | 8890 | 32938 | 51722 | 144992 | 81214 | 321865 |
| NNW | 84 | 253 | 422 | 590 | 759 | 8890 | 28124 | 16662 | 42649 | 90796 | 189230 |
| **Totals** | 1350 | 4049 | 7688 | 12769 | 17196 | 470868 | 1022240 | 1170780 | 1703164 | 2358606 | 6768710 |

**Table 4-35 Collective Population Effective Dose Equivalents to All Ages (Person-Sieverts) within 50 Mi.**

| Sector | 0·1 mi | 1·2 mi | 2-3mi | 3-4mi | 4-5mi | 5-10 mi | 10·20 mi | 20·30 mi | 30-40 mi | 40-50 mi | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 3.12E-06 | 1.34E-05 | 5.88E-06 | 9.29E-06 | 7.42E-06 | 4.17E-05 |
| NNE | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 4.35E-06 | 1.51E-05 | 1.06E-05 | 1.23E-05 | 1.16E-05 | 5.66E-05 |
| NE | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 4.35E-06 | 1.78E-05 | 2.26E-05 | 1.43E-05 | 1.56E-05 | 7.72E-05 |
| ENE | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 5.05E-06 | 5.00E-05 | 1.35E-04 | 1.08E-04 | 2.47E-05 | 3.25E-04 |
| E | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 9.57E-06 | 8.20E-05 | 1.27E-04 | 1.24E-04 | 4.22E-05 | 3.87E-04 |
| ESE | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 1.99E-05 | 7.46E-05 | 5.54E-05 | 4.91E-05 | 4.57E-05 | 2.47E-04 |
| SE | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 8.97E-06 | 3.45E-05 | 3.44E-05 | 5.08E-05 | 1.82E-05 | 1.49E-04 |
| SSE | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 4.86E-06 | 2.04E-05 | 2.75E-05 | 1.73E-05 | 1.21E-05 | 8.48E-05 |
| s | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 3.50E-06 | 1.87E-05 | 1.34E-05 | 1.41E-05 | 1.79E-05 | 7.01E-05 |
| SSW | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 2.71E-06 | 1.40E-05 | 1.75E-05 | 2.38E-05 | 2.83E-05 | 8.89E-05 |
| SW | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 1.40E-05 | 1.64E-05 | 1.13E-05 | 5.50E-06 | 6.27E-06 | 5.61E-05 |
| WSW | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 1.16E-05 | 2.49E-05 | 1.20E-05 | 5.63E-07 | 4.83E-06 | 5.65E-05 |
| w | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 2.20E-05 | 2.06E-05 | 1.08E-05 | 2.85E-07 | 2.60E-07 | 5.66E-05 |
| WNW | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 5.24E-06 | 1.06E-05 | 5.29E-06 | 3.32E-06 | 1.10E-05 | 3.80E-05 |
| NW | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 6.11E-07 | 2.26E-06 | 3.56E-06 | 5.53E-06 | 2.04E-06 | 1.66E-05 |
| NNW | 0 | 0 | 8.67E-07 | 8.67E-07 | 8.67E-07 | 6.11E-07 | 5.26E-06 | 4.45E-06 | 6.85E-06 | 8.06E-06 | 2.78E-05 |
| **Ring Totals** | 0 | 0 | 1.39E-05 | 1.39E-05 | 1.39E-05 | 1.20E-04 | 4.20E-04 | 4.96E-04 | 4.45E-04 | 2.56E-04 | 1.78E-03 |
| **Cum. Totals** | 0 | 0 | 1.39E-05 | 2.77E-05 | 4.16E-05 | 1.62E-04 | 5.83E-04 | 1.08E-03 | 1.52E-03 | 1.78E-03 | |

**Table 4-36 Collective Population Effective Dose Equivalents to All Ages (Person-Rem) within 50 Mi.**

| Sector | 0·1 mi | 1·2 mi | 2-3mi | 3-4mi | 4-5mi | 5-10 mi | 10·20 mi | 20·30 mi | 30-40 mi | 40-50 mi | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 3.12E-04 | 1.34E-03 | 5.88E-04 | 9.29E-04 | 7.42E-04 | 4.17E-03 |
| NNE | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 4.35E-04 | 1.51E-03 | 1.06E-03 | 1.23E-03 | 1.16E-03 | 5.66E-03 |
| NE | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 4.35E-04 | 1.78E-03 | 2.26E-03 | 1.43E-03 | 1.56E-03 | 7.72E-03 |
| ENE | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 5.05E-04 | 5.00E-03 | 1.35E-02 | 1.08E-02 | 2.47E-03 | 3.25E-02 |
| E | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 9.57E-04 | 8.20E-03 | 1.27E-02 | 1.24E-02 | 4.22E-03 | 3.87E-02 |
| ESE | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 1.99E-03 | 7.46E-03 | 5.54E-03 | 4.91E-03 | 4.57E-03 | 2.47E-02 |
| SE | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 8.97E-04 | 3.45E-03 | 3.44E-03 | 5.08E-03 | 1.82E-03 | 1.49E-02 |
| SSE | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 4.86E-04 | 2.04E-03 | 2.75E-03 | 1.73E-03 | 1.21E-03 | 8.48E-03 |
| s | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 3.50E-04 | 1.87E-03 | 1.34E-03 | 1.41E-03 | 1.79E-03 | 7.01E-03 |
| SSW | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 2.71E-04 | 1.40E-03 | 1.75E-03 | 2.38E-03 | 2.83E-03 | 8.89E-03 |
| SW | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 1.40E-03 | 1.64E-03 | 1.13E-03 | 5.50E-04 | 6.27E-04 | 5.61E-03 |
| WSW | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 1.16E-03 | 2.49E-03 | 1.20E-03 | 5.63E-05 | 4.83E-04 | 5.65E-03 |
| w | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 2.20E-03 | 2.06E-03 | 1.08E-03 | 2.85E-05 | 2.60E-05 | 5.66E-03 |
| WNW | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 5.24E-04 | 1.06E-03 | 5.29E-04 | 3.32E-04 | 1.10E-03 | 3.80E-03 |
| NW | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 6.11E-05 | 2.26E-04 | 3.56E-04 | 5.53E-04 | 2.04E-04 | 1.66E-03 |
| NNW | 0 | 0 | 8.67E-05 | 8.67E-05 | 8.67E-05 | 6.11E-05 | 5.26E-04 | 4.45E-04 | 6.85E-04 | 8.06E-04 | 2.78E-03 |
| **Ring Total** | 0 | 0 | 1.39E-03 | 1.39E-03 | 1.39E-03 | 1.20E-02 | 4.20E-02 | 4.96E-02 | 4.45E-02 | 2.56E-02 | 1.78E-01 |
| **Cum. Total** | 0 | 0 | 1.39E-03 | 2.77E-03 | 4.16E-03 | 1.62E-02 | 5.83E-02 | 1.08E-01 | 1.52E-01 | 1.78E-01 | |

**Table 4-37 Summary of 50 Mile Population for All Age Groups -All Airborne Pathways**

| Effective Dose Equivalent Person-Sv (Person-Rem) | GI Tract Person-Sv (Person-Rem) | Bone Person-Sv (Person-Rem) | Liver Person-Sv (Person-Rem) | Kidney Person-Sv (Person-Rem) | Thyroid Person-Sv (Person-Rem) | Lung Person-Sv (Person-Rem) | Skin Person-Sv (Person-Rem) |
|---|---|---|---|---|---|---|---|
| 1.78E-03 | 9.12E-04 | 2.76E-02 | 7.95E-05 | 5.83E-03 | 7.95E-05 | 4.67E-02 | 2.43E-04 |
| (1.78E-01) | (9.12E-02) | (2.76E+00) | (7.95E-03) | (5.83E-01) | (7.95E-03) | (4.67E+00) | (2.43E-02) |

**Table 4-38 Annual Dose Equivalents to Nearest Resident (Adult)**

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 5.02E-05 |
| | (mrem) | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 5.02E-03 |
| Ingestion Vegetables | (mSv) | 2.65E-04 | 3.18E-04 | 4.30E-03 | 0.00E+00 | 1.02E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 2.65E-02 | 3.18E-02 | 4.30E-01 | 0.00E+00 | 1.02E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Meat | (mSv) | 1.93E-06 | 2.32E-06 | 3.13E-05 | 0.00E+00 | 7.45E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 1.93E-04 | 2.32E-04 | 3.13E-03 | 0.00E+00 | 7.45E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Milk | (mSv) | 8.02E-06 | 9.61E-06 | 1.30E-04 | 0.00E+00 | 3.09E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 8.02E-04 | 9.61E-04 | 1.30E-02 | 0.00E+00 | 3.09E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Inhalation | (mSv) | 8.14E-05 | 4.84E-06 | 1.31E-03 | 0.00E+00 | 3.14E-04 | 0.00E+00 | 6.57E-03 | 0.00E+00 |
| | (mrem) | 8.14E-03 | 4.84E-04 | 1.31E-01 | 0.00E+00 | 3.14E-02 | 0.00E+00 | 6.57E-01 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **3.73E-04** | **3.51E-04** | **5.79E-03** | **1.64E-05** | **1.39E-03** | **1.64E-05** | **6.59E-03** | **5.02E-05** |
| | **(mrem)** | **3.73E-02** | **3.51E-02** | **5.79E-01** | **1.64E-03** | **1.39E-01** | **1.64E-03** | **6.59E-01** | **5.02E-03** |

## Table 4-39 Annual Dose Equivalents to Nearest Resident (Teen)

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 5.02E-05 |
| | (mrem) | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 5.02E-03 |
| Ingestion Vegetables | (mSv) | 4.36E-04 | 3.88E-04 | 7.04E-03 | 0.00E+00 | 1.68E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 4.36E-02 | 3.88E-02 | 7.04E-01 | 0.00E+00 | 1.68E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Meat | (mSv) | 1.63E-06 | 1.45E-06 | 2.64E-05 | 0.00E+00 | 6.30E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 1.63E-04 | 1.45E-04 | 2.64E-03 | 0.00E+00 | 6.30E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Milk | (mSv) | 1.48E-05 | 1.31E-05 | 2.39E-04 | 0.00E+00 | 5.70E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 1.48E-03 | 1.31E-03 | 2.39E-02 | 0.00E+00 | 5.70E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Inhalation | (mSv) | 1.16E-04 | 5.13E-06 | 1.87E-03 | 0.00E+00 | 4.47E-04 | 0.00E+00 | 1.13E-02 | 0.00E+00 |
| | (mrem) | 1.16E-02 | 5.13E-04 | 1.87E-01 | 0.00E+00 | 4.47E-02 | 0.00E+00 | 1.13E+00 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **5.85E-04** | **4.24E-04** | **9.19E-03** | **1.64E-05** | **2.21E-03** | **1.64E-05** | **1.13E-02** | **5.02E-05** |
| | **(mrem)** | **5.85E-02** | **4.24E-02** | **9.19E-01** | **1.64E-03** | **2.21E-01** | **1.64E-03** | **1.13E+00** | **5.02E-03** |

## Table 4-40 Annual Dose Equivalents to Nearest Resident (Child)

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 5.02E-05 |
| | (mrem) | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 5.02E-03 |
| Ingestion Vegetables | (mSv) | 1.06E-03 | 3.06E-04 | 1.72E-02 | 0.00E+00 | 2.87E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 1.06E-01 | 3.06E-02 | 1.72E+00 | 0.00E+00 | 2.87E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Meat | (mSv) | 3.08E-06 | 8.89E-07 | 4.99E-05 | 0.00E+00 | 8.34E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 3.08E-04 | 8.89E-05 | 4.99E-03 | 0.00E+00 | 8.34E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Milk | (mSv) | 3.65E-05 | 1.05E-05 | 5.90E-04 | 0.00E+00 | 9.87E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 3.65E-03 | 1.05E-03 | 5.90E-02 | 0.00E+00 | 9.87E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Inhalation | (mSv) | 1.61E-04 | 2.30E-06 | 2.60E-03 | 0.00E+00 | 4.35E-04 | 0.00E+00 | 1.01E-02 | 0.00E+00 |
| | (mrem) | 1.61E-02 | 2.30E-04 | 2.60E-01 | 0.00E+00 | 4.35E-02 | 0.00E+00 | 1.01E+00 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **1.28E-03** | **3.36E-04** | **2.05E-02** | **1.64E-05** | **3.43E-03** | **1.64E-05** | **1.01E-02** | **5.02E-05** |
| | **(mrem)** | **1.28E-01** | **3.36E-02** | **2.05E+00** | **1.64E-03** | **3.43E-01** | **1.64E-03** | **1.01E+00** | **5.02E-03** |

## Table 4-41 Annual Dose Equivalents to Nearest Resident (Infant)

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 1.64E-05 | 5.02E-05 |
| | (mrem) | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 1.64E-03 | 5.02E-03 |
| Ingestion Vegetables | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Meat | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Milk | (mSv) | 6.27E-05 | 1.06E-05 | 8.07E-04 | 0.00E+00 | 1.75E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 6.27E-03 | 1.06E-03 | 8.07E-02 | 0.00E+00 | 1.75E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Inhalation | (mSv) | 8.26E-05 | 8.78E-07 | 1.15E-03 | 0.00E+00 | 2.36E-04 | 0.00E+00 | 7.69E-03 | 0.00E+00 |
| | (mrem) | 8.26E-03 | 8.78E-05 | 1.15E-01 | 0.00E+00 | 2.36E-02 | 0.00E+00 | 7.69E-01 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **1.62E-04** | **2.79E-05** | **1.97E-03** | **1.64E-05** | **4.27E-04** | **1.64E-05** | **7.71E-03** | **5.02E-05** |
| | **(mrem)** | **1.62E-02** | **2.79E-03** | **1.97E-01** | **1.64E-03** | **4.27E-02** | **1.64E-03** | **7.71E-01** | **5.02E-03** |

## Table 4-42 Annual Dose Equivalents to Nearby Business (Adult)

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 3.31E-05 | 3.31E-05 | 3.31E-05 | 3.31E-05 | 3.31E-05 | 3.31E-05 | 3.31E-05 | 1.01E-04 |
| | (mrem) | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 1.01E-02 |
| Ingestion Vegetables | (mSv) | - | - | - | - | - | - | - | - |
| | (mrem) | - | - | - | - | - | - | - | - |
| Ingestion Meat | (mSv) | - | - | - | - | - | - | - | - |
| | (mrem) | - | - | - | - | - | - | - | - |
| Ingestion Milk | (mSv) | - | - | - | - | - | - | - | - |
| | (mrem) | - | - | - | - | - | - | - | - |
| Inhalation | (mSv) | 1.36E-04 | 8.06E-06 | 2.19E-03 | 0.00E+00 | 5.23E-04 | 0.00E+00 | 1.10E-02 | 0.00E+00 |
| | (mrem) | 1.36E-02 | 8.06E-04 | 2.19E-01 | 0.00E+00 | 5.23E-02 | 0.00E+00 | 1.10E+00 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **1.69E-04** | **4.12E-05** | **2.22E-03** | **3.31E-05** | **5.56E-04** | **3.31E-05** | **1.10E-02** | **1.01E-04** |
| | **(mrem)** | **1.69E-02** | **4.12E-03** | **2.22E-01** | **3.31E-03** | **5.56E-02** | **3.31E-03** | **1.10E+00** | **1.01E-02** |

-- No exposure pathway assumed for receptor group.

## Table 4-43 Annual Dose Equivalents to Maximum Site Boundary (Adult)

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 8.04E-05 | 8.04E-05 | 8.04E-05 | 8.04E-05 | 8.04E-05 | 8.04E-05 | 8.04E-05 | 2.47E-04 |
| | (mrem) | 8.04E-03 | 8.04E-03 | 8.04E-03 | 8.04E-03 | 8.04E-03 | 8.04E-03 | 8.04E-03 | 2.47E-02 |
| Ingestion Vegetables | (mSv) | - | - | - | - | - | - | - | - |
| | (mrem) | - | - | - | - | - | - | - | - |
| Ingestion Meat | (mSv) | - | - | - | - | - | - | - | - |
| | (mrem) | - | - | - | - | - | - | - | - |
| Ingestion Milk | (mSv) | - | - | - | - | - | - | - | - |
| | (mrem) | - | - | - | - | - | - | - | - |
| Inhalation | (mSv) | 2.69E-04 | 1.60E-05 | 4.34E-03 | 0.00E+00 | 1.04E-03 | 0.00E+00 | 2.17E-02 | 0.00E+00 |
| | (mrem) | 2.69E-02 | 1.60E-03 | 4.34E-01 | 0.00E+00 | 1.04E-01 | 0.00E+00 | 2.17E+00 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **3.50E-04** | **9.63E-05** | **4.42E-03** | **8.04E-05** | **1.12E-03** | **8.04E-05** | **2.18E-02** | **2.47E-04** |
| | **(mrem)** | **3.50E-02** | **9.63E-03** | **4.42E-01** | **8.04E-03** | **1.12E-01** | **8.04E-03** | **2.18E+00** | **2.47E-02** |

-- No exposure pathway assumed for receptor group.

## Table 4-44 Annual Dose Equivalents to Maximum Hypothetical Resident (Adult)

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 1.08E-03 |
| | (mrem) | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 1.08E-01 |
| Ingestion Vegetables | (mSv) | 5.69E-03 | 6.81E-03 | 9.21E-02 | 0.00E+00 | 2.19E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 5.69E-01 | 6.81E-01 | 9.21E+00 | 0.00E+00 | 2.19E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Meat | (mSv) | 4.15E-05 | 4.97E-05 | 6.72E-04 | 0.00E+00 | 1.60E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 4.15E-03 | 4.97E-03 | 6.72E-02 | 0.00E+00 | 1.60E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Milk | (mSv) | 1.72E-04 | 2.06E-04 | 2.79E-03 | 0.00E+00 | 6.62E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 1.72E-02 | 2.06E-02 | 2.79E-01 | 0.00E+00 | 6.62E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Inhalation | (mSv) | 1.18E-03 | 7.00E-05 | 1.90E-02 | 0.00E+00 | 4.54E-03 | 0.00E+00 | 9.51E-02 | 0.00E+00 |
| | (mrem) | 1.18E-01 | 7.00E-03 | 1.90E+00 | 0.00E+00 | 4.54E-01 | 0.00E+00 | 9.51E+00 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **7.44E-03** | **7.49E-03** | **1.15E-01** | **3.52E-04** | **2.76E-02** | **3.52E-04** | **9.55E-02** | **1.08E-03** |
| | **(mrem)** | **7.44E-01** | **7.49E-01** | **1.15E+01** | **3.52E-02** | **2.76E+00** | **3.52E-02** | **9.55E+00** | **1.08E-01** |

## Table 4-45 Annual Dose Equivalents to Maximum Hypothetical Resident (Teen)

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 1.08E-03 |
| | (mrem) | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 1.08E-01 |
| Ingestion Vegetables | (mSv) | 9.35E-03 | 8.31E-03 | 1.51E-01 | 0.00E+00 | 3.61E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 9.35E-01 | 8.31E-01 | 1.51E+01 | 0.00E+00 | 3.61E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Meat | (mSv) | 3.50E-05 | 3.11E-05 | 5.65E-04 | 0.00E+00 | 1.35E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 3.50E-03 | 3.11E-03 | 5.65E-02 | 0.00E+00 | 1.35E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Milk | (mSv) | 3.17E-04 | 2.82E-04 | 5.12E-03 | 0.00E+00 | 1.22E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 3.17E-02 | 2.82E-02 | 5.12E-01 | 0.00E+00 | 1.22E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Inhalation | (mSv) | 1.68E-03 | 7.43E-05 | 2.70E-02 | 0.00E+00 | 6.47E-03 | 0.00E+00 | 1.64E-01 | 0.00E+00 |
| | (mrem) | 1.68E-01 | 7.43E-03 | 2.70E+00 | 0.00E+00 | 6.47E-01 | 0.00E+00 | 1.64E+01 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **1.17E-02** | **9.05E-03** | **1.84E-01** | **3.52E-04** | **4.43E-02** | **3.52E-04** | **1.64E-01** | **1.08E-03** |
| | **(mrem)** | **1.17E+00** | **9.05E-01** | **1.84E+01** | **3.52E-02** | **4.43E+00** | **3.52E-02** | **1.64E+01** | **1.08E-01** |

## Table 4-46 Annual Dose Equivalents to Maximum Hypothetical Resident (Child)

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 1.08E-03 |
| | (mrem) | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 1.08E-01 |
| Ingestion Vegetables | (mSv) | 2.27E-02 | 6.56E-03 | 3.68E-01 | 0.00E+00 | 6.15E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 2.27E+00 | 6.56E-01 | 3.68E+01 | 0.00E+00 | 6.15E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Meat | (mSv) | 6.61E-05 | 1.91E-05 | 1.07E-03 | 0.00E+00 | 1.79E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 6.61E-03 | 1.91E-03 | 1.07E-01 | 0.00E+00 | 1.79E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Milk | (mSv) | 7.82E-04 | 2.26E-04 | 1.27E-02 | 0.00E+00 | 2.12E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 7.82E-02 | 2.26E-02 | 1.27E+00 | 0.00E+00 | 2.12E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Inhalation | (mSv) | 2.33E-03 | 3.33E-05 | 3.77E-02 | 0.00E+00 | 6.30E-03 | 0.00E+00 | 1.47E-01 | 0.00E+00 |
| | (mrem) | 2.33E-01 | 3.33E-03 | 3.77E+00 | 0.00E+00 | 6.30E-01 | 0.00E+00 | 1.47E+01 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **2.62E-02** | **7.19E-03** | **4.20E-01** | **3.52E-04** | **7.05E-02** | **3.52E-04** | **1.47E-01** | **1.08E-03** |
| | **(mrem)** | **2.62E+00** | **7.19E-01** | **4.20E+01** | **3.52E-02** | **7.05E+00** | **3.52E-02** | **1.47E+01** | **1.08E-01** |

## Table 4-47 Annual Dose Equivalents to Maximum Hypothetical Resident (Infant)

| Source | | Effective Dose Equivalent | GI-Tract | Bone | Liver | Kidney | Thyroid | Lung | Skin |
|---|---|---|---|---|---|---|---|---|---|
| Cloud Immersion | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Grd. Plane direct | (mSv) | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 3.52E-04 | 1.08E-03 |
| | (mrem) | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 3.52E-02 | 1.08E-01 |
| Ingestion Vegetables | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Meat | (mSv) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ingestion Milk | (mSv) | 1.35E-03 | 2.27E-04 | 1.73E-02 | 0.00E+00 | 3.75E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | (mrem) | 1.35E-01 | 2.27E-02 | 1.73E+00 | 0.00E+00 | 3.75E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Inhalation | (mSv) | 1.20E-03 | 1.27E-05 | 1.67E-02 | 0.00E+00 | 3.41E-03 | 0.00E+00 | 1.11E-01 | 0.00E+00 |
| | (mrem) | 1.20E-01 | 1.27E-03 | 1.67E+00 | 0.00E+00 | 3.41E-01 | 0.00E+00 | 1.11E+01 | 0.00E+00 |
| **Sum Total** | **(mSv)** | **2.90E-03** | **5.92E-04** | **3.44E-02** | **3.52E-04** | **7.51E-03** | **3.52E-04** | **1.11E-01** | **1.08E-03** |
| | **(mrem)** | **2.90E-01** | **5.92E-02** | **3.44E+00** | **3.52E-02** | **7.51E-01** | **3.52E-02** | **1.11E+01** | **1.08E-01** |

#### 4.12.3.1.5 Mitigation Measures

Although routine operations at the Facility may create the potential for radiological and non-radiological impacts on the environment and members of the public, the Facility design incorporates features to minimize gaseous and liquid effluent releases and to keep them well below regulatory limits. These features include:

- Process systems that handle $UF_6$ operate at sub-atmospheric pressure, which minimizes outward leakage of $UF_6$.
- $UF_6$ cylinders are moved only when cool and when $UF_6$ is in solid form, which minimizes the risk of inadvertent release due to mishandling.
- Liquid and solid waste handling systems and techniques are used to control waste and effluent concentrations.
- Gaseous effluent passes through filters which greatly reduce the radioactive material in the final discharged effluent to very low concentrations.
- Liquid waste is collected and treated to reduce the radioactive material in the final discharge effluent to very low concentrations.
- Effluent paths are monitored and sampled to ensure compliance with regulatory and permitted discharge limits.

### 4.12.3.2 Public and Occupational Exposure Impacts

#### 4.12.3.2.1 Impacts of Construction

During construction, very limited amounts of radioactive material will be present on the Site and thus the impacts of construction are SMALL. In the time when construction and operations will overlap, the impacts of operation is assumed for all operations and construction workers, due to a closer proximity of operations workers to potential exposure, and is SMALL.

#### 4.12.3.2.2 Impacts of Operation

Using the information from Section 4.12.2.1, the public exposure impacts are reported as follow:

- Table 4-30 and Table 4-38 to Table 4-41 summarizes the annual dose equivalent to nearest resident.
- Table 4-42 summarizes the annual dose equivalent to nearby business.
- Table 4-43 summarizes the annual dose equivalent to maximum site boundary.
- Table 4-44 to Table 4-47 summarizes the annual dose equivalent to maximum hypothetical resident.

The combination of liquid and gaseous related annual effluent dose impacts are summarized in Table 4-48.

**Table 4-48 Maximum Annual Gaseous & Liquid Radiological Impacts**

| Category | Dose Equivalent | Location |
|---|---|---|
| Maximum Effective Dose Equivalent (Hypothetical Resident) | 2.62E-02 mSv<br>2.62E+00 mrem | Site Boundary (SW for D/Q)<br>(W for X/Q depleted) |
| Maximum Thyroid Committed Dose Equivalent (Hypothetical Resident) | 3.52E-04 mSv<br>3.52E-02 mrem | Site Boundary (NNE for D/Q)<br>(N for XlQ depleted) |
| Maximum Organ (Lung) Committed Dose Equivalent (Hypothetical Resident) | 4.20E-01 mSv<br>4.20E+01 mrem | Site Boundary (NNE for D/Q)<br>(N for X/Q depleted) |

As shown on Table 4-49, the dominant source of off-site radiation exposure is from direct radiation from the cylinder storage pads (fixed sources).

**Table 4-49 Estimated Facility Occupational Dose Equivalent Rates**

| Area or Component | Dose Rate, mSv/hr (mrem/hr) |
|---|---|
| Plant general area (excluding Separations Building) | < 0.0001 (< 0.01) |
| Separations Building - Cascade Halls | 0.0005 (0.05) |
| Separations Building - $UF_6$ Handling | 0.001 (0.1) |
| Empty used $UF_6$ shipping cylinder | 0.1 on contact (10.0)<br>0.010 at 1 m (3.3 ft) (1.0) |
| Full $UF_6$ Shipping cylinder | 0.05 on contact (5.0)<br>0.002 at 1 m (3.3 ft) (0.2) |

The calculated dose equivalents are all below the 1 mSv (100 mrem/yr) total effective dose equivalent (TEDE) requirement per 10 CFR 20.1301, and also within the 0.25 mSv (25 mrem/yr) dose equivalent to the whole body and any organ as indicated in 40 CFR 190 (Table 4-50).

**Table 4-50 Annual Total Effective Dose Equivalent (All Sources)**

| Location | Fixed Sources | Gas & Liquid Effluents | TEDE |
|---|---|---|---|
| Site Boundary (SW - fixed; NNE Effl.) (2000 hrs/yr)(mSv) | 0.165 | 3.50E-04 | 0.165 |
| (mrem) | 16.5 | 3.50E-02 | 16.5 |
| Nearest Business (SW 0.49 mi) (2000 hrs/yr)(mSv) | 1.02E-03 | 1.69E-04 | 1.19E-03 |
| (mrem) | 0.102 | 1.69E-02 | 0.119 |
| Nearest Resident (Child) (1.19 mi Max Sect. NE) (8766 hrs/yr) (mSv) | 2.12E-07 | 1.28E-03 | 1.28E-03 |
| (mrem) | 2.12E-05 | 1.28E-01 | 1.28E-01 |

In addition, based on data gathered from the Tricastin site, it is concluded that the operation of the Facility will not exceed the dose equivalent criteria for members of the public as stipulated in Federal regulations (Table 4-51) (Orano 2023).

**Table 4-51 Estimated Annual Facility Occupational (Individual) Exposures**

| | Total number of individuals | Number of Affected workers | Cumulative Collective Dose (person.mSv) / (person.rem) | Average dose for non-affected worker (mSv/yr) / (mrem/yr) | Average dose for affected worker (mSv/yr) / (mrem/yr) | Individual maximum cumulative dose (mSv/yr) / (mrem/yr) |
|---|---|---|---|---|---|---|
| **2021** | 261 | 58 | 14.73 / 1.47 | 0.06 / 6.00 | 0.25 / 25.0 | 0.78 / 78.0 |
| **2022** | 237 | 26 | 6.22 / 0.62 | 0.03 / 3.00 | 0.24 / 24.0 | 0.51 / 51.0 |
| **2023** | 212 | 27 | 6.43 / 0.64 | 0.03 / 3.00 | 0.24 / 24.0 | 0.56 / 56.0 |

Average radiation worker dose values derived from the 2023 Tricastin Annual Safety Report (Orano 2023).

Occupational exposure for Facility workers is addressed in Table 4-2 and Table 4-3 of the License Application and are concluded to be below the exposure limit as indicated in 10 CFR 20.

As noted in Table 4-52, there is not an increased risk of exposure to the public from routing or accidental release.

The impacts during facility operation from radioactive materials at the Facility are SMALL.

**Table 4-52 Accident Criteria Chemical Exposure Limits by Category**

| | High Consequence (Category 3) | Intermediate Consequence (Category 2) |
|---|---|---|
| Worker<br>(10 min exposure in the room) | > 216 mg $UF_6/m^3$<br>(>147 mg $U/m^3$)<br><br>>139 mg $HF/m^3$ | >28 mg $UF_6/m^3$<br>(>19 mg $U/m^3$)<br><br>>78 mg $HF/m^3$ |
| Outside Controlled Area<br>(30-minute exposure) | > 21 mg U intake<br>>28 mg $HF/m^3$ | > 4.06 mg U intake<br>>0.8 mg $HF/m^3$ |
| Environment<br>(outside Restricted Area) | Not a 10 CFR 70.61 requirement | >2.3 mg $U/m^3$<br>(24-hr average) |

4.12.3.2.3 Impacts of Decommissioning

The decommissioning of the Facility consists of removing and disposing of radioactive materials in accordance with NRC regulations and guidance. The impacts to the public from radioactive materials are bounded by the operation of the Facility and are SMALL.

### 4.12.4 Environmental Effects of Accidents

Accidents that could occur at the Facility under the Proposed Action alternative are both radiological and non-radiological in nature.

#### 4.12.4.1 Accident Scenarios

All credible accident sequences were considered during the ISA performed for the Facility and documented in Section 2 of the Integrated Safety Analysis Summary (ISAS). Radiological and chemical impacts from the postulated accidents were evaluated and IROFS to either prevent postulated accidents or to mitigate their consequences to an acceptable level were identified and documented in the ISAS.

#### 4.12.4.2 Accident Mitigation Measures

Accidents evaluated fell into two general types: criticality events and $UF_6$ releases. The only time that the $UF_6$ is liquid and at most risk for a release is when in a self-contained station. In that state, there are administrative and engineering controls in place.

Preventive controls reduce the likelihood of the accident (criticality events and HF release scenarios) such that the risk is reduced to acceptable levels as defined in 10 CFR 70.61. Details regarding the accident controls are described further in the ISAS.

### 4.12.5 Cumulative Impacts

The nearest sensitive receptors are a business 0.49 mi and full-time residence 1.2 mi away from the Facility. During construction, preventative measure are taken to mitigate any off-site non-radiological releases and minimize the likelihood and magnitude of impacts from accidental discharges. This reduces the exposure to workers and the surrounding public.

During operation, the gaseous emissions from the Facility will be well below the existing standards, and will have a negligible environmental and public health impact. To minimize any potential for occupational or chemical exposures, all maintenance and operational activities will be conducted to regulatory standard using appropriate personal protective equipment.

During decommissioning, the non-radiological material will be handled in a similar manner as during operation, and bounded by the small operation impact, while Facility demolition will be bounded by the small impact of the construction impacts.

Chapter 2 describes reasonably foreseeable future actions at other facilities in proximity to the HCS, and a summary of impacts are summarized in Table 8-1. Each of the identified projects are at sufficient distances from the Facility that there is not an increased risk of exposure to the public from either routine operations or accidental release. Past, present and reasonably foreseeable future actions have the potential to affect public health. However, given the expected adherence to federal regulations, the impact is SMALL.

Accordingly, as impacts of the construction, operation and decommissioning of the Facility is SMALL, the incremental contribution of this project to the cumulative impact is SMALL.

## 4.13 WASTE MANAGEMENT IMPACTS

This section provides descriptions and impacts of the waste management of non-radioactive, radioactive, mixed, and hazardous waste generated at the Facility during the construction, operation and decommissioning.

### 4.13.1 Waste Descriptions

The Facility will generate non-radioactive, radioactive, mixed and hazardous waste throughout the lifecycle of the Facility (construction, operation, and decommissioning). The waste is generated under solid waste stream, liquid and gaseous effluents.

Solid Waste Stream

Construction:

The non-radioactive waste is related to the use of industrial processes through the Facility during operations. A list of construction debris is captured in Table 4-6.

Operations:

The non-radioactive waste is related to the use of industrial processes through the Facility during operations. A list of waste stream and associated annual quantities (estimated) is captured in Table 4-53.

**Table 4-53 Estimated Annual Non-Radiological Wastes**

| Waste | Annual Quantity |
|---|---|
| Spent Blasting Sand | 249 kg (550 lbs) |
| Miscellaneous Combustible Waste | 13,607 kg (30,000 lbs) |
| Oils | 3,785 L (1,000 gal) |
| Spent Water | 3,785 L (1,000 gal) |
| Miscellaneous Scrap Metal | 4,536 kg (10,000 lbs) |
| Filters | 45,359 kg (100,000 lbs) |
| Hydrocarbon Sludge * | 23 kg (50 lbs) |
| Methylene Chloride* | 3,785 L (1,000 gal) |

**Note: *** Hazardous waste as defined in 40 CFR 261 (in part or whole)

The radioactive and mixed waste is related to the extraction of the uranium from gaseous and liquid effluents and uranium contaminated solid waste through the Facility during operations. A list of waste stream and associated annual quantities (estimated) is captured in Table 4-54.

**Table 4-54 Estimated Annual Radiological and Mixed Wastes**

| Waste Type | Radiological Waste | | Mixed Waste [1] | |
|---|---|---|---|---|
| | Total Mass kg (lb) | Uranium Content kg (lb) | Total Mass kg (lb) | Uranium Content kg (lb) |
| Sodium Fluoride Traps | 700 (1,543) | 350 (771) | - | - |
| Activated Alumina | 4,320 (9,524) | 4.5 (10) | - | - |
| Perfluoropolyether Oil | 2,053 (4,528) | 10 (22) | - | - |
| Liquid Waste Treatment Sludge [5] | 2,086 (4,599) | 114 (251) [3] | - | - |
| Activated Sodium Fluoride | 1,200 (2,646) | 50 (110) | - | - |
| Assorted Materials (paper, packing, clothing, wipes, etc.) | 4,201 (9,262) | 60 (132) | - | - |
| Ventilation Filters | 92,196 (203,259) | 11 (24) | - | - |
| Non-Metallic Components | 10,001 (22,050) | Trace [4] | - | - |
| Miscellaneous Mixed Wastes (organic compounds) [1, 2] | - | - | 100 (220) | 4 (8.8) |
| Combustible Waste | 7,002 (15,436) | Trace [4] | - | - |
| Scrap Metal | 24,004 (52,920) | Trace [4] | - | - |

1. A mixed waste is a radioactive waste containing listed or characteristic hazardous wastes as specified in 40 CFR 261, subparts C and D.
2. Representative organic compounds consist of acetone, toluene, ethanol, and petroleum ether.
3. The value of 114 kg (251 lb) is composed of uranium in the citric acid and degreaser tanks, precipitated aqueous solutions, uranium in precipitated laboratory/miscellaneous effluents, and uranium in sludge from the citric acid and degreaser tanks.
4. Trace is defined as not detectable above naturally-occurring background concentrations.
5. Consists of sludge and evaporator concentrates.

Decommissioning:

All discussion on waste decommissioning will be captured in the licensing application Chapter 10.

Liquid Effluents

Operations:

Quantities of radiologically contaminated, potentially radiologically contaminated, and non-radiologically contaminated aqueous liquid effluents are generated in a variety of operations and processes in various locations across the Facility. The majority of all potentially radioactive contaminated aqueous liquid effluents are generated in the TSB. All aqueous liquid effluents are collected in tanks that are located in the Liquid Effluent Collection and Treatment Room in the TSB. The collected effluent is sampled and analyzed to determine if treatment is required before release to the atmosphere by evaporation.

In general, liquid effluent that requires treatment is collected and undergoes filtration and precipitation processes to remove uranium and fluorine. These filtration and precipitation cycles are repeated as necessary until acceptable levels of uranium and fluorine are attained. At this point, the liquid is sent to an evaporator for vaporization and final discharge to the atmosphere.

Non-contaminated aqueous effluents that are generated are collected, monitored for contamination, and evaporated and discharged directly to the atmosphere, if found to meet all regulatory and administrative requirements.

A list of liquid effluents and associated annual quantities (estimated) is captured in Table 4-55.

**Table 4-55 Estimated Annual Liquid Effluent**

| Effluent | Typical Annual Quantities | Typical Uranic Content |
|---|---|---|
| Contaminated Liquid Process Wastes: | L (gal) | kg (lb) |
| Laboratory Effluent/Floor Washings/Miscellaneous Condensates | 46,280 (12,226) | 40 (70.5) [1] |
| Degreaser Water | 7,419 (1,960) | 37 (81.6) [1] |
| Spent Citric Acid | 5,440 (1,437) | 44 (98) [1] |
| Total Effluent Discharged to Atmosphere by Evaporation via Liquid Effluent System Evaporator: | 59,147 (15,625) | None |
| Sanitary wastewater: | 1.89E+7 (5,000,000) | None |
| Stormwater Discharge-Gross discharge [2]: | 6.25E+8 (165,000,000) | None |

1. Uranic quantities are before treatment. Volumes for degreaser water and spent citric acid include process tank sludge.
2. Maximum gross discharge is based on total mean annual precipitation falling on the developed portion of the site associated with the runoff to the Site Stormwater Detention Basins and the Cylinder Storage Pads Stormwater Retention Basins, neglecting infiltration into the site soil and evaporation.

Gaseous Effluents

Operations:

The Facility has two main gaseous effluent streams: the gaseous effluent discharged from the GEVS and the chemical and thermal gaseous effluent from the HVAC systems.

The function of the GEVS is to remove particulates containing uranium and HF from potentially contaminated process gas streams. Prefilters and high efficiency particulate air (HEPA) filters remove particulates, and potassium carbonate impregnated activated carbon filters are used for the removal of any HF.

The GEVS produce solid wastes from the periodic replacement of prefilters, HEPA filters, and chemical filters. The systems produce no gaseous effluents of their own, but discharge effluents from other systems after treatment to remove hazardous materials.

The HVAC systems discharge the other gaseous effluent of the Facility via the discharge of chemical constituents and thermal waste.

A list of gaseous effluents and associated annual quantities (estimated) is captured in Table 4-56.

**Table 4-56 Estimated Annual Gaseous Effluent**

| Area | Quantity ($yr^{-1}$) | Discharge Rate SCF/yr @STP |
|---|---|---|
| Gaseous Effluent Vent Systems | NA | $9.18 \times 10^9$ |
| **HVAC Systems** | | |
| Radiological Areas | NA | $6.8 \times 10^{10}$ (max) |
| Non-Radiological Areas | NA | $7.8 \times 10^{10}$ (max) |
| Total Gaseous HVAC Discharge | NA | $14.6 \times 10^{10}$ (max) |
| Constituents: | Quantity ($yr^{-1}$) | |
| Helium | 30,000 $ft^3$ @STP | NA |
| Nitrogen | 4,000 $ft^3$ @STP | NA |
| Ethanol | 20 gal | NA |
| Laboratory Compounds | Traces (HF) | NA |
| Argon | 13,000 $ft^3$ @STP | NA |
| Hydrogen Fluoride | <5 lb | NA |
| Uranium | <0.05 lb | NA |
| Methylene Chloride | 200 gal | NA |
| **Thermal Waste:** | | |
| Summer Peak | $52.3 \times 10^6$ BTU/hr | NA |
| Winter Peak | $74 \times 10^6$ BTU/hr | NA |

### 4.13.2 Waste Management System Description

The Waste Management approach of the Facility is to minimize the generation of waste throughout the Facility lifecycle and relying on the following approach:

- Solid waste to be grouped for efficient packaging prior to be transported and disposed
- Liquid effluent to be treated by the Liquid Effluent Treatment System prior to discharge to the environment
- Gaseous effluent to be treated by the Gaseous Effluent Treatment System prior to discharge to the environment

#### 4.13.2.1 Solid Waste Management System Description

Solid waste generated at the Facility will be grouped into industrial (non–hazardous), radioactive and mixed, and hazardous waste categories. In addition, solid radioactive and mixed waste will be further segregated according to the quantity of liquid that is not readily separable from the solid material. The solid waste management systems will be a set of facilities, administrative procedures, and practices that provide for the collection, temporary storage, (no solid waste processing is planned), and disposal of categorized solid waste in accordance with regulatory requirements. All solid radioactive wastes generated will be Class A low-level wastes as defined in 10 CFR 61.

Industrial waste will be shipped offsite for minimization and then sent to a licensed waste landfill.

Radioactive waste will be collected in labeled containers in each Restricted Area and transferred to the Solid Waste Collection Room for inspection. As appropriate, waste will be volume-reduced and all radioactive waste disposed of at a licensed low-level waste disposal facility.

Hazardous wastes and some mixed wastes will be generated at the Facility. These wastes will be collected at the point of generation, transferred to the Solid Waste Collection Room, inspected, and classified. Any mixed waste that may be processed to meet land disposal requirements may be treated in its original collection container and shipped offsite as low-level waste for disposal.

The Facility annual expected solid waste production is captured in Table 4-53 and Table 4-54.

#### 4.13.2.2 Liquid Effluent Waste Management System Description

Numerous types of aqueous and non-aqueous liquid wastes are generated in the Facility. Handling and eventual disposition of the aqueous liquid effluents is accomplished in two stages, collection and treatment.

Collection

The liquid effluents may have significant, or low, or no radiological contamination. Liquid wastes include:

- Laboratory Effluent
- Degreaser Water
- Citric Acid
- Laundry Effluent
- Floor Washings
- Miscellaneous Condensates
- Radiation Areas Emergency Hand Washing and Shower Water

Based on the collection location, these liquid effluents are sampled to determine their uranic content and then pumped to effluent collection tank in the Liquid Effluent Collection and Treatment Room.

Treatment

The liquid effluent are treated by precipitating the uranium and stripping off the majority of the uranium that is in solution.

The treated effluent is further filtered and a second-stage precipitation generates a sludge solid waste stream and a clean liquid stream which is then evaporated.

The material removed by these treatment operations constitutes the solid waste stream labeled “Liquid Waste Treatment Sludge” of Table 4-54.

For the non-radioactive and non-hazardous liquid effluents (sanitary and stormwater discharge), the Facility intends to collect, monitor, and discharge these effluents to the local sewer system or other permitted discharge pathways.

The Facility annual expected liquid effluent production is captured in Table 4-55.

#### 4.13.2.3 Gaseous Effluent Waste Management System Description

The GEVS consists of the following major components:

- Duct system
- Prefilter and HEPA Filters
- Activated carbon filter
- Monitoring and controls (alpha and HF) before and after filters, and in exhaust vent
- Exhaust vent
- Exhaust Vent Sampling System

Under normal operating conditions, the gaseous effluent throughout the Facility will not be contaminated. In the event that an abnormal situation occurs, the GEVS is designed to protect plant personnel against $UF_6$ and HF exposure.

The GEVS duct network serves all of the $UF_6$ processing systems and operates at negative pressure. The ductwork is connected to filter stations which processes gases from the $UF_6$ processing systems. Filtration stages are:

- Prefilter removes dust particles to prolongs the useful life of the HEPA filter.
- HEPA filters removes uranium aerosols which consist of $UO_2F_2$ particles.
- Activated charcoal filter for removal of HF
- A second and final HEPA filter.

The cleaned gases are then discharged through the vent stack.

### 4.13.3 Waste Disposal Plans

#### 4.13.3.1 Radioactive and Mixed Waste Disposal Plans

All radioactive and mixed wastes will be disposed of at one of the off-site licensed facilities listed in Table 4-5 for Radwaste Disposal. The disposal facility used will be decided on a commercial basis at the time of disposal.

#### 4.13.3.2 $DUF_6$ Cylinder Temporary Storage

The Facility yields a $DUF_6$ stream that will be temporarily stored on-site in cylinders before transfer to a DOE deconversion facility and subsequent disposition. The storage containers are referred to as Full Tails Cylinders although any partially filled tails cylinders will be maintained, controlled and dispositioned in the same manner as full tails cylinders. The storage locations are designated the Cylinder Storage Pads.

The disposition of the $DUF_6$ Cylinders will incur during the Decommissioning stage and is detailed in Chapter 10 of the Facility License Application.

Experience in Europe has shown that outdoor $UF_6$ cylinder storage will have little or no adverse environmental impact when it is coupled with an effective and protective cylinder management

program. In 35 years of operation at three different enrichment plants, the European cylinder management program has not resulted in any significant releases of $UF_6$ to the environment.

### 4.13.4 Waste Minimization

A high priority will be assigned to minimizing the generation of waste through reduction, reuse, or recycling. The Facility incorporates several waste minimization systems in its operational procedures that aim at conserving materials and recycling important compounds.

OE has a program for pollution prevention and waste minimization that includes the following:

- Waste minimization, reduction, reuse, and recycling for the various phases of the Facility construction and operation and decommissioning
- Employee training and education on general environmental activities and hazards regarding the facility, operations and the pollution prevention program
- Responsibilities for pollution prevention and waste minimization

ALARA controls and BMPs will be maintained during facility operation to minimize the generation of radioactive waste as directed in 10 CFR 20.

### 4.13.5 Control and Conservation

The features and systems described in this subsection serve to limit, collect, confine, and treat wastes and effluents from the $UF_6$ enrichment process. A number of chemicals and processes are used in fulfilling these functions. As with any chemical/industrial facility, a wide variety of waste types will be produced. Waste and effluent control is addressed as well as features used to conserve resources.

#### 4.13.5.1 Mitigating Effluent Releases

The equipment and design features incorporated in the Facility are selected to keep the release of gaseous and liquid effluent contaminants as low as practicable, and within regulatory limits. They are also selected to minimize the use of depletable resources.

#### 4.13.5.2 Conserving Depletable Resources

The Facility design serves to minimize the use of depletable resources. Water is the primary depletable resource used at the Facility. Electric power usage also depletes fuel sources used in the production of the power. Other depletable resources are used only in small quantities.

During operation, a non-hazardous materials waste recycling plan will be implemented. The recycling plan will start with the performance of a waste assessment to identify waste reduction opportunities and to determine which materials will be recycled.

#### 4.13.5.3 Prevention and Control of Oil Spills

The Facility will implement a spill control program for accidental oil spills. Its purpose will be to reduce the potential for the occurrence of spills, reduce the risk of injury if a spill occurs, minimize the impact of a spill, and provide a procedure for the cleanup and reporting of spills. The oil spill control program will be established to comply with the requirements of 40 CFR 112. As required by Part 112, an SPCC plan will be prepared prior to either the start of facility operation or prior to the storage of oil onsite in excess of the quantities established in 40 CFR 112.1(d). The SPCC Plan will be reviewed and certified by a Professional Engineer and will be maintained on-site.

As a minimum, the SPCC will contain the following information:

- Identification of potential significant sources of spills and a prediction of the direction and quantity of flow that would result from a spill from each such source;
- Identification of the use of containment or diversionary structures such as dikes, berms, culverts, booms, sumps, and diversionary ponds to be used at the Facility where appropriate to control discharged oil;
- Procedures for inspection of potential sources of spills and spill containment/diversion structures; and
- Assigned responsibilities for implementing the plan, inspections and reporting.

In addition to preparation and implementation of the SPCC Plan, the Facility will comply with the specific spill prevention and control guidelines contained in 40 CFR 112.7, such as drainage of rain water from diked areas, containment of oil in bulk storage tanks, above ground tank integrity testing, and oil transfer operational safeguards.

### 4.13.6 Cumulative Impacts

The various waste management and treatment systems, including an SPCC Plan, implemented at the Facility aim to minimize the waste discharged by Facility operation. By using an effective and protective cylinder management program that has been successfully used at multiple European enrichment plants, the Facility will not yield any significant releases of $UF_6$, and therefore will have little to no adverse environmental impact.

The waste streams for the various projects in the area considered in Chapter 2 are isolated, thus the cumulative impacts to waste at the Facility will be SMALL.

# Chapter 5: Mitigation Measures

## TABLE OF CONTENTS


**Page**

5.0 MITIGATION MEASURES ..... 5-1
- 5.1 LAND USE ..... 5-1
- 5.2 TRANSPORTATION ..... 5-1
- 5.3 GEOLOGY AND SOILS ..... 5-2
- 5.4 WATER RESOURCES ..... 5-3
  - 5.4.1 GROUNDWATER ..... 5-3
  - 5.4.2 SURFACE WATER ..... 5-4
  - 5.4.3 WATER USE ..... 5-4
  - 5.4.4 FLOODPLAINS ..... 5-4
  - 5.4.5 WETLANDS ..... 5-4
- 5.5 ECOLOGICAL RESOURCES ..... 5-5
- 5.6 AIR QUALITY ..... 5-5
- 5.7 NOISE ..... 5-6
- 5.8 HISTORIC AND CULTURAL RESOURCES ..... 5-7
- 5.9 VISUAL/SCENIC RESOURCES ..... 5-7
- 5.10 SOCIOECONOMICS ..... 5-7
- 5.11 ENVIRONMENTAL JUSTICE ..... 5-7
- 5.12 PUBLIC HEALTH ..... 5-7
  - 5.12.1 NON-RADIOLOGICAL HAZARDS ..... 5-7
  - 5.12.2 RADIOLOGICAL HAZARDS ..... 5-8
- 5.13 WASTE MANAGEMENT ..... 5-8

## 5.0 MITIGATION MEASURES

This chapter summarizes the mitigation measures taken to reduce potential adverse impacts (see ER Chapter 4) resulting from the construction, operation, and decommissioning of the Facility. Mitigation measures are those actions or processes that are implemented to avoid or minimize the magnitude of the impact of the Proposed Action on the affected environment, rectify (i.e., repair, rehabilitate, or restore) the affected environment, or compensate for the impact by providing substitute resources or environments as defined in 40 CFR 1502.14(f) and 1508.20. This summary does not preclude additional mitigation measures that may be implemented by OE based on consultations with regulatory agencies.

### 5.1 LAND USE

The use of the Site for the Facility is consistent with the City of Oak Ridge land use plans and zoning requirements. Decommissioning of the Facility will maintain the suitability of the Site for future uses consistent with those same plans and requirements. As such, there are no impacts to onsite or offsite land use. No further mitigative measures are needed.

### 5.2 TRANSPORTATION

Transportation impacts are minor, consisting of incremental increases in local traffic from the workforce during construction, operation, decommissioning and offsite transportation of earthwork during construction and transportation of radioactive and non-radioactive raw materials and products during operation as well as the transportation of used process equipment and materials during decommissioning. It is expected that all transportation activities to and from the Facility will be conducted in compliance with all applicable local, state and federal requirements for vehicular transportation, including requirements related to noise, tailpipe emissions, transportation of hazardous and radioactive materials, and public safety. Transportation activities will be operated by appropriately licensed individuals.

Transportation activities related to construction generally occur during weekdays and daytime hours in compliance with all applicable restrictions of the City of Oak Ridge. Occasional work is required during weekends to meet construction deadlines. Offsite transportation of earthwork during construction will be conducted in compliance with the requirements of the City of Oak Ridge, as implemented through the land use and related permits issued by the City. Earthwork trucks travelling on public roadways will be in compliance with the Tennessee Department of Environment and Conservation (TDEC) National Pollutant Discharge Elimination System (NPDES) permit for construction activities.

The City of Oak Ridge requires a traffic impact study to be prepared by OE to support site planning for facility operations in conjunction with their issuance of the Land Use, Building and other related permits for the Facility. A traffic study was performed by AECOM.. OE will implement the recommendations of any studies required by the City of Oak Ridge.

Transportation activities related to decommissioning generally occur during weekdays and daytime hours in compliance with all applicable restrictions of the City of Oak Ridge. Occasional work is required during weekends to meet decommissioning commitments. Offsite transportation of demolition debris during decommissioning will be conducted in compliance with the

requirements of the City of Oak Ridge, as implemented through the required land disturbance and building permits issued by the City.

The cumulative impacts to transportation are analyzed compared to similar projects in the area listed in Chapter 2. The cumulative impacts to transportation due to the Facility and the similar projects in the area are SMALL.

## 5.3 GEOLOGY AND SOILS

Construction of the Facility requires excavation, grading, and other land disturbing activities across the 600 ac. site. Soils excavated from the Site that require disposal will be disposed of at an existing approved off-site landfill. To minimize erosion, excavated materials are stockpiled on level or gently sloped lands. Where slopes are steeper, appropriate erosion control measures including berms, silt fences, straw bales, ditch check dams, geotextiles, riprap, sedimentation basin and storm drain inlet/outlet protection are used to control erosion.

Decontamination and decommissioning of the Facility will be conducted in accordance with the applicable Nuclear Regulatory Commission (NRC) license termination requirements. Soil testing will be conducted to determine the presence of areas potentially contaminated by site activities. Any soils with elevated levels of constituents of concern are addressed by excavation and removal or addressed with other mitigative measures as appropriate in accordance with NRC and U.S. Environmental Protection Agency (EPA) guidelines. Decontamination and decommissioning is also to be conducted to minimize soil erosion, compaction and alteration of on-site drainage patterns, to the extent practicable. Soils excavated and removed from the Site are transported to an appropriate licensed disposal facility.

Best Management Practices (BMPs) that are used to minimize impacts include the following:

- Following completion of Facility construction, the temporary construction laydown/parking area are graded as needed to reverse the effects of compaction and are replanted with non-invasive herbaceous plant species.
- Establishment and implementation of an approved Decommissioning Plan for ultimate NRC release of the site for unrestricted use and license termination.

The Facility is constructed and operated in accordance with appropriate geotechnical and structural specifications, engineering design criteria, applicable building codes, and relevant NRC Regulatory Guidance. Therefore, additional mitigative measures are not warranted.

## 5.4 WATER RESOURCES

### 5.4.1 GROUNDWATER

Stormwater management designs incorporate relevant and appropriate provisions included in TDEC's stormwater management guidance for planning, design, and construction and the City of Oak Ridge Stormwater Ordinance and development permit requirements. Additional mitigative measures are incorporated into the final design as appropriate in conjunction with permitting by the City of Oak Ridge and TDEC.

The use of construction materials and equipment can result in the release of liquids and potentially cause impacts to groundwater quality. Such spills can include accidental releases of oil and grease from equipment, including vehicles and hydraulic line failures, cement mixing, fuel leaks, and others. These impacts are minimized through the following measures:

- Establishment of proper engineering and design controls.
- Development of a Spill Prevention, Control, and Countermeasures (SPCC) plan under the National Pollutant Discharge Elimination System (NPDES) permits for both the construction and operational phases.
    - The SPCC Plan minimizes or avoids releases to stormwater by regular maintenance and inspection of equipment and rapid response to spills to contain and prevent contaminants from reaching soil, sediment, or water.
- Containment of concrete washout.
- Implementation of a groundwater monitoring program as identified in Section 6.2.

Potential releases from non-radiological materials vessels stored outdoors have an increased potential to migrate from the Facility to surrounding public receptors as compared to materials stored within the building. Non-radiological materials released to the ground surface have the potential to migrate to groundwater and surface water. The groundwater monitoring program serves as a mitigative measure to allow for the detection of potential impacts to groundwater quality during both the construction phase and operational phase of the Facility.

Classes of non-radiological materials used in production include cryogenic liquid, liquids, and compressed gases. Proper design, maintenance, inspection and use of BMPs reduces the potential for the storage of these materials to impact public health and safety. Outdoor major chemical and gas storage tanks are inspected, tested, and maintained as recommended by applicable industry codes and standards. These features include double walls and interstitial monitoring for the underground tanks. Effective implementation of these BMPs minimizes the potential for emissions and, thus, impacts public health.

The potential for unknown surface releases of contaminants to migrate downward to groundwater aquifer resources is expected to be limited due to the mitigation measures implemented by OE. However, if an inadvertent release to groundwater is known to have occurred, sampling of groundwater wells is conducted, and sampling results are compared to background data collected and reported under Section 3.4.1. If groundwater is identified as being impacted based on comparison to background groundwater quality, appropriate mitigation measures would be implemented in accordance with NRC and U.S. EPA guidelines.

Following decommissioning, groundwater sampling will be conducted to demonstrate whether groundwater is potentially contaminated by site activities. Appropriate mitigation measures will be implemented in accordance with NRC and U.S. EPA guidelines for any groundwater characteristics found to have elevated levels of constituents of concern based on comparison to background groundwater quality.

### 5.4.2 SURFACE WATER

The Facility design avoids direct impacts to surface water features. Indirect impacts to changes in stormwater runoff and potential hydrologic alternation of receiving stream based on site drainage and detention, could occur during site preparation and construction and operation. Potential indirect water quality impacts due to releases or runoff could occur during site construction, operation and decommissioning. Impacts to surface water are minimized by the following measures:

- Adherence to stormwater discharge permits for construction obtained from TDEC and the City of Oak Ridge including implementation of any special requirements.
- Implementation of stormwater controls comprehensively described in a Stormwater Pollution Prevention Plan (SWPPP) that are modified and updated throughout the changing conditions of construction.
- Development of a SPCC plan to prevent and control accidental releases.
- The Facility stormwater management system is designed and operated in compliance with stormwater permits from the City of Oak Ridge and from TDEC.

As identified in Chapter 6, an environmental monitoring program is established as a mitigative measure to allow for the detection of water quality impacts.

### 5.4.3 WATER USE

The Facility obtains water, for both potable and industrial use, from the City of Oak Ridge public water distribution system. All domestic, industrial, and non-radiological wastewater is discharged to the City of Oak Ridge municipal sanitary sewer collection system. As such, there are no impacts to water availability as a result of water use by the Facility. Therefore, no mitigative measures are required.

### 5.4.4 FLOODPLAINS

The Site is not located within a mapped 100-year floodplain. As such, there are no impacts to floodplains during the construction phase, the operation phase, or the decommissioning phase. Therefore, no mitigative measures are required.

### 5.4.5 WETLANDS

Construction activities will result in impacts to identified regulatory surface water resources to include wetlands. Construction activities result in land disturbance and the alteration of wetlands present on the Facility and as such have the potential to alter associated stormwater runoff conditions. Construction activities will include placement of fill over three small wetlands (WTL-G, WTL-J and WTL-K). Indirect impacts are minimized with the implementation of required sediment and erosion control measures and other BMPs. The mitigation strategy will be finalized

following the consultation of the U.S. Army Corp of Engineers (USACE) and TDEC final determination.

## 5.5 ECOLOGICAL RESOURCES

Mitigation measures will be taken to minimize potential impacts on ecological resources. These measures include the use of BMP's recommended by various state and federal management agencies, minimizing the construction footprint to the extent possible, avoiding all direct discharge (including stormwater) to any waters of the United States (i.e., the use of temporary detention ponds), and site stabilization practices to reduce the potential for erosion and sedimentation.

OE, in consultation with TDEC, USFWS, and the USACE, will use BMPs to reduce impacts on ecological resources.

OE is evaluating the replanting of trees to compensate for the tree removal required for the construction of the Facility.

## 5.6 AIR QUALITY

Air concentrations of criteria pollutants for vehicle emissions and fugitive dust will be below the National Ambient Air Quality Standards (NAAQS). Particulate matter and visibility impacts from fugitive dust emissions will be minimized with the use of water and water-extender solutions sprayed on the site at least twice daily (when needed) during the construction phase to suppress dust emissions.

Mitigation measures will be considered to minimize potential impact on air quality. These might include the following items:

- Gaseous Effluent Ventilation System (GEVS).
- Construction BMPs will be applied to minimize fugitive dust.
- Applying gravel to the unpaved surface of haul roads.
- Imposing speed limits on unpaved haul roads.
- Applying an environmentally safe chemical soil stabilizer or chemical dust suppressant to the surface of the unpaved haul roads.
- The use of water spray bars at drop and conveyor transfer points.
- Limiting the height and disturbances of stockpiles.
- Applying water to the surface of stockpiles.
- Air concentrations of the criteria pollutants resulting from vehicle emissions and fugitive dust during construction will be below NAAQS.

## 5.7 NOISE

Mitigation of the operational noise sources will occur primarily from the Facility design, whereby cooling systems, valves, transformers, pumps, generators, and other facility equipment, will mostly reside inside plant structures. The buildings themselves will absorb the majority of the noise located within. Natural land contours, vegetation, trees, and site buildings and structures will mitigate the impact of other equipment located outside of structures that contribute to site noise levels.

The nearest home is located approximately 1.25 mi north of the Site as part of a residential neighborhood along SR-95. To minimize noise impacts to these residences, use of SR-95 will be restricted to daytime hours. Similarly, heavy truck and earth moving equipment usage during construction of the access road and highway entrance will be restricted to daytime hours to minimize noise impacts.

OE will minimize and manage noise and vibration impacts as necessary during construction and decommissioning by:

- Performing construction or decommissioning activities with the potential for noise or vibration at residential areas that could have a negative impact on the quality of life during the day-time hours. If it is necessary to perform an activity that could result in excessive noise or vibration in a residential area after hours, the community will be notified in accordance with the site procedures.
- Engineered and administrative controls for equipment noise abatement, including the use of equipment and vehicle mufflers, acoustic baffles, shrouding, barriers and noise blankets.
- Sequencing construction or decommissioning activities to minimize the overall noise and vibration impact (e.g., establishing the activities that can occur simultaneously or in succession).
- Utilizing blast mats, if necessary.
- Posting appropriate State highway signs warning of blasting.
- Creating a Complaint Response Protocol for dealing with and responding to noise or vibration complaints, including entering the complaint into the site's Corrective Action Program.

As described in Section 4.7, no mitigation measures are required for noise associated with normal operations complies with the City of Oak Ridge Zoning Ordinance noise standards.

## 5.8 HISTORIC AND CULTURAL RESOURCES

The impacts to historical and cultural resources are small, however, OE intends to conduct a consultation with SHPO for further determination.

## 5.9 VISUAL/SCENIC RESOURCES

As voluntary mitigation, OE will maintain as much forested land as possible surrounding the Facility, and is considering replanting of trees to decrease the visible impact the Facility will have on the surrounding areas.

Given the limited public visibility of the Facility, the compatibility of the Facility with the planned use, and incorporation of all design standards and requirements of the City of Oak Ridge into the Facility design, no further mitigation measures are warranted.

## 5.10 SOCIOECONOMICS

Population and community services impacts from the construction, operation and decommissioning of the Facility are minor, and economic impacts are beneficial. Therefore, no mitigation measures are needed.

## 5.11 ENVIRONMENTAL JUSTICE

In accordance with Executive Order No. 14148, Environmental Justice has been removed from this ER.

## 5.12 PUBLIC HEALTH

### 5.12.1 NON-RADIOLOGICAL HAZARDS

Management measures and regulatory controls are implemented to minimize public and occupational health impacts. These measures include:

- Establishment of an effluent monitoring program to maintain concentrations of non-radiological materials in plant effluents.
- Development of an NRC-required Emergency Plan.
- Inspection, testing, and maintenance of outdoor major chemical and gas storage tanks as recommended by applicable industry codes and standards.
- Adherence to the Occupational Safety and Health Administration (OSHA) Occupational Safety and Health Standards (29 CFR 1910) .
- Implementation of the environmental monitoring program described in Chapter 6.

### 5.12.2 RADIOLOGICAL HAZARDS

Mitigation measures are used to keep the hazard from radiological sources ALARA. Both engineered and administrative controls are used. The Facility uses the following controls to minimize radiation exposure to the public and workers:

- Radiation source identification.
- Confinement around radiation sources.
- Ventilation and effluent control.
- Access control to radiation areas.
- Contamination control.
- Waste minimization.
- Hazard identification and management control

## 5.13 WASTE MANAGEMENT

Mitigation measures will be considered to minimize both the generation and impact of Facility waste. Solid and liquid waste and gaseous effluents will be controlled in accordance with regulatory limits. Mitigation measures include the following.

- System design features are in place to minimize the generation of solid waste, liquid waste, and gaseous effluent.
- There will be no onsite disposal of waste at the Facility. Waste will be stored in designated areas of the Facility, until an administrative limit is reached. When the administrative limit is reached, the waste will then be shipped off site to a licensed disposal facility.
- All radioactive and mixed wastes will be disposed of at off-site, licensed facilities.

Mitigation measures associated with depleted uranium hexafluoride ($DUF_6$) cylinder storage may consist of the following:

- OE will maintain a cylinder management program to monitor storage conditions on the storage pads, to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs as needed.
- All tails cylinders filled with $DUF_6$ will be stored on concrete (or other suitable material) saddles that do not cause corrosion of the cylinders. These saddles will be placed on a concrete pad.
- The storage pad areas will be segregated from the rest of the enrichment facility by barriers (e.g., vehicle guard rails).
- $DUF_6$ cylinders will be double stacked on the storage pad. The storage array will permit easy visual inspection of all cylinders.
- $DUF_6$ cylinders will be surveyed for external contamination (wipe tested), prior to being placed on a Cylinder Storage Pad or transported off site.
- $DUF_6$ cylinder valves will be fitted with valve guards to protect the cylinder valve during transfer and storage.

- Provisions will be in place to ensure that $DUF_6$ cylinders will not have defective valves installed.
- All $UF_6$ cylinders will be abrasive blasted and coated with anti-corrosion primer/paint when manufactured (as required by specification). Touch-up application of coating will be performed on $DUF_6$ cylinders if coating damage is discovered during inspection.
- Only designated vehicles, operated by trained and qualified personnel, will be allowed on the Cylinder Storage Pads.

Other waste mitigation measures will include:

- Processes used to clean up wastes and effluents, create their own wastes and effluent as well. Control of these process effluents will be accomplished by liquid and solid waste handling systems and techniques.
- The Facility will implement a spill control program for accidental oil spills. The SPCC Plan will be prepared prior to the start of operation of the Facility or prior to the storage of oil on site in excess of de minimis quantities.

A construction phase recycling program will be developed as the construction plan progresses to final design.

The Facility will implement a non-hazardous materials waste recycling program during operation. The recycling effort will start with the performance of a waste assessment to identify waste reduction opportunities and to determine which materials will be recycled. Once the decision has been made of which waste materials to recycle, brokers and haulers will be contacted to find an end market for the materials. Employee training on the recycling program will be performed so that employees will know which materials are to be recycled. Recycling bins and containers will be purchased and will be clearly labeled. Periodically, the recycling program will be evaluated (i.e., waste management expenses and savings, recycling and disposal quantities) and the results reported to the employees.

# Chapter 6: Environmental Measures and Monitoring Programs

## TABLE OF CONTENTS


**Page**

**6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS ..... 6-1**

**6.1 RADIOLOGICAL MONITORING ..... 6-1**

6.1.1 EFFLUENT MONITORING PROGRAM ..... 6-1

6.1.2 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ..... 6-5

**6.2 PHYSIOCHEMICAL MONITORING ..... 6-7**

6.2.1 INTRODUCTION ..... 6-7

6.2.2 EVALUATION AND ANALYSIS OF SAMPLES ..... 6-7

6.2.3 EFFLUENT AND STORMWATER MONITORING ..... 6-8

6.2.4 QUALITY ASSURANCE ..... 6-8

6.2.5 ENVIRONMENTAL MONITORING ..... 6-8

6.2.6 METEOROLOGICAL MONITORING ..... 6-8

6.2.7 LOWER LIMITS OF DETECTION ..... 6-9

**6.3 ECOLOGICAL MONITORING ..... 6-9**

6.3.1 MAPS ..... 6-9

6.3.2 AFFECTED IMPORTANT ECOLOGICAL RESOURCES ..... 6-9

6.3.3 MONITORING PROGRAM ELEMENTS ..... 6-9

6.3.4 OBSERVATIONS AND SAMPLING DESIGN ..... 6-9

## LIST OF FIGURES

**Number** **Title**

Figure 6-1: Facility Monitoring Locations ..... 6-2

# 6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

## 6.1 RADIOLOGICAL MONITORING

### 6.1.1 EFFLUENT MONITORING PROGRAM

The U.S. Nuclear Regulatory Commission (NRC) requires, pursuant to 10 CFR 20 that licensees conduct surveys necessary to demonstrate compliance with these regulations and to demonstrate that the amount of radioactive material present in effluent from the Facility has been kept as low as reasonably achievable (ALARA). In addition, the NRC requires, pursuant to 10 CFR 70, that licensees submit semiannual reports, specifying the quantities of the principal radionuclides released to unrestricted areas and other information needed to estimate the annual radiation dose to the public from effluent discharges. The NRC has also issued Regulatory Guide 4.15 and Regulatory Guide 4.16 that reiterate that concentrations of hazardous materials in effluent must be controlled and that licensees must adhere to the ALARA principal such that there is no undue risk to the public health and safety at or beyond the site boundary.

Refer to Figure 6-1. Effluents are sampled as indicated in the OE Environmental Monitoring Program. For gaseous effluents, liquid condensate samples from the Evaporator exhaust vent and continuous air sampler filters are analyzed for gross alpha and gross beta as required. The filters, or liquid condensate samples, are composited as required and an isotopic analysis is performed if a specified gross alpha or gross beta action level is exceeded.

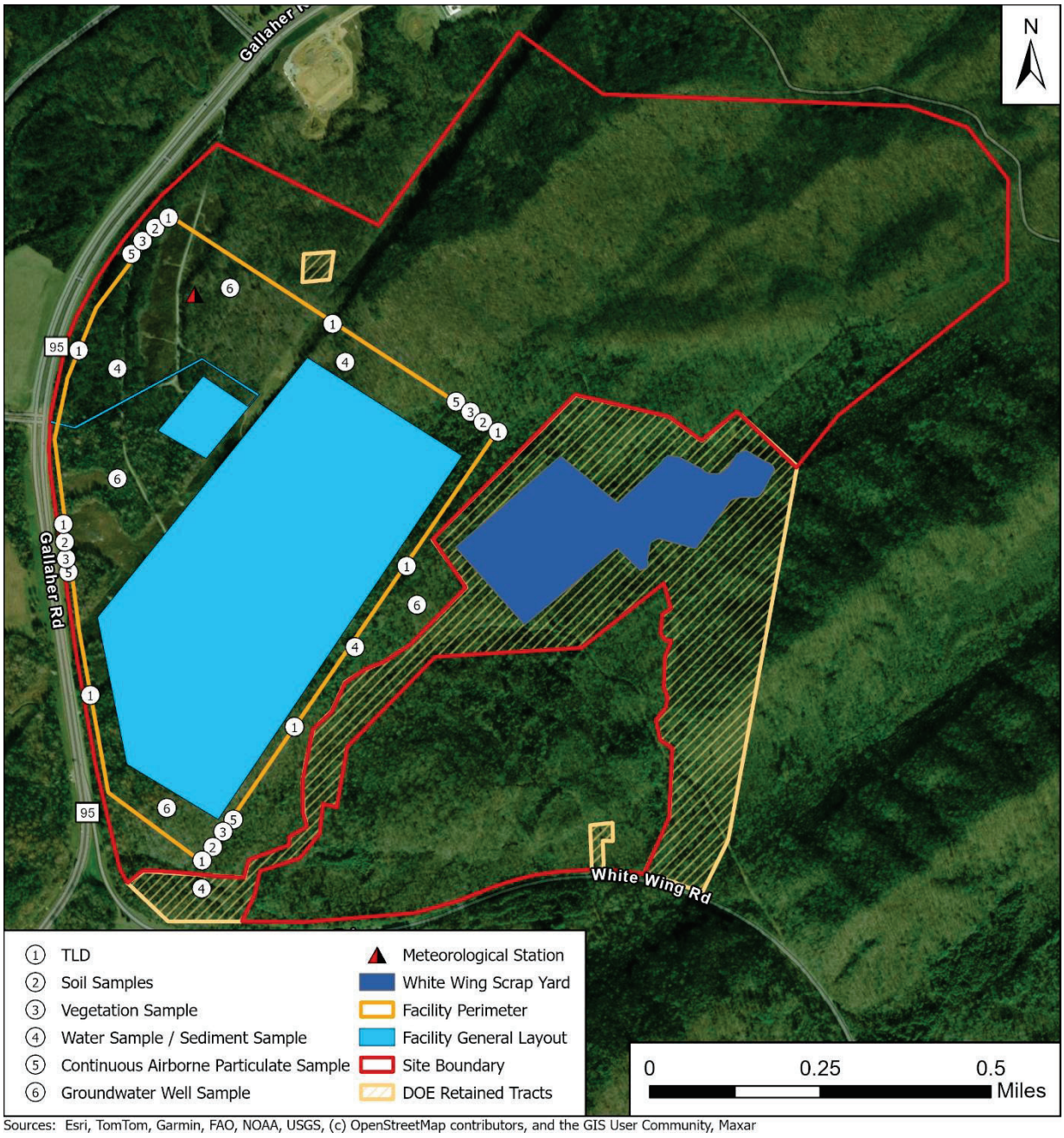



**Figure 6-1: Facility Monitoring Locations**

The guidance in NUREG-1302 (NRC 1991) and Regulatory Guide 4.16 (NRC 2010) will be followed for determining final, actual sample locations, analyses, frequencies, durations, and lower limits of detection for both effluent and environmental samples. Based in data collected from the Land Use Census, OE will determine locations for collection of the various sample types required. Sample quantities are designed to achieve the required detection levels as stated in NUREG-1302, Table 4.12-1 (NRC 1991).

Public exposure to radiation from routine operations at the Facility may occur as the result of discharge of airborne effluents, including controlled releases from the uranium enrichment

process lines during decontamination and maintenance of equipment. In addition, radiation exposure to the public may result from the transportation and storage of uranium hexafluoride ($UF_6$) feed cylinders, product cylinders, and depleted uranium cylinders. Of these potential pathways, discharge of gaseous effluent has the highest possibility of introducing Facility-related uranium into the environment. The Facility's procedures and facilities for solid waste handling, storage, and monitoring result in safe storage and timely disposition of the material. ER Section 1.3 describes all applicable federal and Tennessee state standards for discharges, as well as required permits issued by local, Tennessee, and Federal governments.

Compliance with 10 CFR 20.1301 is demonstrated using a calculation of the total effective dose equivalent (TEDE) to the individual who is likely to receive the highest dose in accordance with 10 CFR 20.1302(b)(1). The determination of the TEDE by pathway analysis is supported by appropriate models, codes, and assumptions that accurately represent the Facility, site, and the surrounding area. The assumptions are reasonably conservative, input data is accurate, and all applicable pathways are considered. Environmental Report (ER) Section 4.12 presents the details of these determinations.

The computer codes used to calculate dose associated with potential gaseous effluent from the Facility follow the methodology for pathway modeling described in Regulatory Guide 1.109 and have undergone validation and verification. The dose conversion factors used are those presented in Federal Guidance Reports Numbers 11 and 12.

Administrative action levels are established for effluent samples and monitoring instrumentation as an additional step in the effluent control process. All action levels are sufficiently low so as to permit implementation of corrective actions before regulatory limits are exceeded. Effluent samples that exceed the action level are cause for an investigation into the source of elevated radioactivity. Radiological analyses will be performed more frequently on ventilation air filters if there is a significant increase in gross radioactivity or when a process change, or other circumstances cause significant changes in radioactivity concentrations as further described in License Application Chapter 9. Additional corrective actions will be implemented based on the level, automatic shutdown programming, and operating procedures to be developed in the detailed alarm design. Under routine operating conditions, radioactive material in effluents discharged from the Facility will be in accordance with established release limits in the license.

Compliance is demonstrated through effluent and environmental sampling data. If an accidental release of uranium should occur, then routine operational effluent data and environmental data will be used to assess the extent of the release. Processes are designed to include, when practical, provision for automatic shutdown in the event action levels are exceeded. Appropriate action levels and actions to be taken are specified for effluent releases. Data analysis methods and criteria used in evaluating and reporting environmental sample results are appropriate and will indicate when an action level is being approached in time to take corrective actions.

Periodic audits of the effluent monitoring program will be conducted by OE. Written procedures will be in place to ensure the collection of representative samples, use of appropriate sampling methods and equipment, proper locations for sampling points, and proper handling, storage, transport, and analyses of effluent samples. In addition, the Facility's written procedures also ensure that sampling and measuring equipment, including ancillary equipment such as airflow meters, are properly maintained and calibrated at regular intervals. Moreover, the effluent

monitoring program procedures include functional testing and routine checks to demonstrate that monitoring and measuring instruments are in working condition. Employees involved in implementation of this program are trained in the program procedures.

The Facility will ensure, when sampling particulate matter within ducts with moving air streams, that sampling conditions within the sample probe are maintained to simulate as closely as possible the conditions in the duct. Particle size distributions will be determined from process knowledge or measured to estimate and compensate for sample line losses and momentary conditions not reflective of airflow conditions in the duct.

Air sampling train flow rates will be verified and/or calibrated each time a filter is replaced or a sampling train component is replaced or modified. Sampling equipment and lines will be inspected for defects, obstructions, and cleanliness. Radiological instruments are used to measure the radiation for which their calibrations are valid and follow the requirements contained in ANSI N323 for radiological instrumentation calibration. Calibration sources are traceable to NIST.

#### 6.1.1.1 GASEOUS EFFLUENT MONITORING

As a matter of compliance with regulatory requirements, all potentially radioactive effluent from the Facility is discharged only through monitored pathways. See ER Section 4.12.2 for a discussion of pathway assessment. The effluent sampling program for the Facility is designed to determine the quantities and concentrations of radionuclides discharged to the environment. The uranium isotopes $^{238}U$, $^{236}U$, $^{235}U$, and $^{234}U$ are expected to be the prominent radionuclides in the gaseous effluent. The annual uranium source term for routine gaseous effluent releases from the 7.4 million separative work units (SWU) Facility has been conservatively assumed to be 592 µCi per year, which is proportional to the 120 µCi per year source term applied to the 1.5 million SWU Facility described in NUREG-1484. This is a very conservative annual release estimate used for bounding analyses. Additional details regarding source term are provided in ER Section 4.12. Representative samples are collected from each release point of the Facility. Because uranium in gaseous effluent may exist in a variety of compounds, effluent data will be maintained, reviewed, and assessed by the Facility's Industrial Safety & Radiation Protection Manager to assure that gaseous effluent discharges comply with regulatory release criteria for uranium.

The gaseous effluent monitoring program for the Facility is designed to determine the quantities and concentrations of gaseous discharges to the environment in accordance with the guidance in NRC Regulatory Guide 4.16 (NRC 2010).

Gaseous effluent from the Facility, which has the potential for airborne radioactivity (albeit in very low concentrations) will be discharged through the Gaseous Effluent Ventilation Systems (GEVS), the Exhaust Filtration System, and the Heating, Ventilating, and Air Conditioning (HVAC) System.

Saturated air from the Evaporator (which is part of the Liquid Effluent Collection and Treatment System) is discharged to the environment through an exhaust vent. An air sampler in this vent line will sample the discharged air and trap the condensed distillate. The liquid condensate will be periodically sampled and analyzed for isotopic uranium.

#### 6.1.1.2 STORMWATER AND SANITARY WASTEWATER LIQUID EFFLUENT MONITORING

General site stormwater runoff is routed to the Site Stormwater Detention Basins (Section 4.4). The Cylinder Storage Pads Stormwater Retention Basins collect stormwater runoff from the Cylinder Storage Pads. Section 4.13 captures the expected volume of stormwater to be collected each year (mean annual) by the detention and retention basins combined. Section 4.13 captures the expected volume of sanitary wastewater liquid effluent to be discharged to the existing sanitary sewer system to be treated by the City of Oak Ridge each year.

These liquid effluents will be included in the site Radiological Environmental Monitoring Program described below in Section 6.1.2.

### 6.1.2 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

The Radiological Environmental Monitoring Program (REMP) at the Facility is a major part of the effluent compliance program. It provides a supplementary check of containment and effluent controls, establishes a process for collecting data for assessing radiological impacts on the environs and estimating the potential impacts on the public, and supports the demonstration of compliance with applicable radiation protection standards and guidelines.

The primary objective of the REMP is to provide verification that the operations at the Facility do not result in detrimental radiological impacts on the environment. Through its implementation, the REMP provides data to confirm the effectiveness of effluent controls and the effluent monitoring program. In order to meet program objectives, representative samples from various environmental media are collected and analyzed for the presence of Facility-related radioactivity. Environmental media identified for sampling consist of ambient air, groundwater, soil/sediment, and vegetation. All environmental samples will be analyzed by an accredited offsite laboratory. Monitoring and sampling activities, laboratory analyses, and reporting of Facility-related radioactivity in the environment will be conducted in accordance with regulatory-approved methodologies.

Reporting procedures will comply with the requirements of 10 CFR 70.59 and the guidance specified in Regulatory Guide 4.16. Reports of the concentrations of principal radionuclides released to unrestricted areas in effluents will be provided and will include the Minimum Detectable Concentration (MDC) for the analysis and the error for each data point.

The REMP includes the collection of data during pre-operational years in order to establish baseline radiological information that will be used in determining and evaluating impacts from operations at the Facility on the local environment. Preoperational environmental surveillances begin approximately two years prior to production of commercial fuel. The objectives of the preoperational environmental surveillances are:

- Establish a baseline of existing radiological and biological conditions before the arrival of the first uranium hexafluoride shipment
- Evaluate procedures, equipment, and techniques used in the collection and analysis of environmental data, and train personnel in their use
- Determine the presence of contaminants that could be a safety concern for personnel.

Preoperational surveillances establish a baseline for operational environmental surveillance for radioactivity levels of environmental media (e.g. air, soil, sediments, and vegetation), as appropriate, with analyses for uranium and other radionuclides of interest.

During the course of Facility operations, revisions to the REMP may be necessary and appropriate to ensure reliable sampling and collection of environmental data. The rationale and actions behind such revisions to the program will be documented and reported to the appropriate regulatory agency, as required. Sampling locations, media types, and collection frequency are described in License Application Chapter 9.

Atmospheric radioactivity monitoring is based on Facility design, demographic, geologic, meteorological, and land use data. Because operational releases are anticipated to be very low and subject to rapid dilution via dispersion, distinguishing Facility-related uranium from background uranium already present in the site environment is a major challenge of the REMP. The gaseous effluent is released from roof-top discharge points, which will result in ground-level releases. A characteristic of ground-level plumes is that plume concentrations decrease continually as the distance from the release point increases. It logically follows that the impact at locations close to the release point is greater than at more distant locations. The radioactive materials in gaseous effluents from the Facility are expected to be very low concentrations of uranium because of process and effluent controls. Consequently, air samples collected at locations that are close to the Facility would provide the best opportunity to detect and identify Facility-related radioactivity in the ambient air. Therefore, air-monitoring activities will concentrate on collection of data from locations that are relatively close to the Facility.

Vegetation and soil samples from locations near the Owner Controlled Area fence line will be collected on a quarterly basis in each sector during the pre-operational REMP. This is to assure the development of a sound baseline. During the operational years, vegetation and soil sampling will be performed semiannually in eight sectors, including three with the highest predicted atmospheric deposition. Vegetation samples may include vegetables and grass, depending on availability. Soil samples will be collected in the same vicinity as the vegetation samples. Vegetation and soil samples will also be collected from an off-site control location.

Groundwater samples from onsite monitoring wells will be collected as required for radiological analysis. The locations of the groundwater sampling (monitoring) wells are shown on Figure 6-1. The rationale for the locations is based on the predominant groundwater flow under the Facility site and proximity to key site structures.

Sediment samples will be collected as required from the Cylinder Storage Pads Stormwater Retention Basins and the Stormwater Detention Basins to look for any buildup of uranic material being deposited.

Direct radiation in offsite areas from processes inside the Facility building is expected to be minimal. However, the uranium cylinders stored on the Cylinder Storage Pads may have an impact in some offsite locations due to direct and scatter (skyshine) radiation. The offsite impact from the storage pads has been evaluated and is discussed in Section 4.12.

The conservative evaluation showed that an annual TEDE of < 0.2 mSv ($\leq$20 mrem) is expected at the highest impacted area at the site boundary.

Because the offsite dose equivalent rate from stored uranium cylinders is expected to be very low and difficult to distinguish from the variance in normal background radiation beyond the site boundary, demonstration of compliance will rely on a system that combines direct dose equivalent measurements and computer modeling to extrapolate the measurements. Environmental thermoluminescent dosimeters (TLDs) placed at the Owner Controlled Area fence line or other location(s) close to the stored uranium cylinders provide background and periodic direct dose equivalent information. Figure 6-1 indicates the location of REMP sampling locations.

Written procedures to ensure representative sampling, proper use of appropriate sampling methods and equipment, proper locations for sampling points, and proper handling, storage, transport, and analyses of effluent samples will be a key part of the REMP.

Each year, the Facility will submit a summary report of the environmental sampling program to the NRC, including all associated data as required by 10 CFR Part 70.

## 6.2 PHYSIOCHEMICAL MONITORING

### 6.2.1 INTRODUCTION

A physiochemical monitoring program is to be implemented at the Facility. The primary objective of physiochemical monitoring is to provide verification that the operations at the Facility do not result in detrimental chemical impacts on the environment. Effluent controls, which are discussed in Section 4.13, are in place to ensure that chemical concentrations in gaseous effluents are minimized as much as possible.

Administrative action levels will be implemented prior to Facility operation to ensure that chemical discharges remains below the limits specified in the Facility discharge permits. The limits are specified in any applicable discharge permits administrated by EPA Region 10 and the Tennessee State Department of Environmental Quality.

In conducting physiochemical monitoring, sampling protocols and emission/effluent monitoring will be performed for routine operations with provisions for additional evaluation in response to potential accidental release.

The Facility relies accredited, offsite laboratories to perform physiochemical analyses of samples.

Compliance will be demonstrated by monitoring and sampling at various Facility and process locations, analyzing the samples, comparing results to applicable criteria defined in permits, and reporting the results of these analyses to the appropriate agencies. The sampling/monitoring locations will be selected by the Environmental, Health, Safety, and Licensing (EHS&L) organization staff in accordance with the Facility permits and good sampling practices. Parameters to be monitored will be identified in environmental permits obtained for the Facility operations.

### 6.2.2 EVALUATION AND ANALYSIS OF SAMPLES

Samples of liquid streams, solids, and gaseous effluents from Facility processes will be analyzed in an accredited offsite environmental laboratory. Results of process samples analyses are used to verify that process parameters are operating within expected performance ranges and

determine if corrective action is required in Facility process and/or effluent collection and treatment systems.

### 6.2.3 EFFLUENT AND STORMWATER MONITORING

Following the physiochemical monitoring program, OE will periodically submit a summary of the environmental sampling program and associated data to the proper regulatory authorities, as required.

Physiochemical effluent monitoring will be conducted via sampling of stormwater, soil, sediment, surface water (if present), vegetation, and groundwater to confirm that trace, incidental chemical discharges are below regulatory limits.

### 6.2.4 QUALITY ASSURANCE

The physiochemical monitoring program for the Facility will use a set of formalized and controlled procedures for sample collection, laboratory analysis, chain of custody, reporting of results, and corrective actions. The program will be operated in accordance with Regulatory Guide 4.15 and is further described in License Application Chapter 9.

### 6.2.5 ENVIRONMENTAL MONITORING

An environmental monitoring program is to be implemented to measure non-radiological chemical impacts upon the natural environment.

The environmental monitoring program relies on the data acquisition from the radiological and physiochemical monitoring programs described in sections 6.1 and 6.2 to detect and contain any potentially adverse releases from the Facility to the environment.

Sampling locations will be determined based on meteorological information and current land use. The sampling locations may be subject to change as determined from the results of any observed changes in land use.

The range of chemical surveillance incorporated into all the planned monitoring programs are designed to be sufficient to predict any relevant chemical interactions in the environment related to Facility operations.

Environmental monitoring program activities would include periodic flora and fauna surveys of the land to identify potential problems and areas needing improvement.

### 6.2.6 METEOROLOGICAL MONITORING

In order to monitor and characterize meteorological phenomena during Facility operation as well as consider interaction of meteorology and local terrain, conditions will be monitored with an instrumented tower located onsite. This data will assist in evaluating the potential locales on and off property that could be influenced by any gaseous emissions. The instrumented tower will be located at a site approximately the same elevation as the finished Facility grade and in an area where Facility structures will have little or no influence on the meteorological measurements.

The data this equipment provided is recorded in the Control Room and can be used for dispersion calculations. Equipment will also measure temperature and humidity, which will be recorded in the Control Room.

### 6.2.7 LOWER LIMITS OF DETECTION

Lower limits of detection (LLD) will be met for sampling parameters and will be based on the baseline surveys and the type of matrix (sample type). Additional information describing the analytical methods and LLD for analysis is described in License Application Chapter 9.

## 6.3 ECOLOGICAL MONITORING

### 6.3.1 MAPS

See Figure 6-1: Facility Monitoring Locations

### 6.3.2 AFFECTED IMPORTANT ECOLOGICAL RESOURCES

Based on Chapter 4.5, the White fringeless orchid, the Gray bat, the Indiana bat, and the Northern Long-Eared bat, all have the potential to occur on the site. Utilizing BMPs, the conclusion is there will be negligible impact to these referenced endangered species.

### 6.3.3 MONITORING PROGRAM ELEMENTS

An ecological monitoring program may be implemented to monitor the natural habitat on the site. The natural habitat elements to be monitored may include vegetation, birds, mammals, and reptiles/amphibians. Currently there is no action or reporting level for each specific element. Agency recommendations, based on future consultation and monitoring program data, will be considered when developing action and/or reporting levels for each element. In addition, OE will periodically monitor the Site during construction and Facility operations to ensure the risk to wildlife is minimized.

### 6.3.4 OBSERVATIONS AND SAMPLING DESIGN

The Facility site observations may include preconstruction, construction, and operations monitoring programs. The preconstruction monitoring program will establish the site baseline data. The procedures used to characterize the natural habitat at the Facility site during pre-construction monitoring will be used for both the construction and operations monitoring programs. Operational monitoring surveys will also be conducted as described below using the same sampling sites established during the preconstruction monitoring program.

These surveys are designed to characterize gross changes in the composition of the natural habitat of the site associated with operation of the Facility. Interpretation of operational monitoring results, however, must consider those changes that would be expected at the Facility site as a result of natural succession processes. Facility communities at the site will continue to change as the site begins to regenerate and mature. Changes in the bird, small mammal, and reptile/amphibian communities are likely to occur concomitantly in response to the changing habitat.

# Chapter 7: Cost-Benefit Analysis

## TABLE OF CONTENTS


| Section | Title | Page |
|---|---|---|
| 7.0 | Cost Benefit Analyses | 7-1 |
| 7.1 | Costs and Benefits of the Proposed Action | 7-1 |
| 7.1.1 | Cost of the Proposed Action | 7-1 |
| 7.1.2 | Benefits of the Proposed Action | 7-1 |
| 7.1.3 | Summary of the Proposed Action | 7-2 |
| 7.2 | Environmental Cost | 7-2 |

## LIST OF TABLES

**Number** **Title**

Table 7-1 Average Direct Annual Salary and Wages for the ROI Workers ..... 7-2
Table 7-2 Summary Table of the Facility's Environmental Consequences ..... 7-3
Table 7-3 Qualitative Environmental Assessment of the Facility ..... 7-6

# 7.0 COST BENEFIT ANALYSES

This chapter describes the costs and benefits of the Proposed Action. Section 7.1 describes the economic impacts from the construction, operation, and decommissioning of the Facility. Section 7.2 describes the qualitative socioeconomic and environmental impacts from facility construction and operation. Section 7.3, No-Action Alternative Cost-Benefit, describes the impacts of the no-action alternative of not building the Facility.

## 7.1 COSTS AND BENEFITS OF THE PROPOSED ACTION

This analysis traces the economic impact of Facility in the 5-county region of influence (ROI) surrounding the Facility, identifying the direct impacts of the Facility construction and operation on revenues of local businesses, on incomes accrued to households, on employment, and on the revenues of state and local government. Further, it explores the indirect impacts of the Facility on local entities using a model showing the interaction of economic sectors in the ROI. The purpose of ER Section 7.1 is to assess the economic impact that construction and operation of the Facility would have on the surrounding area, including Roane, Anderson, Knox, Loudon, and Morgan Counties in Tennessee.

### 7.1.1 Cost of the Proposed Action

The Proposed Action results in adverse impacts on various resource areas, which can also be considered “costs” for the purpose of this analysis. The resource areas and corresponding impacts are summarized below and described in more detail in Chapter 4 of this ER. The adverse impact of the Proposed Action is small for all resource areas.

In terms of monetary cost of resources to OE, the total cost to construct Facility is estimated to be $5 billion. The total decommissioning cost estimate is listed in the Decommissioning Funding Plan.

### 7.1.2 Benefits of the Proposed Action

The Proposed Action results in positive economic impacts in the ROI, as described in Section 4.10. As described in Section 4.10, construction of the Facility will entail significant benefits over the construction period related to earnings, from both direct and indirect employment, associated with the Facility, and, during operations, significant tax revenue will be derived from the local workers spending each year on local purchases. These earnings and associated tax revenue benefit the ROI throughout the life of the Facility.

Table 7-1 shows the average annual employment, salary and wage for the ROI.

**Table 7-1 Average Direct Annual Salary and Wages for the ROI Workers**

| | Construction | Operation | Decommissioning |
|---|---|---|---|
| Average annual employment (direct) | 700 | 300 | 150 |
| Average annual salary and wage earnings (direct) | $49,296,100 | $22,474,200 | $11,237,100 |
| Total output | $394,368,800 | $898,968,000 | $89,896,800 |

### 7.1.3 Summary of the Proposed Action

This analysis shows that although there are economic and fiscal benefits associated with the Proposed Action, these benefits are small to moderate. The costs resulting from impacts associated with the Proposed Action on various resource areas that cannot be expressed in dollar terms the impacts are estimated to be small in magnitude for all resources. Chapter 8 provides further details on the summary of environmental consequences of the Proposed Action.

## 7.2 ENVIRONMENTAL COST

This section compares the costs and benefits of the Proposed Action to those of the No-Action Alternative. This comparison focuses on the tradeoffs between the Facility construction compared to not building the Facility. Table 7-2 and Table 7-3 presents the bounding case impacts.

**Table 7-2 Summary Table of the Facility's Environmental Consequences**

| Impacted Area | ER Section | Summary of Impact | Proposed Action Impact |
|---|---|---|---|
| Land Use | 4.1 | • Construction, operation, and decommissioning will not affect the intended zoning use of the parcel after the transfer of the Site to OE. | Small |
| Transportation | 4.2 | • Construction truck traffic will increase the traffic count in the immediate vicinity of the site entrance.<br>• Operation workforce commute and shipments will increase the traffic count in the immediate vicinity of the site entrance.<br>• Decommissioning traffic activities will have approximately the same impact as that during the construction period. | Small |
| Geology and Soils | 4.3 | • Approximately 300 acres will be disturbed to support the construction, operation, and decommissioning of the Facility.<br>• The Facility will be constructed and operated in accordance with appropriate geotechnical and structural specifications, engineering design criteria, applicable building codes, and relevant NRC Regulatory Guidance. | Small |
| Water Resources | 4.4 | • Engineering design and controls, together with the established management monitoring and maintenance procedures, minimize the potential impacts to groundwater from all life cycle stages of the Facility.<br>• The Facility obtains all potable, industrial, and sanitary water from the City of Oak Ridge and thus does not use groundwater.<br>• Regulated surface waters were identified on the Site. Alterations to jurisdictional wetlands and streams as a result of construction will be managed in compliance with design standards and regulatory criteria and guidelines. | Small |
| Ecology | 4.5 | • Important species and Federally listed threatened, endangered, or special status species are not present or not directly affected under the Proposed Action.<br>• Construction and sediment control BMPs through a project-specific SWPPP and seasonal restrictions to tree clearing, and monitoring and control of invasive species are used to minimize indirect effects. | Small |

| Impacted Area | ER Section | Summary of Impact | Proposed Action Impact |
|---|---|---|---|
| Meteorology and Air Quality | 4.6 | • Criteria pollutants, hazardous air pollutants (HAPs), fugitive dust emissions, and engine exhaust emissions are released during construction.<br>• Air emission sources associated with the Facility will be managed in accordance with appropriate regulation.. | Small |
| Noise | 4.7 | • Noise levels along roadways serving the Facility increase during the construction due to transport of materials and workforce.<br>• Construction noise levels dissipate with distance and impacts are temporary.<br>• Normal operation and loss of power operations result in noise levels at adjacent properties that comply with the City of Oak Ridge Zoning Ordinance. | Small |
| Historical and Cultural Resources | 4.8 | • No sites of local or national significance will be disturbed during the Proposed Action. | Small |
| Visual and Scenic Resources | 4.9 | • Temporary visual impacts resulting from construction and decommissioning are temporary and localized.<br>• A forested visual buffer between the Facility and sensitive visual receptors in the vicinity is maintained.<br>• The Facility design complies with local and state design requirements. | Small |
| Socioeconomics | 4.10 | • Construction, operation, and decommission phases are expected to generate increased economic activity within the region through creation of jobs, tax revenue, and local spending. | Positive |
| Environmental Justice | 4.11 | • Not Applicable | Not Applicable |

| Impacted Area | ER Section | Summary of Impact | Proposed Action Impact |
|---|---|---|---|
| Public and Occupational Health | 4.12 | • Radiological and non-radiological impacts for public health are minimized to reduce exposure and potential effects to workers and the surrounding public including BMPs, safety procedures, spill controls, spill-response plans, countermeasure plans, and spill-response equipment in accordance with Federal and State laws.<br>• Implementation of the proper engineering controls designed to prevent exposure to radiological and non-radiological materials stores on site, adherence to established occupational health and safety plans, including the use of personnel protective equipment, reduces the likelihood of construction-related recordable injuries and illness minimizes impacts to the worker health and safety. | Small |

**Table 7-3 Qualitative Environmental Assessment of the Facility**

| Qualitative Assessment | Determination/Evaluation |
|---|---|
| Change in real estate values in areas/communities adjacent to the Facility (e.g., land, homes, rental property etc.) | Unlikely to occur, potentially beneficial |
| Traffic increases on local Highway | Small impacts mainly associated with Increased traffic during shift changes |
| Air emissions from construction dust and vehicles | Small impact |
| Demand on local police and fire services, public utilities, schools, etc. | Some increased utilization and some increased need for additional staff expected |
| Impact to natural environmental components (e.g., ecology, water quality, air quality, etc.) | Small impact |
| Alteration of aesthetic, scenic, historic, or archaeological areas or values | Small impact |
| Change in local recreational potential | Small impact |
| Site soil erosion during construction | Small impacts |
| Incentive for development of other ancillary/support business development resulting from presence of Facility | Beneficial |
| Increase in local employment opportunities | Beneficial |
| Impacts to local retail trade and services | Beneficial |
| Development of local workforce capabilities | Beneficial |

# Chapter 8: Summary of Environmental Consequences

## TABLE OF CONTENTS


| Section | Title | Page |
|---|---|---|
| 8 | Summary of Environmental Consequences | 8-1 |
| 8.1 | Introduction | 8-1 |
| 8.2 | Unavoidable Adverse Environmental Impacts | 8-1 |
| 8.3 | Irreversible and Irretrievable Commitments of Resources | 8-2 |
| 8.4 | Short-Term and Long-Term Impacts | 8-2 |
| 8.5 | Short-Term uses of the Environment and Maintenance and ENHANCEMENT of Long-Term Productivity | 8-2 |

## LIST OF TABLES

**Number** **Title**

Table 8-1 Unavoidable Adverse Environmental Impacts ..... 8-1
Table 8-2 Impact for Resource Category for Stages of Project Life ..... 8-3
Table 8-3 Summary Table of the Facility's Environmental Consequences ..... 8-4

# 8 Summary of Environmental Consequences

## 8.1 INTRODUCTION

This chapter summarizes the Proposed Action's environmental consequences that cannot be avoided and for which no practical means of mitigation are available to fully eliminate the impacts. The environmental consequences for the OE Facility are described in Chapter 4 and a summary table is provided in Table 8-3.

## 8.2 ENVIRONMENTAL IMPACTS

Environmental impacts from an action that are not detectable or are so minor that they neither destabilize nor noticeably alter any important attribute of an applicable environmental resource are assigned the significance level of SMALL. When the environmental impacts from an action are sufficient to alter noticeably, but not to destabilize, important attributes of a resource, a significance level of MODERATE is assigned. Environmental impacts that are clearly noticeable and are sufficient to destabilize important attributes of a resource are assigned the significance level of LARGE.

The reasoning for the existing unavoidable adverse environmental impacts is captured in Table 8-1.

**Table 8-1 Unavoidable Adverse Environmental Impacts**

| Resource Category | Unavoidable Adverse Environmental Impacts | Reasoning |
|---|---|---|
| Water Resources | SMALL | Impact on surface water is unavoidable but considered SMALL through stream mitigation and bank credit following USACE recommendations.<br>Impact on wetland is unavoidable with the impact to three small wetlands, but considered SMALL by mitigating the impact in accordance with recommendations from TDEC and USACE. |
| Ecology | SMALL | Impact on Ecological resources is SMALL by following TDEC, USFWS and USACE recommendations. |
| Historical & Cultural Resources | SMALL | Impact is SMALL by mitigating with consultation with SHPO. |

The environmental impacts of the Facility are summarized in Table 8-2 by resource category for each stage of the project's life and further expanded in Chapter 4.

## 8.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An “irreversible” commitment and an “irretrievable” commitment are defined in Section 5.8 of NUREG-1748 as follows:

- Irreversible refers to the commitment of environmental resources that cannot be restored.
- Irretrievable refers to the commitment of material resources that once used cannot be recycled or restored for other uses by any practical means.

The irreversible and irretrievable commitments of resources are shown in Table 8-3.

## 8.4 SHORT-TERM AND LONG-TERM IMPACTS

A “short-term period” and a “long-term period” are defined in Section 5.8 of NUREG-1748 as follows:

- Short-term represents the period from start of construction to the end of the Proposed Action, including prompt decommissioning.
- Long-term represents the period extending beyond the end of the Proposed Action.

The short-term and long-term impacts of the Facility are displayed in Table 8-3. Further discussion for these impacts is located in Ch. 4.

## 8.5 SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The terms “short-term uses” and “long-term productivity” are defined in Section 5.8 of NUREG-1748 as follow:

- Short-term uses generally affect the present quality of life for the public (i.e., the planned license period for the Facility).
- Long-term productivity affects the quality of life for future generations based on environmental sustainability (i.e., the period after license termination for the Facility).

The short-term uses of the environment and maintenance and enhancement of long-term productivity of the Facility are presented in Table 8-3. The construction, operation, and decommissioning of the Facility require short-term uses of environmental resources that have a SMALL impact on the quality of life for the public.

**Table 8-2 Impact for Resource Category for Stages of Project Life**

| Resource Category | Construction | Operation | Decommissioning |
|---|---|---|---|
| Land Use | SMALL | SMALL | SMALL |
| Transportation | SMALL | SMALL | SMALL |
| Geology & Soils | SMALL | SMALL | SMALL |
| Water Resources | SMALL | SMALL | SMALL |
| Ecology | SMALL | SMALL | SMALL |
| Air Quality | SMALL | SMALL | SMALL |
| Noise | SMALL | SMALL | SMALL |
| Historical & Cultural Resources | SMALL | SMALL | SMALL |
| Visual / Scenic Resources | SMALL | SMALL | SMALL |
| Socioeconomics | POSITIVE | POSITIVE | POSITIVE |
| Public & Occupational Health | SMALL | SMALL | SMALL |
| Waste Management | SMALL | SMALL | SMALL |

**Table 8-3 Summary Table of the Facility's Environmental Consequences**

| Resource Category | Cumulative Impacts | Irreversible and Irretrievable Commitments of Resources | Short-term and Long-term Impacts | Short-term Uses of the Environment and Enhancement of Long-term Productivity |
|---|---|---|---|---|
| Land Use | SMALL | Due to its original use as an industrial land use, future use of the site remains industrial and as such does not result in a change to existing land use. | SMALL | The Facility will be constructed and operated on the Site in accordance with the industry zoning for the site.<br>The Facility will be decommissioned following its permanent shutdown. |
| Transportation | SMALL | Transportation impacts associated with the Facility will discontinue with the permanent shutdown and decommissioning of the Facility. | SMALL | Transportation routes will see increased traffic during the construction, operation, and decommissioning of the Facility.<br>The impacts to transportation will cease following the decommissioning and permanent shutdown of the Facility. |
| Geology & Soils | SMALL | The impacts to geology and soils associated with the Facility will discontinue with the permanent shutdown and decommissioning of the Facility. | SMALL | The potential impacts to the geology and soils of the Facility are mitigated through engineering controls.<br>The long-term impacts will be mitigated through engineering controls and the decommissioning of the Facility. |
| Water Resources | SMALL | The diversion of waterways and wetlands from the construction of the Facility will require irreversible commitment of resources. | SMALL | The short-term impacts to water resources from the construction and operation of the Facility include the diversion of waterways and wetlands away from the Facility footprint.<br>The long-term impacts include the remainder of the diverted waterways and wetlands beyond the decommissioning and permanent closure of the Facility. |
| Ecology | SMALL | Following the permanent shutdown and decommissioning of the Facility, the site will return to its near original ecological state thus having no irreversible impacts. | SMALL | The construction and operation of the Facility will displace local wildlife to nearby habitats within and adjacent to the site. Disruptions to wildlife travel corridors are not expected to occur. |

| Resource Category | Cumulative Impacts | Irreversible and Irretrievable Commitments of Resources | Short-term and Long-term Impacts | Short-term Uses of the Environment and Enhancement of Long-term Productivity |
|---|---|---|---|---|
| Air Quality | SMALL | Air quality impacts associated with the Facility will discontinue with the permanent shutdown and decommissioning of the Facility. | SMALL | During operation of the Facility, air emission control systems, monitoring programs, and BMPs will remain in place so as to not significantly affect the ambient air concentration levels.<br>The impacts to air quality will cease following the decommissioning and permanent shutdown of the Facility. |
| Noise | SMALL | Noise impacts associated with the Facility will discontinue with the permanent shutdown and decommissioning of the Facility. | SMALL | There are minimal short-term impacts to the public from the noise generated by the operation of the Facility.<br>The impacts to noise will cease following the decommissioning and permanent shutdown of the Facility. |
| Historical & Cultural Resources | SMALL | The existing non-significant historical archaeological home sites on the site will be removed and therefore the impacts to these historical and cultural resources will be irreversible. | SMALL | The short-term and long-term impacts include the removal of existing non-significant historical archaeological home sites on the Site. |
| Visual/ Scenic Resources | SMALL | Due to its original use as an industrial land use, future use of the site remains industrial and as such does not result in a change to existing visual resources. | SMALL | The Facility has minimal impact to short-term visual resources due to its low local visual importance.<br>The long-term impacts of the Facility will be minimal as the site will return to near original state following the decommissioning and permanent shutdown of the Facility. |
| Socioeconomics | POSITIVE | There are no negative impacts to socioeconomics from the construction, operation, or decommissioning of the Facility. | POSITIVE | The short-term impacts to the socioeconomics of the region surrounding the Facility will be positive.<br>There will be no negative impacts following the decommissioning and the permanent closure of the Facility. |

| Resource Category | Cumulative Impacts | Irreversible and Irretrievable Commitments of Resources | Short-term and Long-term Impacts | Short-term Uses of the Environment and Enhancement of Long-term Productivity |
|---|---|---|---|---|
| Environmental Justice | NO IMPACTS | There are no impacts to environmental justice from the construction, operation, or decommissioning of the Facility. | NO IMPACTS | There are no impacts to the environmental justice of the region surrounding the site from construction, operation, or decommissioning of the Facility. |
| Public & Occupational Health | SMALL | Public and occupation health impacts associated with the Facility will discontinue with the permanent shutdown and decommissioning of the Facility. | SMALL | The short-term impacts to the public and occupational health from the Facility are mitigated through the use of appropriate safety equipment and procedures.<br>There are no long-term impacts from the Facility following its decommissioning and permanent shutdown. |
| Waste Management | SMALL | The Facility requires irreversible commitment of land use resources at those off-site land disposal facilities that are used for the permanent disposal of the wastes generated by the construction, operation, and decommissioning.<br>The construction, operation, and decommissioning of the Facility will generate a combination of non-hazardous and hazardous waste streams. Those waste materials that cannot be recovered or recycled, and, therefore, need to be disposed of represent an irretrievable commitment of material resources | SMALL | The short-term impacts to waste from the Facility include the storage and processing of radiological and non-radiological waste.<br>The long-term impacts from the waste generated by the Facility are the storage for non-recyclable material and waste that will last beyond the decommissioning and permanent shutdown of the Facility. |

# Chapter 9: List of References

## TABLE OF CONTENTS


9 REFERENCES ..... 9-1

9.1 Chapter 1 Introduction to the Environmental Report ..... 9-1

9.2 Chapter 2 Alternatives ..... 9-2

9.3 Chapter 3 Description of the Affected Environment ..... 9-3

9.4 Chapter 4 Environmental Impacts ..... 9-11

9.5 Chapter 5 Mitigation Measures ..... 9-15

9.6 Chapter 6 Environmental Measurements and Monitoring Program ..... 9-15

9.7 Chapter 7 Cost Benefit Analysis ..... 9-15

9.8 Chapter 8 Summary of Environmental Consequences ..... 9-15

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## 9.5 CHAPTER 5 MITIGATION MEASURES

None.

## 9.6 CHAPTER 6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAM

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## 9.7 CHAPTER 7 COST BENEFIT ANALYSIS

None.

## 9.8 CHAPTER 8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

None.

# Chapter 10: List of Preparers

**TABLE OF CONTENTS**

10.0 LIST OF PREPARERS ..... 10-1

**LIST OF TABLES**

Table 10-1 Principal Contributors to the ER..... 10-4

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