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Environmental Impact Statement for the TRISO-X Special Nuclear Material License Application for a Fuel Fabrication Facility

Final Report

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Cooperating Agency:

U.S. Department of Energy

Environmental Center of Expertise
Division of Rulemaking, Environmental, and Financial Support
Office of Nuclear Material Safety and Safeguards

ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) prepared this environmental impact statement (EIS) as part of its environmental review of the TRISO-X, LLC (TRISO-X) application for a 40-year license to possess and use special nuclear material at a fuel fabrication facility (FFF) to be constructed on a 110-acre greenfield site in Oak Ridge, Roane County, Tennessee. This EIS assesses the potential environmental impacts of the proposed construction, operation, and decommissioning of the TRISO-X FFF, and alternatives to the proposed action.

The proposed federal action is the issuance of a license, under Title 10 of the Code of Federal Regulations (CFR) Part 70, "Domestic Licensing of Special Nuclear Material" to authorize TRISO-X to possess and use special nuclear material to manufacture high-assay low-enriched uranium (HALEU) fuel at a to-be-constructed FFF. The FFF would produce tri-structural isotropic–based coated particles and final fuel forms using uranium enriched to less than 20 weight percent uranium-235. Issuance of a license enabling the possession and use of special nuclear material at the FFF would be for a first-of-its-kind fabrication operation in the United States.

The U.S. Government and specifically the U.S. Department of Energy (DOE) seeks to assist in the development and demonstration of advanced nuclear reactor technology. Many advanced reactors currently in development will require HALEU fuel that is enriched to greater than 5 weight percent but less than 20 weight percent uranium-235. This fuel differs from the fuel used by the existing commercial reactor fleet in that it is more robust and accident tolerant. Thus, to support the demonstration of certain advanced nuclear reactor technology and its deployment, a reliable supply of HALEU fuel is needed. The DOE cooperated on the development of this EIS.

After weighing the environmental, economic, technical, and other benefits against environmental and other costs, and considering reasonable alternatives, the NRC staff's recommendation, unless safety issues mandate otherwise, is that the NRC issue the license to possess and use special nuclear material to TRISO-X. The NRC staff based its recommendation on the following factors:

- The NRC staff's review of TRISO-X's environmental report (included as part of the TRISO-X license application) and associated responses from TRISO-X to requests from the NRC staff for clarifying information;
- The NRC staff's communications with federal, state, and local agencies, as well as tribal officials;
- The NRC staff's independent environmental review;
- The NRC staff's review of comments received during the scoping process; and
- The NRC staff's consideration of public comments on the draft EIS.

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EXECUTIVE SUMMARY

By letters dated April 5, 2022, and September 23, 2022, the U.S. Nuclear Regulatory Commission (NRC) received an application from TRISO-X, LLC (TRISO-X) requesting a license pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51 to possess and use special nuclear material at a fuel fabrication facility (FFF) to be constructed on the 110-acre Horizon Center Site (HCS), a greenfield site in Oak Ridge, Roane County, Tennessee. On December 30, 2024, TRISO-X filed a revised license application reflecting a new feedstock source for fabricating fuel at the FFF and a corresponding change in the design of the FFF. An updated environmental report (ER) was submitted on January 31, 2025, and March 28, 2025. The license application includes an updated ER, a Safety Analysis Report (SAR), and other relevant documents. This environmental impact statement (EIS) was prepared consistent with NRC's National Environmental Policy Act (NEPA)-implementing regulations contained in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" and the NRC staff guidance in NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs."

The proposed federal action is the issuance of a license, under 10 Code of Federal Regulations (CFR) Part 70, to authorize TRISO-X to possess and use special nuclear material to manufacture high-assay low enriched uranium (HALEU) fuel at a FFF in Oak Ridge, Roane County, Tennessee. The FFF would produce tri-structural isotropic based coated particles and final fuel forms using uranium enriched to less than 20 weight percent Uranium-235. Issuance of a license enabling the possession and use of special nuclear material at the FFF would be for a first-of-its-kind fabrication operation in the United States.

The scope of the EIS includes an evaluation of the radiological and non-radiological environmental impacts of the NRC issuing TRISO-X a license to possess and use special nuclear material in association with TRISO-X constructing, operating, and decommissioning the FFF at the HCS. This EIS considers unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and potential long-term impacts, and irreversible and irretrievable commitments of resources.

The U.S. Government and specifically the U.S. Department of Energy (DOE) seeks to support the development and demonstration of advanced nuclear reactor technology. Many advanced reactors currently in development will require HALEU fuel that is enriched to greater than 5 weight percent but less than 20 weight percent Uranium-235. This fuel differs from the fuel used by the existing commercial reactor fleet. Thus, to support the demonstration of certain advanced nuclear reactor technology and their deployment, a reliable supply of HALEU fuel is needed.

In 2020, under the Advanced Reactor Demonstration Program (ARDP), the DOE Office of Nuclear Energy selected X-Energy, LLC (X-Energy), the parent company of TRISO-X, to deliver a commercial tri-structural isotopic FFF and a four-module version of its Xe-100 high temperature gas-cooled reactor by 2030. TRISO-X plans to manufacture its proprietary version of the tri-structural isotropic based coated particles and final fuel forms in various shapes and configurations at the FFF to power its own advanced reactor and the anticipated fleet of advanced reactors. The ability to supply fuel for new nuclear energy technology and the changing needs of the current reactor fleet will help maintain American security and competitiveness. The FFF, if licensed, would be the first commercial facility to fabricate HALEU fuel on a commercial scale.

In September 2022, TRISO-X submitted its initial ER. On November 18, 2022, the NRC notified TRISO-X of its decision that the application (including the ER) was sufficient to conduct its detailed review. The NRC staff published a Federal Register Notice of Intent (NOI) to prepare an EIS and conduct a scoping process on December 16, 2022 (87 FR 77146). Issuance of the scoping notice initiated a 60-day scoping period. Through the NOI, the NRC invited potentially affected Federal, Tribal, State, and local governments; organizations; and members of the public to provide comments on the scope of the TRISO-X FFF EIS. The scoping period ended on February 14, 2023.

During the week of January 23, 2023, staff from the NRC supported outreach and scoping meetings in Oak Ridge, Tennessee, with local government representatives and the public to exchange information on the TRISO-X FFF application. All comments received during these meetings were transcribed. During this week, NRC staff led separate in-person or virtual discussions with and responded to questions from representatives from the Roane County Commission; Tennessee Department of Environment and Conservation (TDEC); the Tennessee Emergency Management Agency (TEMA); and the City of Oak Ridge government and fire department, including the City Council, City Representatives, City Manager, Government Affairs, Mayor Pro Tem, Fire Chief, and Deputy Fire Chief. On Wednesday January 25, 2023, the NRC staff hosted a one-hour open house meeting for members of the public, local government, and the media to provide an opportunity to interact with the NRC staff members, receive handouts and pamphlets, and to view informational posters that contained details of the proposed project and the NRC’s licensing process. Representatives from TRISO-X were also present to provide project-related handouts and pamphlets and answer questions about the project. Immediately following the open house, the NRC staff led a combined in-person and virtual public scoping meeting. Approximately 45 members of the public attended in-person, and 11 members of the public attended online or by telephone. All transcribed comments from the scoping meetings, as well as any written comments submitted to the NRC during the scoping period in electronic or paper form, were considered by NRC staff and are included in the NRC report entitled, Environmental Impact Statement Scoping Process Summary Report for the TRISO-X FFF Permit Application.

The NRC staff issued multiple requests for additional information (RAIs) to supplement the environmental review of the TRISO-X license application. TRISO-X filed responses to RAIs from the NRC on April 14, 2023, December 20, 2023, March 4, 2024, and April 4, 2024. On December 30, 2024, TRISO-X filed a revised license application, including a revised SAR, reflecting a new feedstock source for fabricating fuel at the FFF and a corresponding change in the design of the FFF. Accordingly, TRISO-X filed revisions to the ER on January 31, 2025, and March 28, 2025. TRISO-X filed responses to subsequent RAIs from the NRC on May 23, 2025, and June 11, 2025.

This EIS considers and weighs the environmental impacts of the radiological and non-radiological environmental impacts of the NRC issuing TRISO-X a license to possess and use special nuclear material, in association with TRISO-X constructing, operating, and decommissioning the FFF at the HCS, on land use, visual resources, air quality, geology and soils, surface and groundwater resources, ecological resources, historic and cultural resources, noise, waste management, public and occupational health, transportation, socioeconomics, and accident impacts, and assesses the general costs and benefits of the project. This EIS also considers all comments received during the draft EIS public comment review period and describes any avoidance, minimization, or mitigation measures TRISO-X would implement to avoid potential adverse impacts on the environment.

The NRC's Environmental Review Guidance for Licensing Actions Associated with Office of Nuclear Materials Safety and Safeguards (NMSS) Programs (NUREG–1748) categorizes the significance of potential environmental impacts as follows:

> SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource.
>
> LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The NRC staff evaluated the environmental resource areas potentially affected by TRISO-X's application for a license to possess and use special nuclear material and construct the FFF and determined that the proposed action would have SMALL or no impacts on land use, visual resources, meteorology and air quality, geology and soils, wetlands and floodplains, terrestrial and aquatic ecology including protected species, historic and cultural resources, noise, public and occupational health, waste management, transportation, and accidents.

The NRC staff determined that project impacts on the socioeconomics of the project's region of influence (ROI) would be SMALL to MODERATE. Specifically, impacts within the ROI on employment and economic activity, population and housing, and public services and finances during the construction and decommissioning periods would be SMALL. Impacts within the ROI on employment, the population, and public services and finances during the operation period would result in MODERATE beneficial impacts.

The NRC staff also evaluated the reasonably foreseeable cumulative effects of the proposed action considering other reasonably foreseeable actions in the vicinity of the FFF site. The NRC staff determined the proposed project would contribute SMALL or no incremental effects on land use, visual resources, meteorology and air quality, geology and soils, groundwater, surface water, wetlands and floodplains, terrestrial and aquatic ecology including protected species, historic and cultural resources, noise, public and occupational health, waste management, transportation, and accidents.

The NRC staff determined the proposed project would contribute to MODERATE incremental effects on ground water quality and surface water and SMALL to MODERATE incremental effects on the socioeconomics of the project's ROI. Specifically, earnings and tax revenue for the FFF over decades would result in substantial positive socioeconomic effects; however, considered in the context of the five-county region, these effects would be SMALL. When these effects are combined with the benefits including increased jobs and tax revenue of other projects in the ROI, the positive socioeconomic effects would be MODERATE.

TRISO-X would implement a range of mitigation actions to avoid or minimize impacts on the environment. Examples of these actions include adhering to best management practices (BMPs) provided in TRISO-X's Stormwater Pollution and Prevention Program (SWPPP) and Spill Prevention and Control (SPCC) plan, and TRISO-X's waste management systems, engineering design features, and contamination control and radiological safety procedures. Additionally, TRISO-X would follow the permit requirements and general guidance of federal and state resource agencies regarding methods to avoid and minimize impacts at the project site.

The NRC environmental review regulations that implement NEPA in 10 CFR Part 51 require the NRC to consider reasonable alternatives, including the no action alternative, to a proposed action. Under the no action alternative, the NRC would not approve the TRISO-X license application for the proposed FFF. The no action alternative would result in TRISO-X not constructing or operating the proposed FFF.

This EIS compares the overall anticipated positive and negative impacts of the proposed action and the no action alternative. The proposed action would have positive and negative impacts, both from an environmental and economic perspective. After assessing and weighing these impacts, the NRC staff concludes that the overall positive impacts of constructing, operating, and decommissioning the proposed TRISO-X facility at the HCS outweigh the negative impacts based upon the mostly SMALL environmental impacts, including radiological impacts and risk to human health, that could be caused by the project; the positive economic impacts, attributable to the project, that would be anticipated to benefit communities near the HCS, and the development of a domestic fuel supply chain that would support advanced reactors to power a new generation of safe, clean, and economical nuclear power.

After weighing the impacts of the proposed action and comparing them to those of the no action alternative, the NRC staff, in accordance with Section 51.91(d) of Title 10 of the Code of Federal Regulations sets forth its NEPA recommendation regarding the proposed action, which is the issuance of an NRC license to TRISO-X to possess and use special nuclear material at the FFF on the HCS in Oak Ridge, Roane County, Tennessee, subject to the determinations in the NRC staff's safety review of the application. This recommendation is based on (i) the license application, which includes the ER and supplemental documents and TRISO-X's responses to the NRC staff's requests for additional information; (ii) consultation with Federal, State, Tribal, and local agencies, and input from other stakeholders, including comments during the public scoping period; (iii) independent NRC staff review; and (iv) the assessments provided in this EIS.

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
μg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
ACHP	Advisory Council on Historic Preservation
ac-ft	acre feet
AEA	Atomic Energy Act
AEGLs	Acute Exposure Guideline Levels
AGR	Advanced Gas Reactor
ALOHA	Areal Locations of Hazardous Atmospheres
APE	Area of Potential Effect
ARC15	Advanced Reactor Concept 2015
ARDP	Advanced Reactor Demonstration Program
ASME	American Society of Mechanical Engineers
BCC	Bird of Conservation Concern
bgs	below ground surface
BLM	U.S. Bureau of Land Management
BMP	best management practice
BORCE	Black Oak Ridge Conservation Easement
BUG	backlight, uplight, and glare
BWXT	BWX Technologies
CBG	census block group
CCS	closed cooling system
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMDF	centrifuge manufacturing development facility
CO_2e	carbon dioxide equivalent
CP	consulting party
CROET	Community Reuse Organization of East Tennessee
CSXT	CSX Transportation
dB	decibel

DBA	design-basis accidents
dBA	A-weighted decibel
DFP	decommissioning funding plan
DOE	U.S. Department of Energy
DOE-NE	U.S. Department of Energy, Office of Nuclear Energy
DOT	U.S. Department of Transportation
EFPC	East Fork Poplar Creek
EIS	environmental impact statement
EMDF	Environmental Management Disposal Facility
EP	Emergency Plan
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	environmental report
ESA	Endangered Species Act
ETSZ	East Tennessee Seismic Zone
ETTP	East Tennessee Technology Park
FEMA	Federal Emergency Management Agency
FFF	fuel fabrication facility
FIRM	Flood Insurance Rate Map
FR	Federal Register
FRED	Federal Reserve Economic Data
ft^3	cubic feet
FWS	U.S. Fish and Wildlife Service
g/kW-hr	grams per kilowatt-hour
GDP	gross domestic product
GHG	greenhouse gas
GIS	geographic information system
GMP	graphite matrix powder
HALEU	high-assay low-enriched uranium
HAP	hazardous air pollutant
HCIP	Horizon Center Industrial Park
HCS	Horizon Center site
HEPA	high-efficiency particulate air (filter)
HTF	helium test facility
HUC	hydrologic unit code

HVAC	heating, ventilation, and air conditioning
IDB	Industrial Development Board
IPaC	Information for Planning and Consultation
IROFS	Items Relied on for Safety
ISA	integrated safety analysis
K-25	K-25 Gaseous Diffusion Process Facility
kg	kilograms
kV	kilovolt
lb/ac/yr	pounds per acre per year
L_{dn}	day-night average sound level
L_{eq}	equivalent noise level
$L_{eq(24)}$	equivalent sound level over 24 hours
m	meter
MAR	material at risk
MBTA	Migratory Bird Treaty Act
MDCT	mechanical-draft cooling tower
MGD	million gallons per day
MOI	maximally exposed offsite individual
MOU	memorandum of understanding
mph	miles per hour
mrem/yr	millirem per year
mSv/yr	millisieverts per year
MTU	metric tons per year
MW	megawatt
MWt	megawatts thermal
NAAQS	National Ambient Air Quality Standards
NCICS	North Carolina Institute for Climate Studies
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NNSA	National Nuclear Security Administration
NOAA	National Oceanic and Atmospheric Administration
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission

NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OCPs	overcoated particles
ORED	Oak Ridge Electric Department
OREIS	Oak Ridge Environmental Information System
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
ORRETC	Oak Ridge Enhanced Technology and Training Center
ORRM	Oak Ridge Reservation Meteorology
OSHA	Occupational Safety and Health Administration
PAC	protective action criteria
PCB	polychlorinated biphenyls
PFO1A	palustrine forested broad-leaved deciduous temporarily flooded
Philotechnics	Philotechnics, LLC
PHRS	process heat removal system
PM	particulate matter
POR	period of record
ppm	parts per million
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
REMP	radiological environmental monitoring program
RIMS II	Regional Input-Output Modeling System
ROD	record of decision
ROI	region of influence
RRV	runoff reduction volume
SD	surface drainage
SER	safety evaluation report
SHPO	State Historic Preservation Office
SNF	spent nuclear fuel
SPCC	spill prevention, control, and countermeasures (plan)
SR	state route
SWPPP	stormwater pollution prevention plan
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation

TEDE	total effective dose equivalent
TEMA	Tennessee Emergency Management Agency
THC	Tennessee Historical Commission
TMDL	total maximum daily load
TN 95	Tennessee State Route 95
TPY	tons per year
TRISO-X	TRISO-X, LLC
TRU	transuranic
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
U_3O_8	triuranium octoxide
UO_2	uranium dioxide
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGCRP	U.S. Global Climate Research Program
USGS	U.S. Geological Survey
USNC	Ultra Safe Nuclear Corporation
WBNP	Watts Bar Nuclear Plant
Wood	Wood Environment & Infrastructure Solutions, Inc.
WOTUS	Waters of the U.S.
X-Energy	X-Energy, LLC
yd^3	cubic yards

1.0 INTRODUCTION

By letters dated April 5, 2022, and September 23, 2022, the U.S. Nuclear Regulatory Commission (NRC) received an application from TRISO-X, LLC (TRISO-X) requesting a license pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental Protection Regulations For Domestic Licensing And Related Regulatory Functions" to possess and use special nuclear material at a fuel fabrication facility (FFF) to be constructed on a 110-acre greenfield site in Oak Ridge, Roane County, Tennessee (TRISO-X, 2022a; 2022b). Applicants for NRC licenses are required under 10 CFR 51.45, "Environmental report," to submit an environmental report (ER) containing a description of the proposed project, a statement of its purposes, a description of the affected environment, and specific information needed for the NRC staff to evaluate the potential environmental impacts. TRISO-X submitted its initial license application materials to the NRC on April 5, 2022, including a safety analysis report (SAR; TRISO-X, 2022a), and subsequently filed an ER on September 23, 2022 (TRISO-X, 2022b). TRISO-X filed responses to Requests for Additional Information from the NRC on April 14, 2023 (Accession No. ML23104A419; TRISO-X, 2022c), December 20, 2023 (Accession No. ML23354A288; TRISO-X, 2023a), March 4, 2024 (ML 24065A313, TRISO-X, 2024a), April 4, 2024 (ML24095A341, TRISO-X, 2024b). On December 30, 2024, TRISO-X filed a revised license application, including a revised SAR, reflecting a new feedstock source for fabricating fuel at the FFF and a corresponding change in the design of the FFF (ML24365A255, TRISO-X, 2024c). Accordingly, TRISO-X filed revisions to the ER on January 31, 2025 (ML25031A457, TRISO-X, 2025a) and March 28, 2025 (ML25087A161, TRISO-X, 2025b). TRISO-X filed responses to Requests for Additional Information from the NRC regarding the revised ER on May 23, 2025 (ML25143A217, TRISO-X, 2025c), June 11, 2025 (ML25162A267, TRISO-X, 2025d), and January 29, 2026 (ML26029A128, TRISO-X, 2026). As a federal agency, prior to issuance of the license, the NRC is required to consider the environmental impacts of the proposed action under the National Environmental Policy Act of 1969 (NEPA; 42 U.S. Code [USC] 4321 et seq.). This environmental impact statement (EIS) was prepared consistent with NRC's NEPA implementation regulations contained in 10 CFR Part 51 and the NRC staff guidance in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs" (NRC, 2003). The NRC and the U.S. Department of Energy (DOE), Office of Clean Energy Demonstrations entered into a cooperating agreement to prepare an EIS evaluating the effects of the TRISO-X license application. This EIS will satisfy the NEPA responsibilities of the NRC and DOE, and each agency plans to issue a record of decision (ROD).

1.1 Proposed Federal Action

1.1.1 Nuclear Regulatory Commission

The proposed federal action is the issuance of a license under 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material" to authorize TRISO-X to possess and use special nuclear material to manufacture high-assay low-enriched uranium (HALEU) fuel at a FFF in Oak Ridge, Roane County, Tennessee. The FFF would produce tri-structural isotropic[1]–based coated particles and final fuel forms using uranium enriched to less than 20 weight percent uranium-235. Issuance of a license enabling the possession and use of special nuclear material at the FFF would be for a first-of-its-kind fabrication operation in the United States.

[1] *Isotropic* means of equal physical properties along all axes.

1.1.2 Department of Energy

As a cooperating agency, DOE's proposed federal action is the decision of whether to provide financial assistance to X-energy, through TRISO-X, to construct and operate the FFF as part of the Advanced Reactor Demonstration Program (ARDP). DOE must conduct a NEPA review prior to making a decision to authorize the expenditure of Federal funds. As part of a Memorandum of Understanding between the NRC and DOE, these parties have agreed to conduct a NEPA review of the TRISO-X Fuel Fabrication Facility that reflects the obligations of both DOE in its role as funding agency and the NRC in its role as regulator. Based on the outcome of the NEPA review, DOE would issue a separate ROD to fulfill its NEPA obligations and issue ARDP funds.

1.2 Purpose and Need

1.2.1 Nuclear Regulatory Commission

The U.S. Government and specifically the DOE seek to support the development and demonstration of advanced nuclear reactor technology. Many advanced reactors currently in development will require HALEU fuel that is enriched to greater than 5 weight percent but less than 20 weight percent uranium-235. This fuel differs from the fuel used by the existing commercial reactor fleet. Thus, to support the demonstration of certain advanced nuclear reactor technology and its deployment, a reliable supply of HALEU fuel is needed.

On November 15, 2021, the Infrastructure Investment and Jobs Act[2] was signed into law, providing more than $62 billion for the DOE to support technological innovation as a critical component for meeting the U.S. goal of reaching 100 percent carbon-free electricity by 2035 and a net-zero-carbon economy by 2050. In support of these goals, Congress allocated almost $2.5 billion to DOE and the Advanced Reactor Demonstration Program (ARDP).

In 2020, under the ARDP, the DOE-NE selected X-energy, LLC (X-energy), the parent company of TRISO-X, to deliver a commercial tri-structural isotopic FFF and a four-module version of its Xe-100 high-temperature gas-cooled reactor by 2030. In March 2023, Dow Chemical, Inc. and X-energy signed a joint development agreement establishing a mutual partnership to support the development and commercial demonstration of the country's first grid-scale advanced nuclear reactor for an industrial site in North America. X-energy and Dow Chemical, Inc. have identified a site for this reactor in Texas. Additionally, X-energy is working with Energy Northwest and Amazon to construct an Xe-100 high-temperature gas-cooled reactor in Benton County, Washington. The reactors at both locations would operate using the fuel fabricated at the proposed TRISO-X facility.

TRISO-X plans to produce tri-structural isotropic–based coated particles and final fuel forms in various shapes and configurations to power its own advanced nuclear reactors and the anticipated fleet of advanced nuclear reactors. The ability to supply fuel for new nuclear energy technology and the changing needs of the current reactor fleet will help maintain American security and competitiveness.

Tri-structural isotropic fuel was first developed in the U.S. and United Kingdom in the 1960s with uranium dioxide (UO_2) fuel. In 2002, the DOE initiated the Advanced Gas Reactor Fuel Development and Qualification Program to establish U.S. capability to fabricate high-quality tri-

[2] Infrastructure Investment and Jobs Act, Public Law No. 117-58, 135 Stat. 429 (2021).

structural isotropic fuel and improve its performance. Tri-structural isotropic–based coated particles are important for use in many advanced reactor designs.

TRISO-X seeks the NRC's authorization to possess and use special nuclear material for processing and fuel fabrication at the FFF in Oak Ridge, Tennessee. The FFF would manufacture its proprietary version of the tri-structural isotropic fuel at the Horizon Center site (HCS), within the Horizon Center Industrial Park (HCIP), located in Roane County, Tennessee. The fuel could be used in pebble-bed high-temperature gas-cooled and prismatic gas-cooled advanced reactors. The FFF, if licensed, would be the first facility to fabricate HALEU fuel on a commercial scale.

1.2.2 Department of Energy

The purpose and need for the DOE action is to comply with DOE's statutory mandates in the fiscal year 2020 Further Consolidated Appropriations Act and the Infrastructure Investment and Jobs Act to select and fund the demonstration of advanced reactors through cost-shared partnerships (cooperative agreements) with U.S. industry. The X-energy Xe-100 Reactor Demonstration Project was competitively selected by DOE to support the design, licensing, construction, and operation of first-of-a-kind advanced reactor designs under the Advanced Reactor Demonstration Program (ARDP). The need for the DOE action is to respond to X-energy's request for financial assistance through the cost-shared partnership to complete construction and operation activities for TRISO-X Fuel Fabrication Facility, as described in this EIS.

1.3 National Environmental Policy Act Process and NRC Environmental Review

NEPA established national environmental policy and goals to protect, maintain, and enhance the environment and established guidelines for federal agencies to implement these specific goals for actions under their jurisdiction. The purpose of this EIS is to assess the potential environmental impacts of the TRISO-X license application, associated proposal to construct, operate, and decommission the FFF, and alternatives to the proposed action. The NRC staff has prepared this EIS following NRC regulations at 10 CFR Part 51 and pursuant to guidance in NUREG-1748 (NRC, 2003) and NUREG-2212, "Standard Review Plan for Applications for 10 CFR Part 70 Licenses for Possession and Use of Special Nuclear Materials of Critical Mass but Not Subject to the Requirements in 10 CFR Part 70, Subpart H" (NRC, 2022a).

1.3.1 Notice of Intent to Prepare an Environmental Impact Statement and Scoping Process

In September 2022, TRISO-X submitted its ER (TRISO-X, 2022b). On November 18, 2022, the NRC notified TRISO-X that its application (including the ER) provided sufficient information for the NRC to proceed with a detailed review (Accession No. ML22320A110). The NRC staff published a notice of intent (NOI) to prepare an EIS and conduct a scoping process in the *Federal Register* on December 16, 2022 (87 FR 77146). Issuance of the scoping notice initiated a 60-day scoping period. Through the NOI, the NRC invited potentially affected federal, tribal, state, and local governments; organizations; and members of the public to provide comments on the scope of the EIS. The scoping period ended on February 14, 2023.

During the week of January 23, 2023, staff from the NRC supported outreach and scoping meetings in Oak Ridge, Tennessee, attended by local governments and the public to exchange information on the FFF license application. On Monday, January 23, 2023, the NRC staff led an in-person discussion with and responded to questions from representatives from the Roane County Commission. On Tuesday, January 24, 2023, the NRC staff conducted a virtual discussion and question-and-answer meeting with representatives from the Tennessee Department of Environment and Conservation (TDEC), a separate in-person discussion and question-and-answer meeting with representatives from the Tennessee Emergency Management Agency (TEMA), and a separate in-person discussion and question-and-answer session with representatives from the City of Oak Ridge and government affairs as well as the fire chief, deputy fire chief, city manager, and mayor pro tem. On Wednesday, January 25, 2023, the NRC staff hosted a 1-hour open house meeting for members of the public, local government, and the media to provide an opportunity to interact with the NRC staff members, receive handouts and pamphlets, and view informational posters that contained details of the proposed FFF and the NRC's licensing process. Representatives from TRISO-X were also present to provide project-related handouts and pamphlets and answer questions about the project. Immediately following the open house, the NRC staff led a combined in-person and virtual public scoping meeting. Approximately 45 members of the public attended in-person, and 11 members of the public attended online or by telephone. All comments received during the public scoping meeting were transcribed.

All transcribed comments from the public scoping meeting, as well as any written comments submitted to the NRC during the scoping period in electronic or paper form, were considered by the NRC staff and are included in the NRC report entitled, "Environmental Impact Statement Scoping Process Summary Report for the TRISO-X Fuel Fabrication Facility Public Comment Scoping Period January – February 2023" (ML24010A167; NRC, 2023a).

1.3.2 Draft EIS Public Comment Period

The NRC registered the draft EIS with the U.S. Environmental Protection Agency (EPA) in September 2025. However, due to the lapse of government appropriations, notice of the availability of the document was not published on October 3, 2025, by EPA as originally scheduled. The NRC staff issued a *Federal Register* notice on October 23, 2025 (90 FR 48508) to make the public aware of the availability of the document and to request comments on the draft EIS. That *Federal Register* notice notified the public of the original comment period end date of November 17. However, to be consistent with the requirement in 10 CFR Part 51, the staff issued another *Federal Register* notice on November 17, 2025, notifying the public that the comment period end date was being extended to December 8, 2025.

The NRC accepted all comments on the draft EIS received on or before December 8, 2025. The NRC received 13 separate comment correspondences through the www.regulations.gov website or by mail. From these, the NRC identified 50 unique comments. Appendix E contains summaries of these comments by subject matter area and topic and the NRC staff's response to the comments. Where applicable, the responses note which sections the NRC staff edited in response to the comments.

1.3.3 Scope of the Environmental Impact Statement

The scope of the EIS includes an evaluation of the radiological and nonradiological environmental impacts of the NRC issuing TRISO-X a license to possess and use special nuclear material in association with TRISO-X constructing, operating, and decommissioning the FFF at the HCS. This EIS considers unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and potential long-term impacts, and irreversible and irretrievable commitments of resources.

The EIS is organized as follows. Chapter 1 is this introduction. Chapter 2 provides a description of the proposed TRISO-X project, summarizing key elements of the design to evaluate potential environmental impacts. Most of the project design information in chapter 2 is drawn from TRISO-X's description of its project in the ER. Chapter 2 also presents the NRC staff's evaluation of the no action alternative. Chapter 3 describes the affected environment for each of the 14 environmental resource areas identified by the NRC staff through its scoping process, followed by the staff's evaluation of potential environmental impacts on each resource. The staff independently verified and summarized the affected environment descriptions from the ER and other public documents, relying on incorporation by reference to the extent possible to focus the EIS. The staff developed evaluations of environmental impacts independently from the applicant but relied in part on impact data presented by the applicant after independent verification. Chapter 4 summarizes the staff's conclusions and recommendations to the NRC Commission based on the environmental review.

1.3.3.1 Issues Studied in Detail

To meet its NEPA obligations related to its review of the proposed FFF, the NRC staff conducted an independent and detailed evaluation of the potential environmental impacts from construction, operation, and decommissioning of the proposed facility at the proposed location and of the no action alternative. This EIS provides a detailed analysis of the following resource areas:

- Land use
- Visual resources
- Meteorology and air quality (including greenhouse gases and climate change)
- Geologic environment
- Water resources
- Ecological resources
- Historical and cultural resources
- Noise
- Waste management
- Public and occupational health
- Transportation
- Socioeconomics
- Accident impacts
- Cumulative impacts

1.3.3.2 Issues Outside the Scope of the EIS

This EIS evaluates the environmental impacts of construction, operation, and decommissioning of the FFF. Some issues and concerns raised during the public scoping process on the EIS

(NRC, 2024) were determined to be outside the scope of the EIS. As a result, these issues and concerns are not addressed in the EIS. These topics include (but are not limited to) the following:

- General concerns about the safety and feasibility of nuclear power and alternatives to nuclear power;
- The safety of advanced nuclear reactors and the ability of advanced nuclear reactors to operate without the fuel that would be produced at the proposed FFF;
- The historical business and environmental practices of the City of Oak Ridge and the Oak Ridge Industrial Development Board (IDB);
- Previously proposed developments at the HCS; and
- Historical zoning changes at the HCS.

1.3.4 Nuclear Regulatory Commission Environmental Review

This EIS constitutes the NRC staff's review of potential environmental impacts from the proposed action of issuing a special nuclear material license, as required under 10 CFR 51.90, et seq., "Final environmental impact statement—general." To conduct a complete environmental review, this EIS covers the potential impacts from the construction, operation, and decommissioning life-cycle phases of the FFF. TRISO-X's current license application requests a license for 40 years. Therefore, the time frame of analysis for this proposed action is 40 years. At the end of the 40-year license period, TRISO-X would have the option to renew the license, at which time a new full environmental and safety review would be conducted.

This EIS presents the NRC staff's analysis that considers and weighs the environmental impacts of TRISO-X's FFF project at the proposed site, including the environmental impacts associated with the construction, operation, and decommissioning of the proposed facilities; the no action alternative; and mitigation measures available for reducing or avoiding adverse environmental effects. It also provides the NRC staff's recommendation to the NRC Commissioners regarding the issuance of the special nuclear material license for the proposed FFF at the site in Oak Ridge, Tennessee.

1.3.5 Concurrent Nuclear Regulatory Commission Reviews

The NRC process to review license applications consists of two separate, parallel reviews. The NRC staff's safety review evaluates an applicant's SAR to ensure the application meets the NRC regulatory safety requirements. The NRC staff documents the findings of the safety review in a safety evaluation report. The environmental review is conducted under NRC's regulations at 10 CFR Part 51 and evaluates the environmental impacts of, and alternatives to, the proposed action. The NRC considers the findings of both the safety evaluation report and the environmental review in making its decision to grant or deny the issuance of the license. This EIS presents the results of the environmental review.

1.3.6 Preconstruction Activities

The NRC defines construction activities for 10 CFR Part 70 facilities in 10 C.F.R. § 70.4. "Commencement of construction" is defined as taking any action defined as "construction" or any other activity at the site of a facility that has a reasonable nexus to radiological health and safety or common defense and security. The term "construction" includes installation of foundations or in-place assembly, erection, exploration, excavation, fabrication, or testing for any structure, system, or component of a facility or activity related to radiological health and safety or common defense and security.

In addition to the NRC's defined construction activities, there are many other conventional construction activities required to build a fuel fabrication facility. These activities are not regulated by the NRC and are generally referred to as preconstruction activities. Preconstruction activities could include actions such as site clearing and grading, excavating, building of service facilities (e.g., paved roads, parking lots), erection of support buildings, and other associated activities. Preconstruction actions may take place before a special nuclear material license is issued and during the NRC staff's review of an application.

The application did not differentiate between the two types of construction activities and the staff did not require TRISO-X to rewrite the application to parse them out. Instead, the staff decided to perform a bounding analysis for direct and indirect impacts. The NRC staff decided to perform a conservative analysis because doing so reduces the applicant's efforts to separate construction actions, and because it improves the readability of the document.

The reasonably foreseeable cumulative effects in this EIS include the activities that are not under the NRC's regulatory authority, including pre-construction activities. Since the staff will have already included all pre-construction activities in their indirect and direct impacts analysis, the staff will use those as the baseline to evaluate additional impacts from reasonably foreseeable actions within each resource area. This method accounts for potential impacts from all types of construction activities for the proposed fuel fabrication facility.

1.4 Regulatory Provisions, Permits, and Required Consultations

This section summarizes the major environmental requirements, agreements, executive orders, and permits relevant to the construction, operation, and decommissioning of the proposed FFF. The status of the environmental regulatory requirements, permits, and consultations necessary for construction of the proposed FFF are provided in tables 1.4-1 and 1.4-2. The applicant bears the responsibility of obtaining each of the permits listed in table 1.4-1. The NRC staff bears the responsibility of undertaking each of the consultations listed in table 1.4-2 as required under the Endangered Species Act of 1973 (ESA), as amended (16 USC 1531 et seq.) and National Historic Preservation Act of 1966 (NHPA), as amended (54 USC 300101 et seq.).

1.4.1 Related State and Federal Actions

As a federal agency, the NRC is required to comply with the consultation requirements of the ESA and the NHPA. Additionally, the NRC staff interacted with federal, state, local, and tribal agencies during preparation of this EIS to gather information on potential issues, concerns, and environmental impacts related to the proposed project. The coordination process with non-federal entities included discussions with TDEC, TEMA, local organizations (e.g., county commissioners), and tribal governments. Details regarding federally mandated agency consultations are provided in section 1.4.2. The NRC staff addresses the issues and concerns raised by federal and non-federal entities in the individual resource sections in chapter 3.

Table 1.4-1 Permits and approvals required for construction and operation

Agency	Regulatory authority	Permit or approval	Activity covered	Status
U.S. Nuclear Regulatory Commission	10 CFR Part 70	Special Nuclear Material License	Receipt, possession, use, and transfer of special nuclear material	Under review
U.S. Environmental Protection Agency	Clean Water Act 40 CFR Part 112	Spill prevention, control, and countermeasure (SPCC) plans for construction and operation	Storage of oil during construction and operation	Partial SPCC Plan prepared to support TRISO-X's General NPDES Permit for Stormwater Discharges Associated with Construction Activity SPCC Plan for operations not yet prepared
U.S. Department of Transportation	Hazardous Material Transportation Act 49 CFR Part 107	Certificate of Registration	Transportation of hazardous materials	Registration application not yet submitted
Tennessee Air Pollution Control Board and TDEC	Federal Clean Air Act Tennessee Code Annotated Title 68	Air Quality Construction Permit	Construction of a new air contaminant source; the proposed FFF has at least one (and possibly several)	Permit application accepted for review by TDEC on December 31, 2025

Agency	Regulatory authority	Permit or approval	Activity covered	Status
			new effluent discharge stacks	
		Air Pollution Control Operating Permit	Operation of an air contaminant source	Permit application not yet submitted
TDEC's Division of Water Resources	Federal Clean Water Act Tennessee Code Annotated Title 69	Notice of Coverage under the General National Pollutant Discharge Elimination System (NPDES) Permit for Stormwater Discharges Associated with Construction Activity	Clearing, grading, or excavation that disturbs 1 or more acres	Permit application approved. Notice of Coverage effective November 10, 2022 Tracking Number TNR136931
		Industrial Stormwater Discharge Permit	Discharge of stormwater runoff from the site during facility operation	Permit application not yet submitted

Agency	Regulatory authority	Permit or approval	Activity covered	Status
TDEC's Division of Solid Waste Management	Tennessee Comprehensive Rules and Regulations 0400-12-01 and 0400-12-02 40 CFR Chapter 1, Subchapter I, Solid Wastes Tennessee Code §68-212-101 Resource Conservation and Recovery Act	Hazardous Waste Permit	Owning or operating a new or existing facility that treats, stores, or disposes of a hazardous waste	Pending determination of applicability
TDEC, Division of Radiological Health	Rules of the TDEC, Chapter 0400-20-10, Licensing and Registration	Specific Radioactive Material License	Required for source material and/or sealed sources above exempt quantities	License application not yet submitted
		Radioactive Waste License for Delivery	Transportation of radioactive waste into or within the State of Tennessee to a disposal/processing facility	License application not yet submitted
	10 CFR 30	By-Product Material License	Production, possession, and	License application not yet submitted

Agency	Regulatory authority	Permit or approval	Activity covered	Status
			transfer of radioactive by-product material	
	10 CFR 40	Source Material License	Possession, use, and transfer of radioactive source material	License application not yet submitted
City of Oak Ridge Community Development Department	City of Oak Ridge Ordinance	Site Plan Application	A finalized site plan (with all landscaping, site design, etc.) must be submitted for approval before a land disturbance permit and/or building permit can be issued	Preliminary site plan approved by City of Oak Ridge on March 8, 2024.
		Building Permit	Required for construction of buildings	Permit issued on September 8, 2025
		Land Disturbance Permit	Required for land disturbing activity that disturbs more than 1 acre of land.	Land disturbance permit (Permit No. PRLD202402171) issued on October 3, 2024
		Plumbing Permit	Required for installation of plumbing systems	Permit issued September 22, 2025
		Electrical Permit	Required for installation of electrical systems	Electrical permits issued September 22, 2025, and November 6, 2025

Agency	Regulatory authority	Permit or approval	Activity covered	Status
				Permit application for permanent site power not yet submitted
		Mechanical Permit	Required for installation of mechanical systems	Permit application not yet submitted
	City of Oak Ridge Zoning Ordinance	Zoning Approval	Required for construction of a nuclear fuel fabrication facility	Ordinance to amend the zoning from IND-2 to IND-3 (heavy industrial district) completed, effective as of September 22, 2022

Table 1.4-2 Consultations required for construction and operation

Agency	Regulatory authority	Consultation	Required surveys	Status
U.S. Fish and Wildlife Service (FWS)	Endangered Species Act	Informal consultation regarding potential to adversely impact endangered protected species; concurrence with no adverse impact or consultation on appropriate mitigation measures	Rare, threatened, and endangered species survey	FWS provided concurrence for determinations that the project is Not Likely To Adversely Affect federally listed species on October 12, 2023
Tennessee State Historic Preservation Office	National Historic Preservation Act Section 106	Consultation regarding potential to adversely impact historic resources; concurrence with no adverse impact or consultation on appropriate mitigation measures	Phase I cultural resource survey	Concurrence that no historic properties or cultural resources would be affected by the Project provided by the Tennessee State Historic Preservation Office on September 11, 2023

1.4.2 Status of Compliance

1.4.2.1 Endangered Species Act of 1973, as Amended (16 USC 1531 et seq.)

The ESA was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7 of the ESA requires consultation with the U.S. Fish and Wildlife Service (FWS) and/or the National Marine Fisheries Service to ensure that actions federal agencies authorize, permit, or otherwise carry out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. The FWS has responsibility for certain species of Tennessee wildlife under the ESA, the Migratory Bird Treaty Act (MBTA) as amended (16 USC 701–715), and the Bald and Golden Eagle Protection Act (BGEPA) as amended (16 USC 668–668c). Consultation with the National Marine Fisheries Service is not required for this project.

TRISO-X contacted the FWS to introduce the project on March 9, 2022 (Wood Environment & Infrastructure Solutions, Inc. [Wood], 2022a). The FWS responded on April 15, 2022, to note the presence of listed bats in the project area and express concern regarding the clearing of the site by the Oak Ridge IDB prior to TRISO-X's ownership or involvement with the site (FWS, 2022). The NRC sent a letter to the FWS on September 22, 2023, requesting to engage in informal consultation. The FWS responded by letter on October 12, 2023, stating the FWS concurs with the determinations that the project is "not likely to adversely affect" federally listed species (FWS, 2023a). On August 6, 2025, the NRC notified the FWS of the changes described in TRISO-X's revised license application and that the changes did not require reinitiation of consultation. Additionally, the NRC staff acknowledged the proposed listing of the monarch butterfly (*Danaus plexippus*), which was proposed for listing as threatened under the ESA on December 12, 2024. The staff confirmed that conference was not necessary regarding the effects of the proposed action on the monarch butterfly (NRC, 2025).

1.4.2.2 National Historic Preservation Act of 1966 Section 106 Consultation

Section 106 of the NHPA requires federal agencies to account for the effects of their undertakings on historic properties and allow the Advisory Council on Historic Preservation (ACHP) an opportunity to review and comment on the undertakings. The ACHP is an independent federal agency that promotes the preservation, enhancement, and productive use of our nation's historic resources. The NHPA-implementing regulations are found in 36 CFR Part 800, "Protection of Historic Properties." In accordance with 36 CFR 800.8, "Coordination with the National Environmental Policy Act," the NRC staff coordinated its NHPA Section 106 review with its NEPA environmental review.

The goal of consultation is to identify historic properties the undertaking potentially affects, assess the effects of the undertaking on these properties, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties. As such, the NRC staff contacted 15 federally recognized tribes that have historic or current ties to the TRISO-X project area to assist in identifying historic and cultural properties within the site boundary. The NRC contacted the Absentee Shawnee Tribe, Alabama-Coushatta Tribe of Texas, Alabama-Quassarte Tribal Town, Cherokee Nation of Oklahoma, Coushatta Tribe of Louisiana, Eastern Band of Cherokee Indians of North Carolina, Eastern Shawnee Tribe of Oklahoma, Jena Band of the Choctaw Indians, Kialegee Tribal Town, Muscogee (Creek) Nation of Oklahoma, Seminole Nation of Oklahoma, Seminole Tribe of Florida, Shawnee Tribe of Oklahoma, Thlopthlocco Tribal Town, and the United Keetoowah Band of Cherokee Indians. Of the 15 contacted tribes, 2 tribes, the

Alabama-Coushatta Tribe of Texas and the Eastern Band of Cherokee Indians agreed to consult on the proposed project. Additional correspondence was sent to both tribes in March 2023 (ML23075A278 and ML23073A201, respectively) but no additional communication was received.

The NRC staff sent a letter to the Tennessee Historical Commission (THC) State Historic Preservation Office (SHPO) on September 5, 2023, requesting concurrence from the THC that no historic properties or cultural resources would be affected if the proposed license is issued to TRISO-X (NRC, 2023). On September 11, 2023, NRC received confirmation from the THC that the NRC's cultural resources review for the project meets the Tennessee SHPO Reporting Standards and/or the Tennessee SHPO Standards and Guidelines for Archaeological Resource Management Studies, thereby concluding NRC's NHPA Section 106 activities (THC, 2023a). A full listing of correspondence can be found in section 3.7.5 of this EIS.

1.4.2.3 U.S. Environmental Protection Agency Region IV

The EPA reviews all EIS documents prepared by federal agencies in accordance with Section 309 of the Clean Air Act. The NRC staff will transmit the EIS to EPA Region IV upon publication. The EPA provided comments on the draft EIS, which NRC staff addressed in section 3.3 in this EIS.

1.5 Cooperating Agencies

The NRC entered into a cooperating agreement with the U.S. DOE Office of Clean Energy Demonstrations for the TRISO-X Special Nuclear Material License Application to be used at a fuel fabrication facility (NRC and DOE, 2024). The DOE is responsible for making a decision regarding funding a portion of the project design and construction. The memorandum of understanding (MOU) between the NRC and DOE can be found using ADAMS (Accession No. ML24018A208). For additional details on the DOE federal action and purpose and need, see EIS sections 1.1.2 and 1.2.2, respectively. This EIS will serve to fulfill the NEPA responsibilities of both the NRC and DOE, with both the NRC and the DOE issuing a separate ROD.

2.0 PROPOSED PROJECT

2.1 Proposed Action

The proposed federal action is the issuance of a 40-year license to TRISO-X, LLC (TRISO-X) for the possession and use of special nuclear material to manufacture high-assay low-enriched uranium (HALEU) fuel at a fuel fabrication facility (FFF). TRISO-X seeks a special nuclear material license, pursuant to 10 Code of Federal Regulations (CFR) Part 70. If granted a license, TRISO-X would produce tri-structural isotropic–based coated particles and final fuel forms using uranium enriched to less than 20 weight percent uranium-235.

The FFF would produce fuel for the next generation of nuclear reactors. The manufacturing process would not include any enrichment of material. Manufacturing operations would include receipt of low enriched uranium triuranium octoxide (U_3O_8), high-assay low-enriched uranium (HALEU) U_3O_8, and HALEU dilute uranyl nitrate; conversion of U_3O_8 into a uranyl nitrate solution for formation into gel spheres and then into kernels; and then coating, overcoating, fuel form pressing, and high-temperature carbonization of the fuel kernels.

2.1.1 Site Location and Description

TRISO-X is proposing to build the FFF on a 110-acre site within the Horizon Center site (HCS) in Oak Ridge, Roane County, Tennessee. The HCS is on Renovare Boulevard, approximately 7 miles southwest of the approximate city center of Oak Ridge, Tennessee, and approximately 1 mile north of the Oak Ridge Turnpike interchange between Tennessee State Routes 58 (TN 58) and 95 (TN 95). The FFF would be centered at approximately 35.961 degrees north latitude and −84.370 degrees west longitude. Figure 2.1-1 depicts the proposed layout of the facility within the HCS. TRISO-X would use existing roads to access the site during construction.

The FFF would consist of the following structures and areas:

- TX-1 Process Building;
- TX-2 Process Building;
- Administration building;
- Graphite matrix powder (GMP) building;
- Security/emergency operations center building;
- Electrical and mechanical equipment yards;
- Process building heating, ventilation, and air conditioning (HVAC) exhaust stacks;
- Meteorological tower;
- Internal roadways;
- Stormwater detention basins and stormwater drainage ditches;
- Permanent parking areas;
- Shipping and receiving docks; and

- Temporary construction laydown/parking areas.

Facility operations would be supported by shipping and receiving, laboratory, quality control, research and development, uranium recovery, sanitary system, and waste disposal processes. The target production capacity would be 25 metric tons of uranium per year.

The project would include construction, operation, and decommissioning of process buildings. TRISO-X expects that construction (as defined in 10 CFR 70.4, “Definitions”) of the FFF is expected to take 5 years. The FFF would be initially licensed for 40 years of operation, with license renewal available under 10 CFR 70.33. At the end of the FFF’s useful life, TRISO-X would decommission it. Decontamination and decommissioning are projected to take 2 years.

2.1.1.1 Site Utilities Connections

TRISO-X would connect to utility lines (water, sanitary sewer, natural gas, and telecommunications) currently present within the Renovare Boulevard utility easement. TRISO-X would supply water to the site by connecting to the city of Oak Ridge’s municipal water main and would remove sewage from the site through a connection to the city of Oak Ridge’s sanitary sewer line. TRISO-X would heat the FFF using natural gas provided by the Oak Ridge Utility District. TRISO-X anticipates providing the FFF with electrical power through overhead transmission lines connecting to the site. The Oak Ridge Electric Department (ORED) plans to construct a transmission line that would extend from a newly constructed substation south of TN 95 northward along Norvus Drive and enter the HCS at its southern point at the intersection of Norvus Drive and Renovare Boulevard (City of Oak Ridge, 2022a).

2.1.1.2 Water Consumption and Treatment

TRISO-X anticipates an estimated 609,500 gallons per day of water would be required to operate the FFF (TRISO-X, 2025b). All water used during construction, operation, and decommissioning of the FFF would be sourced from the Oak Ridge municipal water supply. The following processes and components of the FFF would require water supply:

- Process heat removal system (PHRS; thermal transfer by water evaporation, drift, blowdown processes);
- HVAC chiller cooling tower system (evaporation, drift, blowdown);
- Demineralizer skid makeup (demineralized water makeup);
- Domestic water (for use in lavatories, sinks, showers, drinking fountains, landscaping);
- Fire protection water (for use in fire hydrants, sprinkler systems, hose stations);
- Mechanical system fill; and
- Humidification.

TRISO-X would treat the municipal water for the following systems:

- Demineralized water system (deionization system);
- Closed cooling system (CCS);
- PHRS;

- HVAC chilled water system; and

  HVAC cooling tower system.

TRISO-X would treat the closed-loop cooling water systems (i.e., CCS and HVAC chilled water system) prior to start-up and periodically throughout operation of the FFF. Water used in the HVAC cooling tower system would also be treated. The methods TRISO-X would use to treat the water would be selected based on the chemistry of the makeup water for the cooling water systems and would include the following:

- Biocides to inhibit microbial growth and reduce the potential for pathogen proliferation and fouling of the systems' equipment;
- Corrosion inhibitors (often halogen-based biocides) to inhibit corrosion within piping and other system components; and
- Scale inhibitors to reduce scale formation, particularly within heat exchangers and cooling towers.

2.1.1.3 Site Workers and Vehicular Deliveries

TRISO-X anticipates construction of the FFF would last approximately 5 years. Construction would occur primarily during weekdays and daylight hours, subject to any local restrictions imposed by the City of Oak Ridge. Construction could occasionally occur on weekends as necessary to reach construction deadlines. TRISO-X anticipates a daily average of 188 construction workers on site. The maximum number of construction workers on site daily is estimated to be 268. Accordingly, TRISO-X anticipates a daily peak of 268 construction worker vehicle roundtrips and 20 materials deliveries and waste removal vehicle roundtrips to and from the site per day throughout the construction phase of the project.

TRISO-X plans to excavate the entire project site during the first 6 months of construction and backfill the site with clean, earthen material trucked in from local offsite borrow areas. Although TRISO-X would test the excavated material to determine its suitability as backfill after undergoing lime treatment for expansive clay, TRISO-X is conservatively estimating that none of the excavated material would be suitable to use as backfill. TRISO-X would truck the excavated material that is unsuitable for use as backfill to offsite landfills. The City of Oak Ridge would need to approve the use of proposed borrow areas and landfills during the building permits process. TRISO-X anticipates excavation would remove approximately 560,243 cubic yards (yd^3) of topsoil and subsoil, and approximately 362,661 yd^3 of backfill would be transported in. Given these estimates, excavation and backfilling of the site would require a monthly average of approximately 15,729 truckloads of excavated materials and backfill to be transported from and to the site during the first 6 months of the project.

The licensed operational life of the FFF would be 40 years. During this period TRISO-X anticipates the maximum operational workforce at full capacity to reach 1,569 employees. TRISO-X estimates nonradioactive operational deliveries and waste removal during operations to be 1,040 roundtrips per year (20 roundtrips per week). Additionally, TRISO-X estimates that 36 truck deliveries per year of uranium source material, 196 truck shipments per year of fabricated fuel, and 60 truck shipments per year of solid radioactive waste would be necessary during operations.

2.1.1.4 Equipment and Material Usage

The materials expected to be required for construction would consist of concrete (56,151 yd^3), structural steel (7,403 tons), miscellaneous steel (4,256 tons), asphalt (9,000 yd^3), stone granular material (48,500 yd^3), and roofing (2,005 tons). TRISO-X expects materials transport and construction activities to consume 465,726 gallons of diesel fuel during construction.

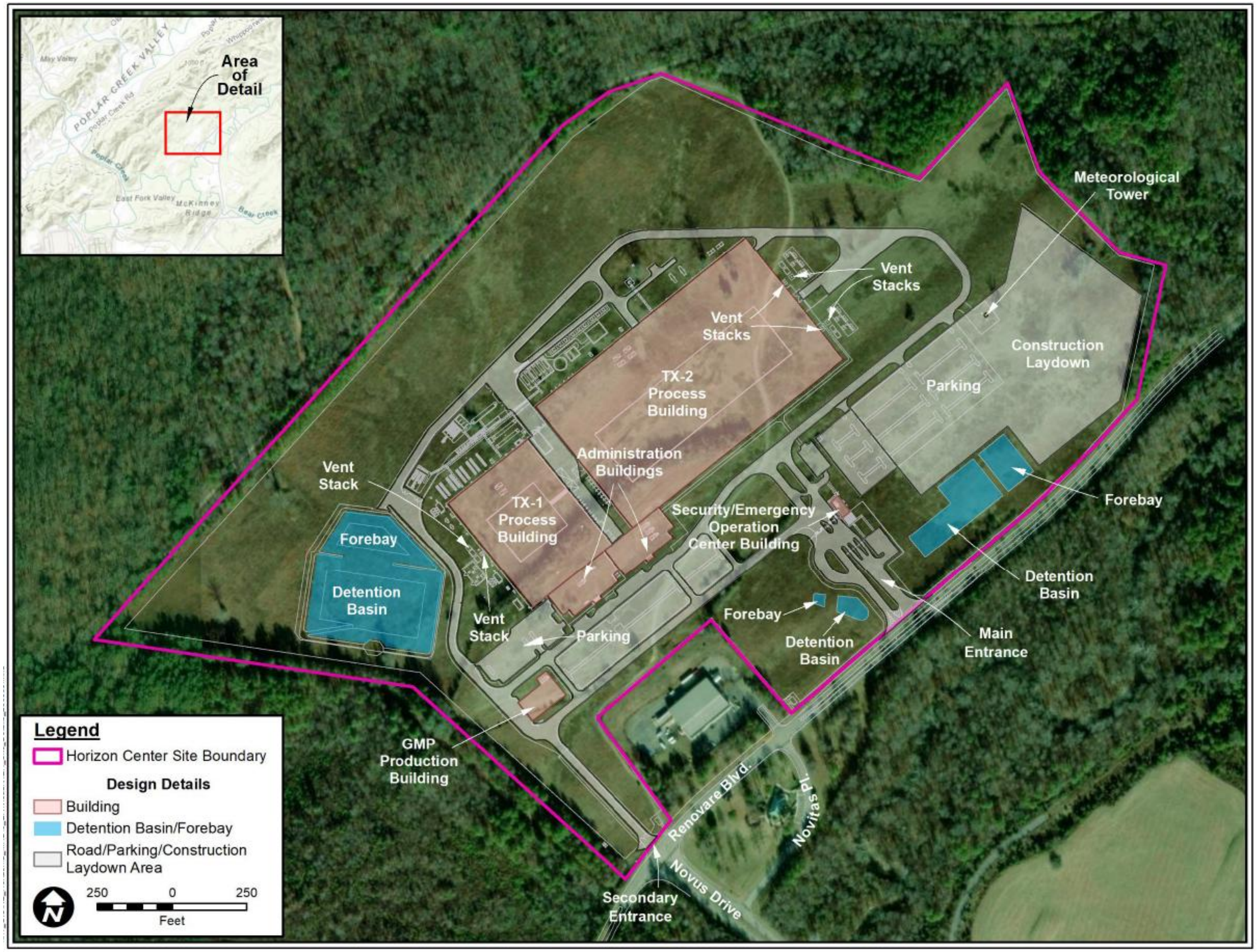


Figure 2.2-1 Proposed location of the TRISO-X fuel fabrication facility at the Horizon Center site (Source: TRISO-X, 2025b)

2.1.2 Operation Processes

2.1.2.1 Fuel Fabrication

The general steps in the fuel fabrication process that would occur at the FFF during operations are dissolution, gelation, kernel conversion, coating, overcoating, fuel form preparation, and high-temperature carbonization. The feedstock for the process would be U_3O_8 powder enriched to less than 20 weight percent uranium-235. TRISO-X would obtain the U_3O_8 powder through deliveries to the FFF by external suppliers; by converting dilute uranyl nitrate, delivered to the FFF by external suppliers, into U_3O_8 powder; and by recovering uranium from damaged, degraded, or otherwise non-conforming product materials through a variety of batch operations during the fuel fabrication process and converting the recovered uranium to U_3O_8 powder. The latter uranium recovery process would consist of reducing, deconsolidating, oxidizing, and/or converting the non-conforming product materials to U_3O_8 powder. TRISO-X would verify fabricated fuel product quality by analyzing samples during various stages of the process. Destructive and non-destructive tests would be performed to confirm the chemical composition, physical attributes, and material properties. The steps of the fuel fabrication process are summarized below:

- In the dissolution process, U_3O_8 powder enriched to less than 20 weight percent uranium-235 is manually transferred from a portable container into a hopper in a glovebox. The U_3O_8 powder is then metered into a nitric acid and water solution in a column where it is mixed until the required amount of U_3O_8 is dissolved, resulting in uranyl nitrate solution. The uranyl nitrate solution is then transferred to storage columns until it is used in the gelation process.
- In the gelation process, the uranyl nitrate solution is mixed with organic additives, and liquid droplets are formed that react with heated silicone oil to produce gel spheres. The gel spheres are aged in silicone oil, washed and rinsed to remove the silicone and additives, and then dried. The resulting dried microspheres are combined by mass to form the input batches to the kernel conversion process.
- In the kernel conversion process, the dried microspheres are converted in a high-temperature furnace to fuel kernels of uranium compounds, such as uranium dioxide and uranium dicarbide, based on the fuel design being fabricated. The fuel kernels undergo quality checks, and non-conforming products are rejected and sent to the uranium recovery process. The fuel kernels that pass the quality checks are combined by mass to form the input batches for the coating process.
- In the coating process, the fuel kernels are coated with several carbonous layers using a fluidized bed chemical vapor deposition system, resulting in coated particle fuel. When four carbonous layers are used, the resulting uranium-bearing microspheres are known as TRISO (tri-structural isotropic) particles. The coated particles undergo quality checks, and non-conforming products are rejected and sent to the uranium recovery process. The coated particles that pass the quality checks are combined by mass to form the input batches for the overcoating process.
- In the overcoating process, the coated particles are overcoated with a layer of GMP, based on the fuel design being fabricated and the packing fraction required in the fuel element. The overcoated particles (OCPs) undergo quality checks, and non-conforming products are rejected and sent to a washing station to remove the overcoating layer

before being reintroduced into the overcoating process. The OCPs that pass the quality checks are batched and sent to the fuel form preparation process.

- In the fuel form preparation process, OCPs are poured into molds or tooling and compressed or compacted into green fuel forms of the desired geometry, such as compacts or pebbles, based on the fuel design being fabricated. Some fuel designs require encapsulating OCPs in additional GMP and/or shaping. The green fuel forms undergo dimensional checks, and non-conforming products are rejected and sent to the uranium recovery process. The green fuel forms that pass the quality checks are batched and sent to the high-temperature carbonization process.
- In the high-temperature carbonization process, the green fuel forms are processed through a high-temperature furnace to convert the green body into a strong carbonized fuel form capable of withstanding handling and reactor service conditions. The final fuel forms undergo quality checks, and those that pass are loaded into shipping containers. Non-conforming products are rejected and sent to the uranium recovery process.

2.1.2.2 Chemical Receipt, Storage, and Handling

The FFF would receive and consume a number of chemicals in the production of the fuel. The chemicals that would be stored in bulk quantities include chemicals stored outdoors and chemicals stored indoors. The storage configuration (e.g., design standards for vessels, valves, and piping, or separation requirements) for each chemical would address and meet requirements from the applicable codes, standards, and guidelines including publications from the American Society of Mechanical Engineers (ASME), Compressed Gas Association, International Building Code, International Fire Code, National Fire Protection Association (NFPA), Occupational Safety and Health Administration (OSHA), and the Nuclear Regulatory Commission (NRC).

The liquid and gaseous chemicals stored and consumed in the production of the fuel are provided in the TRISO-X environmental report (ER; tables 2.1-1a through 2.1-1e of TRISO-X, 2026). These chemicals would be received by truck. Deliveries for indoor chemicals and certain outdoor chemicals (e.g., acetylene, carbon monoxide, and methyltrichlorosilane) would be in the form of packaged chemicals (i.e., cylinders, cluster packs, trailer-mounted cylinder packs, custom tanks, and intermediate bulk [storage] containers). For these chemicals, provisions for onsite receipt and return of empty containers would be included to prevent spills, releases, and accidents. These provisions would follow accepted engineering practices and adhere to applicable laws, regulations, codes, and standards. and adhere to applicable laws, regulations, codes, and standards.

For outdoor storage of certain liquids (e.g., argon, ethanol, hexamethyldisiloxane, and propylene), deliveries would be by transfer from a delivery vehicle (i.e., tanker truck) to the fixed onsite storage tank(s). Provisions for onsite chemical transfer operations would be included to prevent spills and accidents. These provisions would follow accepted engineering practices and adhere to applicable laws, regulations, codes, and standards. The FFF Site Emergency Plan and Integrated Safety Analysis will provide guidance regarding the designs for underground outdoor storage, aboveground outdoor storage of hazardous chemicals, (non-pressurized) indoor storage of certain liquids used and consumed in the various production processes, and provisions for solids stored in bulk quantities in the main facility and the GMP building, respectively.

2.1.2.3 Shipping and Transportation

All shipments of nuclear materials and wastes would conform with NRC, U.S. Department of Transportation, and State of Tennessee requirements. Incoming U_3O_8 and dilute uranyl nitrate feedstock would arrive by truck in approved containers licensed by the NRC or the DOE. Final fuel forms would be delivered to customers by truck in approved containers licensed by the NRC. Low-level waste shipments would be appropriately packaged and analyzed for uranium content prior to shipment to licensed low-level waste disposal sites.

2.1.2.4 Research and Development

In addition to the primary fuel fabrication processes, TRISO-X would also conduct research and development for future fuel products and processes at the FFF. This includes conducting small-scale production process testing and destructive and non-destructive tests. Research and development testing could include radiological materials of various compositions, physical attributes, and material properties.

2.1.3 Waste and Effluent Management

The FFF would be constructed with ventilation systems designed and operated to ensure adequate control of radioactive dust and particulates throughout the fabrication process. Solid wastes would be collected in the areas of generation and transferred to the waste handling area for assay and processing. Wastes could be compressed and/or their size reduced to allow containerization into 55-gallon drums and B-25 boxes, and those that meet free release criteria could be disposed of as non-contaminated. Liquid waste streams would be collected, sampled, and chemically adjusted as necessary to recycle/reuse in the process or to prepare and package for offsite disposal. Compliance with regulatory limits would be verified through periodic sampling of the waste streams.

There would be no long-term storage or disposal of radioactive waste at the FFF. Waste at the FFF would be characterized among many possible waste categories, including municipal solid waste (MSW), nonhazardous industrial waste, hazardous waste, and radioactive waste. Waste consisting of a combination of radioactive and hazardous materials is referred to as mixed waste. Mixed waste is regulated by the Resource Conservation and Recovery Act (RCRA) and the Atomic Energy Act (AEA). The NRC implements the requirements of the AEA regulating mixed waste. The types of radioactive liquid, solid, and gaseous wastes generated by the operation of the FFF can be summarized as follows:

- Liquid and gaseous effluents associated with process streams (e.g., wet chemistry material recovery process, gelation process, tri-structural isotropic particle washing, high-temperature carbonization process);
- Solid waste associated with receipt of feedstock materials (e.g., empty HALEU containers); dry active waste including personal protective equipment, rags, cleaning supplies, waste from consumables used in the production process; and materials carried into the ventilation system (e.g., U_3O_8 powder, GMP, materials abraded from mechanical handling; and high-efficiency particulate air [HEPA] filters);
- Quality control laboratory wastes; and
- Routine waste from maintenance activities (e.g., trash generation from decontamination, filter replacement).

TRISO-X would consolidate and compact Class A waste (i.e., waste containing relatively short-lived radionuclides and therefore low levels of radioactivity) into 55-gallon drums and B-25 boxes and ship them offsite for disposal.

Liquid waste at the FFF would primarily result from liquid processing operations such as the following:

- U_3O_8 dissolution to acid deficient uranyl nitrate; storage of the process solution; formation of gel sphere kernels; subsequent aging, washing, and drying of the gel spheres;
- High-viscosity substances from the high-temperature carbonization furnace;
- Effluents from operation of the quality control laboratory analytical equipment; and
- Effluents from uranium recovery.

TRISO-X would collect the liquid waste streams and chemically adjust the liquids as necessary to reuse them in the fuel fabrication process or prepare and package them for offsite disposal.

HEPA filters used on systems that could potentially discharge radioactive materials would be disposed of as solid waste. Radiological stacks that would discharge gaseous effluents would be continuously sampled to ensure radioactive limits established in 10 CFR Part 20, “Standards for Protection Against Radiation,” appendix B, table 2, column 1 would not be exceeded.

Waste management at the FFF is discussed more fully in section 3.9. Transportation of radioactive materials is addressed in section 3.10.

2.1.4 Monitoring and Mitigation Programs

The TRISO-X ER (TRISO-X, 2025b) details the federally mandated and other monitoring programs that TRISO-X would implement during construction, operation, and decommissioning of the FFF. Monitoring programs include radiological monitoring comprising gaseous and liquid effluent monitoring and a radiological environmental monitoring program (REMP); physiochemical monitoring comprising air, surface water, and groundwater sampling; ecological monitoring comprising invasive vegetation control and monitoring of impacts on the U.S. Department of Energy (DOE) natural areas adjacent to the HCS; and historic and cultural resources monitoring focused on minimizing impacts on the McKamey and Carmichael Cemetery adjacent to the HCS.

Programs that TRISO-X would implement to mitigate impacts on the environmental resources on the HCS and its vicinity are described in section 3.0 within the individual resource sections.

2.1.5 Decommissioning Activities

At the conclusion of the 40-year license period, TRISO-X would decontaminate and decommission the FFF in accordance with the license termination requirements at 10 CFR 70.38, unless a license renewal is requested under 10 CFR 70.33. If the NRC grants a license, TRISO-X would fund the decontamination and decommissioning of the FFF as stipulated in its decommissioning funding plan (DFP) for the FFF (TRISO-X, 2024c). TRISO-X’s DFP provides the plans for funding the decommissioning of the FFF and the disposal of radioactive waste generated as a result of plant operations, as required by 10 CFR 70.25(e) and is consistent with

NRC guidance in NUREG-1757. The NRC technical staff will review the adequacy of the decommissioning funding plan as part of its safety and safeguards review.

Radioactive equipment and materials would be disposed of during decommissioning according to local and federal laws and regulations. Post-operational decommissioning activities would require up to 150 workers. TRISO-X anticipates the average number of truck shipments from the site during decommissioning to be no more than the average daily truck traffic during the construction phase. Building materials, such as wood, concrete, and steel, and process equipment would be removed from the site.

Before decommissioning activities begin, TRISO-X would prepare a decommissioning plan for submittal to the NRC pursuant to 10 CFR 70.38, "Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas." The decommissioning plan would provide information concerning the FFF, the types of items to be decontaminated, the disposition of facilities used for hazardous materials, the assumptions upon which the cost of decommissioning are derived, and an estimated schedule for decommissioning and closing the facility. TRISO-X intends to decommission and close the FFF to reduce the level of radioactivity remaining in the facility to residual levels acceptable for release of the facility site for unrestricted use and for NRC license termination pursuant to 10 CFR 20.1401, "General provisions and scope" and 10 CFR 20.1402, "Radiological criteria for unrestricted use."

Prior to decommissioning, TRISO-X would assess the radiological status of the FFF. Decommissioning and closure activities would include cleaning and removing radioactive and hazardous waste contamination that may be present on materials, equipment, and structures. General guidelines that would apply to the decommissioning and closure effort are more fully discussed in sections 3.8 and 3.9.

2.2 No Action Alternative

Under the no action alternative, the NRC would not issue a license for the possession and use of special nuclear material for the manufacture of HALEU fuel to TRISO-X at its FFF. The FFF would not be available to produce tri-structural isotropic fuel, and this fuel would not be available to the nuclear industry. In this scenario, the stated purposes and needs of the NRC and DOE (refer to section 1.1) would not be fulfilled.

The no action alternative would limit the domestic sources of HALEU fuel for use in advanced reactors, with reliance remaining primarily on overseas producers. Plans to manufacture HALEU fuel by other U.S. companies are under development, but no licenses have been issued. Furthermore, other planned production capacity is unlikely to meet the estimates of future commercial demand. If the use of advanced reactors is demonstrated but domestic sources of HALEU fuel are limited, it is possible that advanced reactor deployment could be hindered. Other sources of power generation such as fossil fuel–based power plants could be added to the electric grid or remain in operation longer. Fossil-fuel use contributes to greenhouse gas emissions and other forms of air pollution that are not associated with nuclear power plants. The no action alternative would not result in any of the potential environmental impacts related to issuance of a special nuclear material license to TRISO-X or the associated construction, operation, and decommissioning of the FFF as discussed in chapter 3.

3.0 AFFECTED ENVIRONMENT, ENVIRONMENTAL IMPACTS, AND MITIGATION

This chapter provides a discussion of each environmental resource, describes the region of interest or potential project impact area, and assesses the potential impacts of the proposed action (i.e., the issuance of a license to authorize TRISO-X, LLC [TRISO-X] to possess and use special nuclear material to manufacture high-assay low-enriched uranium [HALEU] fuel and the construction, operation, and decommissioning of the associated fuel fabrication facility [FFF]) on the environmental resources. This chapter also describes, where applicable, mitigation measures for the reduction or avoidance of potential adverse impacts that (1) TRISO-X has committed to in its license application, or (2) additional measures the Nuclear Regulatory Commission (NRC) staff identified as having the potential to reduce environmental impacts, but that the applicant did not commit to in its application.

Sections 3.1 through 3.13 address the potential environmental impacts on the following resource areas: land use, visual resources, air quality (including greenhouse gases and climate change), geology and soils, water resources, ecological resources, historic and cultural resources, noise, waste management, public and occupational health, transportation, and socioeconomics, and present a discussion of potential project-related accidents.

The NRC staff uses the Council on Environmental Quality (CEQ) regulations-based standards of significance for assessing environmental impacts, as described in the NRC guidance in NUREG-1748 (NRC, 2003) and summarized as follows:

- SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource.
- LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Section 3.14 summarizes the reasonably foreseeable cumulative effects of the project. The NRC's regulations implementing the National Environmental Policy Act of 1969 (NEPA) require that the final environmental impact statement (EIS) "include a final analysis and a final recommendation on the action to be taken…" (10 Code of Federal Regulations [CFR] Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions"). A proposed project could contribute to collective environmental impacts when its environmental impacts overlap with those of other past or present actions.

3.1 Land Use

This section describes current land use within a 5.0-mile radius of the outer extents of the proposed fuel fabrication facility (FFF; referred to as the land use study area) following guidance in NUREG-1748 (NRC, 2003). TRISO-X, LLC (TRISO-X) provided information for this land use study area to describe the conditions within the vicinity of the proposed FFF. NUREG-1748 states the vicinity of a land use study area can range from less than 1 mile to 50 miles, depending on the action and the environmental media being considered. NRC staff determined the use of a 5-mile radius is reasonable given the relatively small footprint of the FFF and that land use within 5 miles of the FFF is generally reflective of land use within the broader region of east-central Tennessee in which the FFF would be located. For comparison, “Interim Staff Guidance Augmenting NUREG-1537, Part 1, ‘Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content,’ for Licensing Radioisotope Production Facilities and Aqueous Homogeneous Reactors” (NRC, 2012) also prescribes 5 miles as the required radius for describing land use impacts.

3.1.1 Affected Environment

The proposed FFF would be constructed on a previously cleared, approximately 110-acre parcel (i.e., the Horizon Center site [HCS]) dedicated for industrial development within the partially developed Horizon Center Industrial Park (HCIP). The parcel consists primarily of open, herbaceous vegetation and about 5 acres of mixed and evergreen forest.

The HCIP is a 1,000-acre industrial park comprised of several existing industrial and commercial facilities and several lots ranging in size from 11 to 148 acres, identified for future development. The HCIP was formerly part of the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR). Ownership of the HCIP was transferred to Horizon Center in 2003 and subsequently to the Oak Ridge Industrial Development Board (IDB) in 2005 (DOE, 1996, 2013). Since 1998, construction has occurred in several areas throughout the HCIP to transition the land use to be more consistent with an industrial park. Development has consisted of road construction, two bridges across East Fork Poplar Creek, utilities construction, clearing and grading of some lots, and construction of buildings and a telecommunication tower (DOE, 2003a). Five hundred acres of forested land are interspersed between the industrial lots of the HCIP. The forested lands are designated as natural areas to be indefinitely preserved as mitigation for impacts from the industrial lots that that would be cleared (DOE, 1996, 2003a). As of March 2023, most of the lots of the HCIP are zoned as general industrial districts (IND-2[3]). The HCS is now owned by TRISO-X and is zoned as a heavy industrial district (IND-3[4]) (City of Oak Ridge, 2023).

The majority of the land use study area is within Roane County, Tennessee, though a small portion of the outer extents of the area overlap Anderson, Loudon, and Morgan Counties, Tennessee. The predominant land uses in this area are forest lands (64 percent), developed lands (17 percent), agriculture (13 percent), and waters or wetlands (5 percent) (Dewitz, 2019;

[3] The IND-2 general industrial district is established to provide areas in which the principal use of land is for processing, manufacturing, assembling, fabrication and for warehousing. Medium industry produces moderate external effects such as smoke, noise, soot, dirt, vibration, odor, etc. These uses do not depend primarily on frequent personal visits of customers or clients (City of Oak Ridge, 2022b).

[4] The IND-3 heavy industrial district is established, in part, to provide sites for activities that involve manufacturing activities that pose significant risks due to the involvement of radioactive materials. It is the intent of this district to provide an environment for industries that are unencumbered by nearby residential, institutional, or commercial development (City of Oak Ridge, 2022b).

TRISO-X, 2025b). Appendix A provides figures of the land uses in the study area and a table of the respective acreages and percentages of each land use.

3.1.1.1 Developed Lands and Infrastructure

The city of Oak Ridge is the closest major population center to the HCS. It had an estimated population of 32,614 in 2022 (U.S. Census Bureau [USCB], 2022). Other towns in the vicinity of the land use study area include Oliver Springs, Harriman, Kingston, and Lenoir City. Oak Ridge provides electricity, water, gas, and sewer to its residents, and lines for these utilities are currently present in the utility easement of Renovare Boulevard at the HCS.

Transportation infrastructure in the land use study area consists of Tennessee State Route 95 (TN 95), Interstate 40 located 7 miles south of the HCS, and Interstate 75 approximately 11 miles east of the HCS. Additionally, a CSX Transportation (CSXT) Class I Railroad freight rail line extends from Anderson County, north of Roane County, along State Routes (SRs) 61 and 327 to the East Tennessee Technology Park (ETTP) approximately 2 miles southwest of the HCS.

There are currently no airports in the land use study area. The closest airports outside of the study area include the private Oliver Springs Airport approximately 6 miles northeast of the HCS, Liles Airport approximately 9 miles west of the HCS, and Big T Airport approximately 10 miles south of the HCS.

3.1.1.2 Schools and Hospitals

There are three schools within the land use study area: Mount Pisgah Christian Academy, approximately 3.3 miles north-northwest of the HCS; Dyllis Springs Elementary School, approximately 3.5 miles north-northeast of the HCS; and Linden Elementary School, approximately 4.4 miles northeast of the HCS. There are no hospitals within the land use study area.

3.1.1.3 Agriculture and Prime Farmland

Approximately 13 percent of the land use study area consists of agricultural lands. Specifically, it consists of approximately 7,347 acres of hay/pasturelands. According to the 2017 U.S. Department of Agriculture (USDA) Census of Agriculture (the most recently available census year), Roane County as a whole contains approximately 47,389 acres of farmland (USDA, 2017). Cropland and pastureland account for approximately 57 percent of this acreage, woodland 35 percent, and other agriculture about 5 percent. Ninety-eight percent of the crop acreage in Roane County is used to grow forage (hay/haylage). Other crops in the county include corn for grain, sweet corn, and berries (USDA, 2017).

USDA Natural Resources Conservation Service (NRCS) soil survey data are not available for federal lands, which account for more than one-third of the land use study area (NRCS, 2023a). TRISO-X estimated the amount of prime farmland soils within the land use study area based on available NRCS soils data and historical DOE environmental assessments for the site (DOE, 1996; NRCS, 2021). Based on this estimation, approximately 7,225 acres of the land use study area is considered prime farmland. Another 168 acres is considered prime farmland if drained or prime farmland if protected from flooding or not frequently flooded during the growing season (TRISO-X, 2025). However, the DOE environmental assessment conducted at the HCS noted that because these soils are present on land within the limits of the City of Oak Ridge, the prime farmland soils designation is waived, and other uses of the lands are permitted (DOE, 1996). The NRCS (2023b) states that prime farmland does not apply to urban areas or to areas that are not available for crop production.

3.1.1.4 Special Land Uses

The ORR was established in the early 1940s as part of the Manhattan Project, a secret undertaking that produced materials for the first atomic bombs. The ORR consists of federally owned land spread across approximately 37,000 acres in Anderson and Roane Counties. About 25,000 acres of the ORR are undeveloped and remain in a relatively natural state. The ORR's role has evolved over the years but both the previous and current functions of the sites involve the use of radiological and nonradiological hazardous materials (Tennessee Emergency Management Agency [TEMA], 2023).

The developed areas consist of three DOE-owned, contractor-operated sites: the ETTP, the Oak Ridge National Laboratory (ORNL), and the Y-12 National Security Complex (TEMA, 2023). As noted, the ETTP is approximately 2 miles southwest of the HCS and includes the Manhattan Project National Historical Park; the ORNL is an energy and national security research laboratory approximately 4 miles southeast of the HCS; and the Y-12 National Security Complex is a manufacturing facility prominent in the DOE's Nuclear Security Enterprise and is also involved with processing, retrieving, and storing nuclear materials. The Y-12 National Security Complex is approximately 5 miles east of the HCS.

The entire ORR was designated a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site (i.e., Superfund site) by the US. Environmental Protection Agency (EPA) in 1989. About 15 percent of the ORR is contaminated by hazardous and radioactive materials, including waste sites and remediation areas (TEMA, 2023).

3.1.1.5 Conservation Areas

As noted above, 500 acres of forested land, designated as natural areas, are interspersed between the industrial lots of the HCIP (see figure A-4, in appendix A). These natural areas border the northern, southern, and eastern boundaries of the HCS. In the original leasing/ownership transfer of the lands including these natural areas and the HCIP, the natural areas were strategically placed as buffers between the developed lots and indefinitely excluded from direct disturbance and development as mitigation for the potentially significant adverse impacts of industrial development of the HCIP lots. None of the designated natural areas are within the HCS. The intent in conserving these natural areas was to protect wildlife habitat, plant communities, water resources, wetlands, and potentially present threatened and endangered species and historic and archaeological resources. The areas were designed to act as buffers from the developed lots and serve as corridors to reduce the effects of fragmentation on the surrounding natural habitats (DOE, 1996). These areas are described in more detail in 1996 DOE environmental assessment (DOE, 1996). The natural areas are zoned as Greenbelt Districts (G) in the city zoning ordinance (City of Oak Ridge, 2022b).

The Black Oak Ridge Conservation Easement (BORCE) borders the western boundary of the HCS. It consists of approximately 3,000 acres of ORR land, managed predominately as a wildlife management area by the Tennessee Wildlife Resources Agency (TWRA) in cooperation with the Tennessee Department of Environment and Conservation (TDEC). The BORCE also contains multiple greenway trails used for non-motorized recreation. One such greenway trail is the North Boundary Greenway trail, which is a 14-mile trail used for hiking and biking. About 0.5

mile of the trail runs adjacent and parallel to the western boundary of the HCS. The trail is currently separated from the HCS by a band of trees ranging in width from approximately 100 feet at the southwestern corner of the HCS to approximately 30 feet at the northwestern corner of the HCS.

There are no other conservation or wilderness areas, parks, or recreational use areas in the immediate vicinity of the HCS.

3.1.1.6 Mineral Resources

There is currently no coal, oil, gas, or non-fuel mineral production in the land use study area (TRISO-X, 2025).

3.1.1.7 Land Use Plans

The City of Oak Ridge describes its goals for growth and development in its City Blueprint (City of Oak Ridge, 2019). The City Blueprint presents a citizen-supported, visionary plan for future growth and development in Oak Ridge. The development plan outlines the city's goals to, in part, support and expand infrastructure, economic vitality, and sustainable growth. The plan identifies the development of the HCS as part of this growth. Likewise, the Horizon Center Development Plan (Horizon Development Corporation, 2001) identifies the current and future land use plans for the HCIP, which include accommodating development of approximately 4 million square feet of manufacturing, research and development, distribution, office, and support facilities. Currently proposed or constructed developments within the HCIP in addition to the FFF include the X-energy helium test facility (DOE, 2024) and BWX Technologies advanced centrifuge manufacturing facility (BWX Technologies, 2026).

3.1.2 Environmental Impacts

TRISO-X anticipates the entire 110-acre HCS parcel would be cleared of existing trees, excavated, graded, and/or covered with fill during construction. Operational activities of the FFF would be confined to the bounds of HCS, and decommissioning of the site would consist of potential deconstruction of some parts of the facility while other portions would be decontaminated but remain onsite. Decommissioning activities would be similar in scope to construction activities.

Given that construction, operation, and decommissioning of the FFF would occur only within the bounds of the HCS parcel, impacts on land use in the surrounding land use study area would be minimal. The land use of the FFF would be in accordance with the current zoning classification of the site. As noted, the HCS is currently zoned as a heavy industrial district (IND-3; City of Oak Ridge, 2023). As described in the City of Oak Ridge Zoning Ordinance, the heavy industrial district is established to provide sites for activities that, in part, involve manufacturing facilities that pose significant risks due to the involvement of radioactive materials. This type of district is intended to provide an environment for industries that are unencumbered by nearby residential, institutional, or commercial development (City of Oak Ridge, 2022b).

Construction, operation, or decommissioning of the FFF would not directly impact or change the land use of the developed lands in Oak Ridge and the surrounding towns, including schools, the ORR facilities, including the forested natural areas, and the transportation infrastructure (i.e., roadways or railroads) in the land use study area. Potential impacts on the transportation sector are discussed in section 3.11. The risk of accidents at the FFF due to external factors is addressed in section 3.13.

Given that the HCS, and HCIP as a whole, has been zoned as an industrial area since its inception, construction, operation, and decommissioning of the FFF would not directly impact agricultural land use. The HCS was cleared prior to TRISO-X's acquisition of the site, but no portion of the HCIP is currently used for agricultural purposes. As noted, a portion of the HCS likely contains soils classified as prime farmland soils; however, because the HCS is within the limits of the City of Oak Ridge, the prime farmland soils designation is waived, and other uses of the lands are permitted (DOE, 1996).

Construction, operation, and decommissioning of the FFF could have small impacts on how the public perceives the land use of the conservation areas surrounding the HCS. DOE studies on the impacts of development of the industrial sites within the HCIP on the natural areas indicate the flora and fauna of the natural areas have not been significantly affected by development to-date (DOE, 2013). Given the expected limited impacts of construction, operation, and decommissioning of the FFF on the land use study area surrounding the HCS, the NRC staff concludes impacts of the project on land use would be SMALL.

3.1.3 Mitigation

Given that the proposed action would result in minimal land use impacts and would be consistent with the current use of the site, no additional mitigation measures have been identified by TRISO-X or the NRC staff.

3.2 Visual Resources

3.2.1 Affected Environment

The Horizon Center site (HCS) is an approximately 110-acre parcel within the partially developed Horizon Center Industrial Park (HCIP). As discussed further in section 3.4.1, the topography surrounding the HCS is typical of the Valley and Ridge physiographic province, in which the HCS is located. The Valley and Ridge physiographic province consists of ridges aligned northeast to southwest interspersed with relatively flat or slightly undulating valleys. The HCS is within the East Fork Valley, and the Black Oak Ridge rises steeply northwest of the site (TRISO-X, LLC [TRISO-X],2025b). Accordingly, the HCS is generally surrounded by forested ridges and hills. Section 3.9 of the TRISO-X environmental report (ER) provides photographs of the viewshed surrounding the HCS (TRISO-X, 2025b). Forested natural areas (described in section 3.1) are adjacent to the east, west, and south borders of the property, and the Black Oak Ridge Conservation Easement (BORCE) is adjacent to the northern border. Aside from the vegetation clearing that occurred prior to TRISO-X's acquisition of the land, the site is undeveloped. There are no buildings on the site. Human-made structures or roadways currently present in the immediate vicinity of the site are Renovare Boulevard, which extends between the HCS and the forested natural area southeast of the site; a warehouse/office building present near the southern corner of the site; the North Boundary Greenway trail, which parallels the northwestern border of the site within the BORCE; and Tennessee State Route 95 (TN 95). Renovare Boulevard is a two-lane divided roadway that provides access to the HCIP. The warehouse/office building facility, which is bordered by Renovare Boulevard to the southeast and the HCS on the remaining sides, consists of a one-story building with offices, warehouse space, and paved parking lots. Perimeter fencing separates the warehouse/office building facility from the HCS. The North Boundary Greenway trail, which is currently separated from the HCS by an approximately 65-foot-wide tree line, is a low-density recreational gravel trail used for hiking and biking. TN 95 is about 0.3 mile southeast of the HCS. There are no constructed features on the HCS, the adjacent warehouse/office building facility, or the adjacent segment of Renovare Road that are currently visible from TN 95.

The Nuclear Regulatory Commission (NRC) staff implements procedures from the Bureau of Land Management (BLM) *Visual Resource Management Manual,* which provides a means for determining visual resource values through determinations of scenic quality, sensitivity level, and distance zones delineation (BLM, 1986). Based on these three factors, lands can be placed into one of four visual resource inventory classes (Class I through IV). These inventory classes represent the relative value of the visual resources at a location. The NRC staff rated the visual resources and scenic quality of the HCS using the BLM Visual Resource Management System.

The scenic quality classification is the rating of the visual appeal of the land designated for the proposed FFF. This rating is based on an evaluation of seven key factors—landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. Scenic quality is classified as one of three ratings A, B, or C, with A as the highest quality visual rating. The NRC staff gave the HCS a C rating, that of low scenic quality, given its lack of notable landscape features, low vegetation diversity, absence of water, muted colors, cultural modifications to adjacent scenery, and commonality within the physiographic province.

The sensitivity level is a measurement of public concern for scenic quality, using six different indicators—types of users, amount of use, public interest, adjacent land uses, special areas, and other factors. The sensitivity level of public concern for scenic quality is assigned as high, moderate, or low. The NRC staff assigned the HCS a moderate sensitivity level. This was based on the rationale that the most frequent users of the HCS and surrounding area would be TRISO-X employees, visitors (e.g., contractors or delivery personnel) to the FFF, or employees and visitors to future industrial developments in the HCIP vicinity. These users are likely to have low sensitivity to changes in the visual quality of the site given that their interaction with the site would primarily begin after construction of the FFF is completed. However, users of the North Boundary Greenway trail, which parallels the northwestern border of the HCS, would be highly sensitive to changes in the visual quality of the area despite there being a line of trees between the trail and the HCS and the limited visibility of the HCS from the trail when users are not directly adjacent to the site due to the hilly terrain and dense forest habitat in the vicinity of the HCS.

Landscapes are subdivided into three distance zones, based on relative visibility from travel routes or observation points. These three zones are foreground-middleground, background, and seldom seen. The foreground-middleground zone includes areas seen from highways, rivers, or other viewing locations that are less than 3 to 5 miles away. Visible areas beyond the foreground-middleground zone but less than 15 miles away are in the background zone. Areas not seen as foreground-middleground or background (i.e., hidden from view) are in the seldom-seen zone (BLM, 1986). As discussed above, the HCS is surrounded by forested hills and ridges, which limit the visibility of the site to the immediately surrounding vicinity. Furthermore, the forested areas immediately adjacent to the HCS constitute the forested natural areas discussed in section 3.1 and the BORCE. These areas are not expected to be developed in the future and, therefore, the screening function that the forested lands provide would be expected to endure throughout the proposed operational period of the FFF. Given the extent of undeveloped, forested land surrounding the HCS, the site can be reasonably characterized as occurring in the seldom-seen zone.

3.2.2 Visual Resources Impacts

This section describes the potential impacts on visual resources associated with construction, operation, and decommissioning of the FFF. Impacts on visual resources from the construction stage would be associated with the cranes and heavy machinery used to clear and excavate the site and to build the facilities constituting the FFF and increased vehicle traffic at the HCS necessary to transport construction workers to the site. Decommissioning of the FFF would generally consist of cleaning and removal of materials, equipment, and structures contaminated by radioactive or hazardous waste during operation. Some buildings, parking areas, drainage features, and access roads could be left in place after closure of the facility. Otherwise, impacts on visual resources from the decommissioning stage to dismantle the FFF would include similar activities and equipment as used during the construction stage.

Visual impacts from operation of the FFF would arise from the presence of the buildings and other facilities that make up the FFF. Appendix B provides renderings of the FFF developed by TRISO-X. The main structures of the FFF would be the process buildings, which would rise approximately 64 feet above ground level. The administration, graphite matrix powder (GMP), and security and emergency operations center buildings would rise no more than approximately 26 feet. Six ventilation stacks, located at opposite ends of the process buildings, would rise approximately 100 feet above ground level, and a meteorological tower southeast of the process buildings would rise approximately 33 feet above ground level.

As noted above, visibility of the site to surrounding areas is limited by the forested hills and ridges in the immediate vicinity of the HCS. Visibility of the site would generally be limited to visitors and staff of the HCS or other surrounding developed areas within the HCIP and members of the public using the North Boundary Greenway trail directly adjacent to the HCS. TRISO-X assessed the likely visibility of the FFF to the public within a 3-mile radius of the HCS based on the heights of the FFF structures, the elevations of the surrounding topography, and an estimated average height of the predominate tree cover in the area. This viewshed estimate concluded approximately 1 percent of the surrounding 3-mile radius would have direct line of sight to the process buildings or vent stacks (TRISO-X, 2025b). Visitors and staff at the HCS and surrounding HCIP are expected to have low sensitivity to changes in the visual quality of the HCS given that their interaction with the site would primarily begin after construction of the FFF is completed. Users of the North Boundary Greenway trail, which parallels the northwestern border of the HCS, are likely to be highly sensitive to changes in the visual quality of the area. However, the forested nature of the trail and the areas surrounding the HCS would minimize the degree to which the FFF would be visible from the trail. Users of the trail would be expected to only have direct views of the FFF, through a tree line separating the FFF from the trail, when immediately adjacent to the site while traveling along the north boundary. Prior to arriving at the site and immediately after passing the site, the forested nature of the area would be expected to obscure visibility of the site.

The buildings and other facilities that would constitute the FFF would be consistent with the parameters of the City of Oak Ridge zoning designation for the HCS (City of Oak Ridge, 2023). Lighting associated with the FFF would also adhere to design standards prescribed in the City of Oak Ridge zoning ordinances; specifically, lighting would be installed in such a manner that the light source would be sufficiently obscured to prevent glare on public streets, walkways, or on the surrounding area (City of Oak Ridge, 2022b). The results of the NRC staff’s visual resource management classification of the HCS described above indicate the HCS would fall into Class IV of the visual resource inventory classes. Class IV is considered to have the lowest visual and scenic value and allows for major modifications of the existing landscape. Therefore, the NRC staff concludes that the impact on visual resources associated with construction, operation, and decommissioning of the FFF would be SMALL.

3.2.3 Mitigation

Given the anticipated small impacts on visual resources due to the relatively limited visibility of the HCS to the public, the adherence to City of Oak Ridge zoning designations, and the FFF being consistent with the planned use of the HCIP, TRISO-X has not proposed mitigation measures to avoid or minimize impacts on visual resources.

3.3 Climatology, Meteorology, and Air Quality

This section describes the climatology, meteorology, and air quality in the vicinity of the proposed fuel fabrication facility (FFF) and considers the potential direct or indirect impacts the proposed federal action would have on air quality.

3.3.1 Affected Environment—Climatology and Meteorology

3.3.1.1 Climate

The proposed FFF is in the Ohio Valley climate region (National Centers for Environmental Information, 2023). The region is situated between the Great Smoky Mountains and the Cumberland Mountains and experiences the full range of four seasons. Being situated between two mountain ranges helps to deflect and decrease wind velocities. The area is classified as humid subtropical and typically experiences hot, humid summers and cool to mild winters. During the summer, occasional frontal systems can produce lines of thunderstorms and rare tornadoes. Summer precipitation often results from “air mass” thunderstorms that form from the interaction of daytime heating, rising humid air, and local terrain features. The fall season sees some precipitation; however, August through October are often the driest months of the year. Precipitation events are significant in the winter months, often occurring every 3 to 5 days. Snow and ice are not generally associated with these events (Oak Ridge Reservation Meteorology [ORRM], 2026).

Meteorological data were collected for the Oak Ridge area from a National Oceanic and Atmospheric Administration (NOAA) weather station (KOQT) approximately 8.7 miles northeast of the Horizon Center site (HCS; table 3.3-1) (ORRM, 2026). Table 3.3-1 shows the climate data collected from 1991 to 2020. The average maximum monthly temperatures ranged from 47.8 degrees Fahrenheit (°F) in January to 88.6°F in July. The average liquid equivalent precipitation ranged from 5.5 inches in February to 3.2 inches in October.

Wind speed is typically less than 4 miles per hour (mph), and it blows mostly to the northeast and southwest near Oak Ridge. A wind rose chart is a graphical depiction of typical wind speed and direction at a specific location. The 5-year wind rose depicted in figure 3.3-1 is from Oak Ridge National Laboratory (ORNL) Tower M for data collected from 2016 to 2020 (ORRM, 2026).

The Oak Ridge area experiences a handful of severe weather events, with thunderstorms being the most frequent of events, averaging a frequency of 47 days per year based on data collected from 2011 to 2022 (Birdwell, 2023). Most thunderstorms happen during the summer months of June through August, with the highest number recorded in July. Approximately 4.6 days per year have hail, based on the period from 1950 to 2020. Tornadoes have been observed in the area but occur more in the middle and western portion of the State. The strongest tornado documented near Oak Ridge in Anderson and Roane Counties was an F3 on the Fujita scale in 1993 (Birdwell, 2023). Approximately 0.5 tornadoes per year affected Anderson, Knox, Loudon, and Roane Counties from 1950 to 2020, with F1 tornadoes being the most common category represented. Ice and snowstorms do not regularly produce significant events, with a normal annual average (from 1985–2021) of 4.9 inches of snowfall (Birdwell, 2023).

Additional and more detailed weather and meteorological data and information for the vicinity of the HCS are provided in TRISO-X’s environmental report (ER) section 3.6 (TRISO-X, 2025b).

Table 3.3-1 Climatological normals (1991–2020) and means—Oak Ridge, Tennessee (Station KOQT)

Parameter	POR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Normal daily max. temperature (°F)	30	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
Normal daily min. temperature (°F)	30	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
Normal dry bulb temperature (°F)	30	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
Normal humidity (%)	6	73.9	74.2	67.2	67.6	74.2	76.9	78.3	79.3	77.5	79.5	75.7	80.1	75.4
Mean wind speed (mph)	25	3.1	3.4	3.7	3.4	2.6	2.3	2.2	1.9	1.8	1.9	2.2	2.6	2.6
Prevailing wind direction (tens of degrees)[1]	25	22	05	05	22	22	21	21	06	06	06	05	22	05
Normal liquid equivalent precipitation (in.)	30	5.2	5.5	5.1	5.2	4.2	4.5	5.6	3.3	4.0	3.2	4.8	5.5	55.8
Average snowfall (inch)	30	1.8	2.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	5.7

°F – degrees Fahrenheit; POR – period of record (number of years)
Sources: Kantor et al., 2023; ORRM, 2026.
[1] *Prevailing wind direction is the true direction from which the wind is blowing measured from 10 degrees clockwise through 360 degrees. North is 360 degrees.*

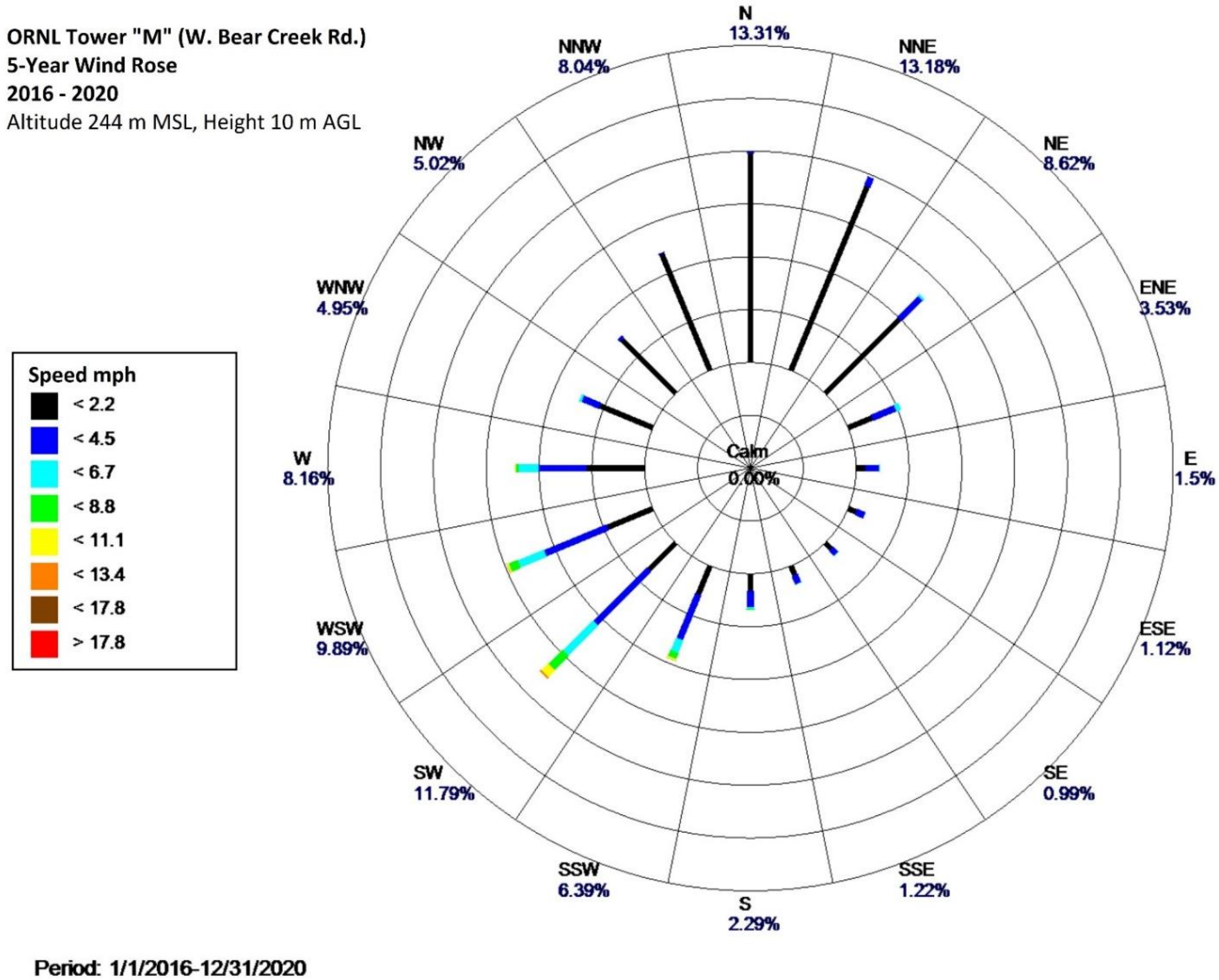


Figure 3.3-1 ORNL tower "M" 5-year wind rose, 2016–2020 (Source: ORRM, 2026)

3.3.1.2 Climate Change

Rising global average temperature is associated with widespread changes in weather patterns, with extreme weather events likely to become more frequent or more intense with human-induced climate change (U.S. Environmental Protection Agency [EPA], 2023a). Average temperature has risen across the contiguous 48 States since 1901, with an increased rate of warming over the past 30 years (EPA, 2023a). Temperatures in Tennessee have risen by 0.5°F since the beginning of the twentieth century, less than a third of the overall warming for the United States (North Carolina Institute for Climate Studies [NCICS], 2022). The number of individual days with maximum temperatures above 100°F was highest in the 1930s and early 1950s. However, some recent average annual temperatures have been among the warmest during the period of recorded meteorological data, specifically the years 2012 (second warmest), 2016 (third warmest), 2017 (fifth warmest), and 2019 (seventh warmest), likely due in part to a recent trend toward warmer winters (NCICS, 2022).

Tennessee's total annual precipitation has been mostly above average since 1990, and the number of 3-inch extreme precipitation events has also been generally above the long-term average over the same period (NCICS, 2022). The highest 5-year average of such events occurred from 2000 to 2004 (NCICS, 2022). The wettest year on record was 2018, with an annual total of 67.1 inches (NCICS, 2022).

The following list from NOAA shows additional climate change projections for Tennessee (NCICS, 2022):

- Unprecedented warming;
- Increased winter and spring precipitation; and
- Increased intensity of droughts.

3.3.2 Affected Environment—Air Quality

3.3.2.1 Non-Greenhouse Gases

The Clean Air Act of 1970, as amended, requires EPA to set primary and secondary National Ambient Air Quality Standards (NAAQS) that limit the concentrations of six criteria air pollutants. These pollutants are carbon monoxide, ozone, lead, nitrogen dioxide, sulfur dioxide, and particulate matter (both $PM_{2.5}$ [particles with diameter of 2.5 microns or smaller] and PM_{10} [particles with diameter 10 microns or smaller]). Primary NAAQS provide public health protection, and secondary NAAQS provide public welfare protection. Table 3.3-2 contains all NAAQS pollutants and their respective standards.

The EPA requires States to monitor ambient air quality and evaluate compliance with the NAAQS. Based on the results of these evaluations, the EPA assigns areas to various NAAQS compliance classifications (i.e., attainment, nonattainment, or maintenance) for each of the six criteria air pollutants. An attainment area is defined as a geographic region that the EPA designates as meeting the NAAQS for a pollutant. A nonattainment area is defined as a geographic region that the EPA designates as not meeting the NAAQS for a pollutant or that contributes to the ambient pollutant levels in a nearby area that does not meet the NAAQS. A maintenance area is defined as any geographic region previously designated as nonattainment and subsequently redesignated as attainment by the EPA. These classifications characterize the air quality within a defined area, which can range in size from portions of cities to large air quality control regions composed of many counties. An air quality control region is an EPA-designated area for air quality management purposes.

The proposed FFF is within the Eastern Tennessee–Southwestern Virginia Interstate Air Quality Control Region (EPA, 1971). Air quality monitors are located throughout multiple surrounding counties and show that Sullivan County is the closest in non-attainment for sulfur dioxide (EPA, 2023b). Additional and more detailed data and information for carbon monoxide, ozone, lead, nitrogen dioxide, sulfur dioxide, and particulate matter (both $PM_{2.5}$ and PM_{10}) in the vicinity of the HCS, all demonstrating compliance with the NAAQS, are provided in TRISO-X's ER in section 3.6.

The EPA established Prevention of Significant Deterioration (PSD) standards (40 Code of Federal Regulations [CFR] 52.21, "Prevention of significant deterioration of air quality") that set maximum allowable concentration increases for nitrogen dioxide, particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide above baseline conditions in attainment areas. The PSD program designated three different classes or groups of areas with different standards or levels of protection established for each class. Class I areas have the most stringent requirements. Federally designated Class I areas include national parks, wilderness areas, and monuments, as specified in 40 CFR Part 81, "Designation of Areas for Air Quality Planning Purposes." Areas not designated as Class I are, by default, classified as Class II areas, as there are no designated Class III areas in the United States. There is one Class I area in proximity to the proposed FFF, the Great Smoky Mountains National Park, approximately 34 miles to the southeast of the HCS.

Table 3.3-2 National Ambient Air Quality Standards

Pollutant		Primary/ secondary	Averaging time	Level	Form
Carbon monoxide (CO)		Primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		Primary and secondary	Rolling 3-month average	0.15 μg/m^{3}(1)	Not to be exceeded
Nitrogen dioxide (NO^2)		Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	1 year	53 ppb(2)	Annual mean
Ozone (O_3)		Primary and secondary	8 hours	0.070 ppm(3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particulate matter (PM)	$PM_{2.5}$	Primary	1 year	9.0 μg/m^3	Annual mean, averaged over 3 years
		Secondary	1 year	15.0 μg/m^3	Annual mean, averaged over 3 years
		Primary and secondary	24 hours	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24 hours	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years

Pollutant	Primary/ secondary	Averaging time	Level	Form
Sulfur dioxide (SO_2)	Primary	1 hour	75 ppb([4])	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	1 year	10 ppb	Annual mean, averaged over 3 years

Sources: EPA, 1990; 89 Federal Register (FR) 16202; 89 FR 105692
$\mu g/m^3$ – micrograms per cubic meter; ppm – parts per million
[1] In areas designated nonattainment for the lead standards prior to the promulgation of the 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 $\mu g/m^3$ as a calendar quarter average) also remain in effect.
[2] The level of the annual nitrogen dioxide standard is 0.053 ppm. It is shown here in terms of parts per billion for the purposes of clearer comparison to the 1-hour standard level.
[3] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) ozone 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) ozone standards.
[4] The previous sulfur dioxide 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 that is designated nonattainment under the previous sulfur dioxide standards or is not meeting the requirements of a State Implementation Plan call under the previous sulfur dioxide standards (40 CFR 50.4(3)). A State Implementation Plan call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

3.3.2.2 Greenhouse Gases

Gases that trap heat in the atmosphere are greenhouse gases (GHGs). GHGs include carbon dioxide, methane, nitrous oxide, and fluorinated gases. Emissions of GHGs are largely due to human activities including but not limited to burning fossil fuels, production and transportation of coal, and agriculture and land use. Emission levels are referred to in terms of carbon dioxide equivalent (CO_2e), which is the aggregate measure of total GHG global warming potential described in terms of carbon dioxide and accounts for the heat-trapping capacity of different gases.

On September 22, 2009, the EPA issued a final rule requiring GHG reporting for large GHG emission sources in the United States (40 CFR Part 98, “Mandatory Greenhouse Gas Reporting”). In general, the threshold for reporting is 25,000 tons of CO_2e emissions per year and/or an aggregate maximum heat input capacity greater than 30 million British thermal units per hour.

In May 2010, the EPA issued the GHG Tailoring Rule. This rule set the thresholds for a phase-in approach to regulating GHG emissions under the PSD and Title V permitting programs (75 *Federal Register* [FR] 31514). Operating permits issued to major sources of GHG under the

PSD or Title V federal permit programs must contain provisions requiring the use of best available control technology to limit the emissions of GHGs, if those sources would be subject to PSD or Title V permitting requirements because of their non-GHG pollutant emission potentials and if their estimated GHG emissions are at least 75,000 tons per year of CO_2e. In June 2014, the U.S. Supreme Court issued its decision in *Utility Air Regulatory Group v. EPA*, 573 U.S. 302 (2014), in which it held that the EPA may not treat GHGs as an air pollutant for determining whether a source is a major source required to obtain a PSD or Title V permit. The court also stated that the EPA could continue to require PSD and Title V permits otherwise required based on emissions of conventional pollutants.

3.3.3 Environmental Impacts

3.3.3.1 Air Quality

Air emissions from the FFF could include nitrogen oxides, carbon monoxide, sulfur oxides, hydrocarbons in the form of volatile organic compounds, hazardous air pollutants, $PM_{2.5}$, and PM_{10}.

Air emission sources are managed in accordance with federal, state, and local air quality control laws and regulations. The FFF would comply with all applicable regulatory requirements of the Clean Air Act and Tennessee Department of Environment and Conservation (TDEC) requirements to minimize impacts on state and regional air quality. As discussed below, since the FFF is a minor source, impacts on ambient air quality are expected to be SMALL.

Impacts to Class I areas, including the Great Smoky Mountains, are unlikely. Crosswind transport of emissions to this area would not likely adversely affect air quality and air quality-related values in this area (TRISO-X, 2025b).

3.3.3.1.1 Construction

The use of gasoline and diesel-fueled vehicles and heavy equipment during construction would cause visible emissions. The types of vehicles, machinery, and equipment that would be in operation during construction of the FFF are provided in TRISO-X's ER in table 2.1-4 (TRISO-X, 2025b). The vehicles, machinery, and equipment would be powered by gasoline or diesel engines and would produce emissions intermittently throughout construction when they are in use. As a conservative estimate of emissions, TRISO-X assumed all vehicles, machinery, and equipment would be powered by diesel fuel and calculated the resulting potential annual volumes of air pollutants that would be emitted during construction of the FFF. Table 3.3-3 provides this estimate based on the assumed usage of 145,546 gallons of diesel to construct process building 1 (TX-1) and 320,180 gallons of diesel to construct process building 2 (TX-2). The construction emissions would be below the thresholds to be classified as significant as defined by TDEC (Tenn. Comp. R. & Regs. 1200-03-09-.01). Additionally, the emissions would be short term, lasting the duration of construction, and would be moderated by engine maintenance in accordance with manufacturers' specifications. As provided in table 1.4-1, TRISO-X has applied for an air quality construction permit and would adhere to any permit requirements provided therein.

Table 3.3-3 Estimated annual air emissions during construction of the fuel fabrication facility

Pollutant	Process building 1 – (TX-1) potential emissions (tons per year)	Process building 2 – (TX-2) potential emissions (tons per year)
Particulate matter (PM)	0.81	1.79
Carbon monoxide (CO)	2.74	5.44
Nitrogen oxides (NO_x)	11.4	25.0
Sulfur dioxide (SO_2)	0.05	0.11
Volatile organic carbons (VOCs)	0.91	2.0

During construction of the proposed FFF, additional traffic and equipment movement may generate fugitive dust and potentially affect visibility. Dust generation during construction would be temporary and limited to the construction phase. Best management practices would be used as mitigation to prevent particulate matter from becoming airborne (TRISO-X, 2025b). These practices would include:

- Use of water spray or soil binders on soil surfaces during construction activities;
- Use of adequate containment methods during excavation;
- Covering the beds of open-bodied trucks during transportation of soils or other materials;
- Removal and clean-up of earthen materials deposited by trucks or earthmoving equipment or by wind erosion on paved roads; and
- Stabilization or covering of bare soil once earthmoving activities are completed.

Given the use of these practices and that the annual estimates of construction emissions would be below the significant threshold, we conclude impacts on air quality during construction of the FFF would be SMALL.

3.3.3.1.2 Operation

As discussed in chapter 2, the FFF's manufacturing operations would receive high-assay low-enriched uranium (HALEU) in the form of triuranium octoxide (U_3O_8) powder enriched to less than 20 weight percent uranium-235, or uranyl nitrate solution. The facility would convert the U_3O_8 into a uranyl nitrate solution and then into gel spheres and fuel kernels. The fuel kernels would be processed through coating, heat treatment, and carbonization. These operations would be supported by shipping and receiving, laboratory, quality control, research and development, uranium recovery, and waste disposal.

The FFF's proposed design would consist of three production lines with expected production capacity of 5 metric tons of uranium (MTU) per year, for one line (process building 1; TX-1) and 10 MTU per year per production line (i.e., a total of 20 MTU) for the other two lines (process building 2; TX-2). The facility would operate 24 hours a day, 7 days a week. The three production lines would each have their own ventilation system that would discharge to 100-foot-tall stacks adjacent to the process buildings. The production line 1 stack would have a larger diameter to accommodate discharges from the production line and other common areas. The characteristics of the stacks are provided in table 3.3-4. Ventilation systems would have both local and system filtration before discharge to the atmosphere. The projected emission points for the FFF are depicted in figure 3.3-2.

Three types of mechanical-draft cooling towers (MDCTs) are proposed. For production lines 1 and 2, one set of towers would reject the heat from the production equipment and the other set would reject heat from the heating, ventilation, and air conditioning (HVAC) system. Excess heat in the cooling water would be transferred to the atmosphere via evaporation, and a small percentage of that water would be lost by way of droplets. Evaporation of the droplets would leave deposits of dissolved solids; however, no noticeable impacts would be expected from the MDCTs. For production line 3, air-cooled chillers would reject process heat to surrounding air.

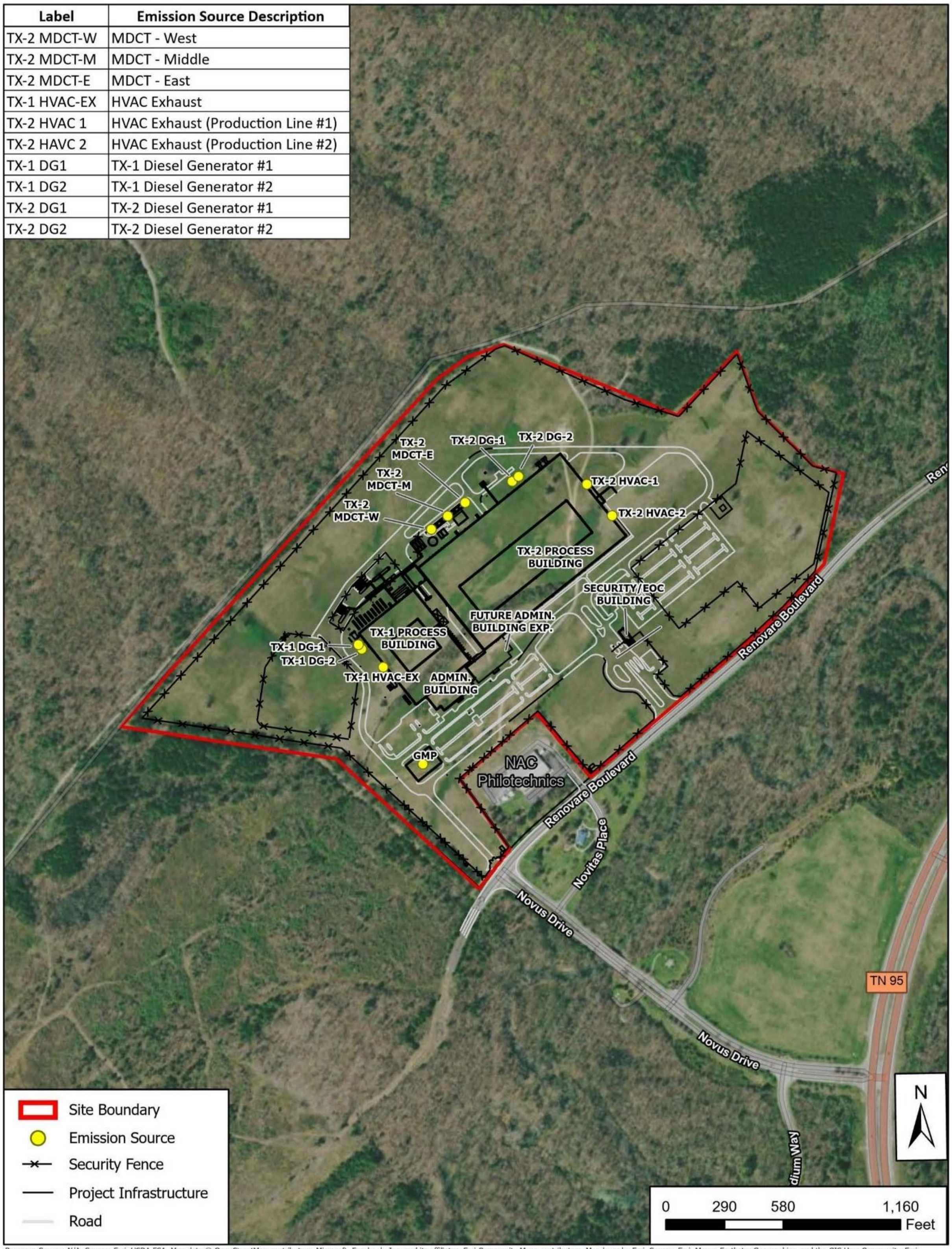
Air emissions would also occur due to vehicular traffic during operations. Cars, trucks, and delivery vehicles would arrive and depart the FFF. Although deliveries would occur throughout the day, the heaviest traffic would be associated with the morning and evening commute by workers.

Table 3.3-4 Physical characteristics of atmospheric emissions sources at the fuel fabrication facility

Source	Label (figure 3.3-2)	Location (UTM, Zone 16)		Grade elevation (feet, above mean sea level)	Release height (feet, above ground level)	Exit diameter (inch)	Exit velocity (feet per second)	Exit temperature (degrees Fahrenheit)
		Easting (m)	Northing (m)					
TX-2 HVAC exhaust (Production line #1)	TX-2 HVAC-1	737,320.635	3,983,040.318	810.5	100	80	50	75
TX-2 HVAC exhaust (Production line #2)	TX-2 HVAC-2	737,359.337	3,982,993.192	810.5	100	68	50	75
TX-1 HVAC exhaust (Production line #3)	TX-1 HAVAC EX	737,015.667	3,982,760,691	810.5	100	68	50	100
TX-1 Thermal Oxidizer exhaust[1]	TX-1 HAVAC EX[2]	737,001.455	3,982,765.985	810.5	100	--	--	--
TX-2 Thermal Oxidizer 1 exhaust[1]	TX-2 HVAC-1[2]	737,328.329	3,983,045.846	810.5	100	--	--	--
TX-2 Thermal Oxidizer 2 exhaust[1]	TX-2 HVAC-2[2]	737,365.672	3,983,000.368	810.5	100	--	--	--
GMP building vent[1]	GMP	737,445.110	3,982,615.671	810.5	--	--	--	--
Process Building 1 Diesel generator #1 [3, 4, 5, 6]		736,979.566	3,982,794.565	810.5	15	12	38.3	803

Source	Label (figure 3.3-2)	Location (UTM, Zone 16) Easting (m)	Location (UTM, Zone 16) Northing (m)	Grade elevation (feet, above mean sea level)	Release height (feet, above ground level)	Exit diameter (inch)	Exit velocity (feet per second)	Exit temperature (degrees Fahrenheit)
Process Building 1 Diesel generator #2		736,984.788	3,982,788.203	810.5	15	12	38.3	803
Process Building 2 Diesel generator #1	EGEN-1	737,207.403	3,983,043.205	810.5	15	12	160.9	884.2
Process Building 2 Diesel generator #2	EGEN-2	737,216.828	3,983,050.944	810.5	15	12	160.9	884.2
Process Building 2 MDCT – West[7,8]	MDCT-W	737,066.995	3,982,953.422	810.5	18.2	120	23	96
Process Building 2 MDCT – Middle	MDCT-M	737,078.424	3,982,962.806	810.5	18.2	120	23	96
Process Building 2 MDCT – East	MDCT-E	737,089.854	3,982,972.190	810.5	18.2	120	23	96

[1] *Emissions parameters to be determined in detailed engineering.*
[2] *The locations of the thermal oxidizer exhaust stacks are paired with HVAC exhaust stacks when the site is viewed at the scale of figure 3.3-2.*
[3] *Nominal stack heights and diameters for each generator are subject to change based on results from air dispersion modeling.*
[4] *Exit velocity for each generator is based on a flow rate of 7,582.8 cubic feet per minute and a nominal 12-inch-diameter stack.*
[5] *Operation for each generator is up to 100 hours per year for maintenance, testing, and non-emergency use, including no more than 50 hours per year for non-emergency situations.*
[6] *Enclosure housing dimensions for each generator: length: 384 inches, width: 101 inches, height: 148 inches.*
[7] *Cooling tower cell dimensions: height: 18 feet 2.5 inches; length: 14 feet 1.75 inches; width: 11 feet 10 inches. Fan diameter: 10 feet.*
[8] *The water flow rate for the cooling towers in the process heat removal system is 1,600 gallons per minute per cell. The water flow rate for the cooling tower in the heating, ventilation, and air conditioning system is 2,100 gallons per minute per cell.*



Basemap Source: N/A Source: Esri, USDA FSA, Map data © OpenStreetMap contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors, Map layer by Esri, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Figure 3.3-2 Emission points for the fuel fabrication facility (Source: Triso-X, 2025b)

Two diesel-powered backup generators per process building would be used to provide emergency backup power in the event of power outage. It is anticipated that the backup generators would operate intermittently and for brief periods. Emissions limits data for the backup generators include 6.4 units of carbon monoxide, 3.5 units of nitrogen oxides plus non-methane hydrocarbons and 0.2 units of particulate matter, all in grams per kilowatt-hour (g/kW-hr).

Air emissions resulting from operation of the FFF would include nitrogen oxides, carbon monoxide, sulfur oxides, volatile organic compounds, hazardous air pollutants, and $PM_{2.5}$ and PM_{10}. Estimated annual emissions from the FFF are presented in table 3.3-5. The emissions are based on the projected annual production rates of 5 MTU from process building 1 (TX-1) and 20 MTU from process building 2 (TX-2). Thermal oxidizers at each production line would decrease levels of carbon monoxide and other hazardous air pollutants (HAP) by converting them to carbon dioxide and water. The carbon dioxide emissions and water would then be discharged to the environment through the thermal oxidizer exhaust stacks (table 3.3-4).

The FFF air emissions constituents would all be below regulatory thresholds and managed in accordance with Clean Air Act and TDEC requirements. Annual emissions of criteria pollutants would remain below the 250-tons-per-year threshold defining a major stationary source for PSD under New Source Review regulations; annual emissions of the individual criteria pollutants would remain below the 100-tons-per-year major source threshold under Title V regulations; and HAP emissions would remain below the Title V major source thresholds of 25 tons per year of any combination of HAPs and less than 10 tons per year of any single HAP (table 3.3-5). Therefore, the FFF would be subject to permitting as a minor air pollutant source according to 40 Code of Federal Regulations (CFR) Part 70.2 requirements. Potential impacts upon visibility would be minor. Because the FFF would be a minor air pollutant source, impacts upon air quality would be SMALL. Given the 34-mile distance to the closest Class I area (the Great Smoky Mountains National Park) and prevailing winds as described above, impacts to Class I areas are unlikely.

Table 3.3-5 Potential annual emissions from the fuel fabrication facility

Pollutant	Process Building 1 – 5 MTU potential emissions (tons per year)		Process Building 2 – 20 MTU potential emissions (tons per year)	
	Uncontrolled	Controlled	Uncontrolled	Controlled
Criteria				
Particulate matter	20.9	0.45	83.4	1.78
Carbon monoxide	1.84	0.95	7.34	3.8
Nitrogen oxides	0.96	1.51	3.84	6.04
Sulfur dioxide	--	3.3×10^{-3}	--	0.01
Volatile organic compounds	23.3	21.1	93.0	84.4

Pollutant	Process Building 1 – 5 MTU potential emissions (tons per year)		Process Building 2 – 20 MTU potential emissions (tons per year)	
	Uncontrolled	Controlled	Uncontrolled	Controlled
Hazardous Air Pollutants (HAPs)				
Benzene	0.22	4.4×10^{-3}	0.88	0.02
Ethylene	0.11	2.1×10^{-3}	0.42	8.4×10^{-3}
Formaldehyde	4.2×10^{-4}	4.2×10^{-4}	1.7×10^{-3}	1.7×10^{-3}
Hydrogen chloride	0.53	0.53	2.12	2.12
Methanol	0.08	0.08	0.31	0.31
Propylene	0.48	0.26	1.92	1.03
Toluene	0.35	7.1×10^{-3}	1.42	0.03
Total HAPs	**1.77**	**0.87**	**7.07**	**3.51**
Greenhouse Gases				
Carbon dioxide	709.5	708.9	2,838	2,836
Methane	1.14	0.013	4.57	0.052
Carbon dioxide equivalent	738	709.2	2,952	2,837

3.3.3.1.3 Decommissioning

Decommissioning of the FFF would be expected to take 2 years. Plans can be found in section 2. The decommissioning process includes removing and decontaminating the used process equipment and materials. Traffic and equipment movement during removal has the potential to generate transient fugitive dust, and overall impacts would be similar to the construction phase. Emissions may impact air quality for short periods of time with overall impacts likely to be SMALL. Best management practices would be used for prevention of airborne particulate matter described in section 3.3.3.1.2 and impacts would be considered SMALL.

3.3.3.2 Greenhouse Gas and Climate Change Impacts

Climate change effects are considered the result of overall GHG emissions from numerous sources rather than an individual source. There is not a strong cause-and-effect relationship between where the GHGs are emitted and where the impacts occur. Because of these two factors, the Nuclear Regulatory Commission (NRC) staff addressed the contribution of GHGs from the proposed FFF to the overall atmospheric GHGs levels and the relevant climate change effects in section 3.14, which discusses reasonably foreseeable cumulative air quality effects, rather than in this section, which addresses the air quality effects specifically attributed to the proposed FFF.

3.3.4 Mitigation

As noted above, TRISO-X would employ several measures to mitigate potential impacts to air quality during construction including dust suppression, soil containment both on-site and during transport by trucks, clean-up and stabilization of exposed soils to prevent migration to off-site areas and adjacent roads, and proper maintenance of vehicle and equipment engines. These same measures would also apply to decommissioning.

During operations, TRISO-X would use specially designed ventilation systems and high-efficiency particulate-absorbing (HEPA) filters to limit air emissions to ensure compliance with all applicable laws and regulations.

3.4 Geology and Soils

3.4.1 Affected Environment—Geology

Descriptions of the physiography, geology, hydrogeology, soils, and seismology for the Horizon Center site (HCS), where the fuel fabrication facility (FFF) is proposed to be sited, are presented in this section. The descriptions provide information at both regional and local or site-specific levels of detail. Unless noted otherwise, the information presented in this section originates from the TRISO-X, LLC (TRISO-X) environmental report (ER; TRISO-X, 2025b).

3.4.1.1 Regional Geology

The information presented in this section is intended to establish the regional geologic framework for a detailed study of the subject site. Additional details and assessments of site-specific physiography, geology, groundwater, and karst conditions are found in subsequent sections of this document.

3.4.1.1.1 Physiography

Five physiographic provinces were identified within a 100-mile radius of the HCS (TRISO-X, 2025b): the Interior Low Plateaus province, the Appalachian Plateaus province, the Valley and Ridge province, the Blue Ridge province, and the Piedmont province. The HCS is located within the Valley and Ridge physiographic province, near the Appalachian Plateaus physiographic province to the northwest. TRISO-X (2025) provides detailed descriptions of the formation and characteristics of the regional physiographic provinces and their stratigraphy.

3.4.1.1.2 Hydrogeology

The hydrogeologic units assigned to the regional stratigraphy are detailed in the ER (TRISO-X, 2025b). Formations that are considered capable of transmitting large quantities of groundwater are classified as aquifers, while formations considered to have a relatively limited capacity for groundwater transmission are classified as aquitards. One aquifer bounded by an upper and lower aquitard has been characterized in the regional stratigraphy. Figure 3.4.1-1 from the TRISO-X ER provides a general cross section that illustrates the hydrogeology of the HCS and its vicinity (TRISO-X, 2025b).

The upper aquitard consists of the Mississippian/Devonian Formations plus the Sequatchie Formation and Reedsville Shale from the Upper Ordovician. The lower aquitard consists of Conasauga Group Formations; it is defined by the Nolichucky Shale at the top and the Rome Formation at the bottom. The aquifer consists of the formations in Ordovician-aged Chickamauga Supergroup, the Knox Group, and the Maynardsville Limestone from the Upper Cambrian-aged Conasauga Group. Most of the geologic units in the aquifer are carbonate in composition and are described as limestones or dolomites. As noted on figure 3.4.1-1, the HCS is underlain by the Chickamauga and Knox Group carbonate rocks of the regional aquifer (TRISO-X, 2025b). The presence of carbonate rock suggests the potential for karst conditions.

3.4.1.1.3 Karst Conditions

Karst is a unique hydrogeologic feature in which the surface water and groundwater regimes are highly interconnected and often constitute a single, dynamic flow system. The presence of karst usually is indicated by the occurrence of distinctive physiographic features that develop as a result of the dissolution of soluble bedrock, such as limestone or dolostone. In well-developed karst, these physiographic features may include sinkholes, sinking (or disappearing) streams, caves, and karst springs. The presence of karst is also generally associated with distinctive hydrologic characteristics (Taylor and Green, 2008, as cited in TRISO-X, 2025b):

- Internal drainage of surface runoff through sinkholes;
- Underground diversion or partial subsurface piracy of surface streams (that is, sinking streams and losing streams);
- Temporary storage of groundwater within a shallow, perched epikarst zone;
- Rapid, turbulent flow through subsurface pipelike or channel-like solutional openings called conduits; and
- Discharge of subsurface water from conduits by way of one or more large perennial springs.

The potential for karst conditions in Tennessee is closely associated with both carbonate rocks and the Valley and Ridge physiographic province. The *Tennessee Permanent Stormwater Management Manual* (Tennessee Department of Environment and Conservation [TDEC], 2014) describes karst geology as “a unique type of landscape that is formed by the dissolution of rocks, such as limestone and dolomite. Karst areas have aquifers and a high potential to contain large preferential pathways in soil overburden that are directly connected with the groundwater.” The causative relationship between stormwater intrusion and sinkhole development is also summarized by the TDEC manual (2014).

According to the U.S. Geological Survey (USGS) (2008), the region containing the HCS may contain carbonate rocks that can develop karst features over time (karstification). These folded and faulted carbonate rocks are Paleozoic in age and are subject to dissolution that may produce a range of karst features including solution voids, collapse, cover-collapse sinkholes, and caves (USGS, 2021a).

Based on the regional information discussed above, karst conditions may be present at the HCS because the site is in the Valley and Ridge physiographic province and is underlain by carbonate rocks that are part of a regional aquifer. An evaluation of karst was performed as part of TRISO-X’s site assessment.

3.4.1.2 Site Geology

3.4.1.2.1 Site Physiography

The area of the HCS is located within the Valley and Ridge physiographic province, as discussed in section 3.4.1.1.2. Several ridges, oriented northeast to southwest, form the undulating topography associated with the HCS. The general topography of the area is illustrated on figure 3.3.3-2 in the TRISO-X ER. The HCS is situated on a terrace within the valley of East Fork Poplar Creek (EFPC) and consists of undulating terrain. Black Oak Ridge is located immediately to the northwest of the site. The Poplar Creek Valley is the next valley north and parallels Black Oak Ridge. East Fork Ridge is located to the south and east of the HCS and is interrupted by Bear Creek Valley and Tennessee State Route 95 (TN 95). Pine Ridge is located south and east of East Fork Ridge.

A topographic map of the HCS and its vicinity was generated from USGS 1:24000 quadrangle map data and is depicted in the TRISO-X ER (TRISO-X, 2025b). Land surface elevations range from about 840 feet to 780 feet (256 to 238 meters [m]) across the proposed FFF. Ground elevation is highest along the northwestern boundary of the proposed HCS, near the side slopes of Black Oak Ridge, and slopes gently to the southeast and southwest. In the southern portion of the site, land surfaces slope eastward toward Renovare Boulevard and EFPC. For most of the northern portion of the site, land surfaces slope toward a broad, flat vegetated karst swale with an unnamed drainage feature that originates on the side slopes of Black Oak Ridge. The vegetated swale crosses the middle of the site and then slopes toward a closed depression (sinkhole) located directly west of the HCS.

Field inspections found that the broad swale drainage feature lacks a defined channel structure. In a karst environment, swales with these characteristics are defined as karst swales. Further, the drainage feature could also be a disappearing stream, given the lack of drainage channel structure and the karst setting.

North of the HCS, the land slopes to an unnamed intermittent drainage feature that parallels the northern boundary of the HCS. These drainage features also originate on the side slopes of Black Oak Ridge and slope eastward to EFPC.

Two other intermittent drainage features (four total) are present offsite but in the vicinity of the HCS. These drainage features also originate on the side slopes of Black Oak Ridge and slope eastward to EFPC.

3.4.1.2.2 Site Stratigraphy

Figure 3.3.3-1 from the TRISO-X ER shows a geologic map of the HCS and its vicinity. The site is underlain by geologic units from the Knox Group (Kingsport Formation, Mascot Dolomite) and the Chickamauga Supergroup (Pond Springs Formation, Murfreesboro Limestone, Ridley Limestone, and Lebanon Limestone), with the units progressing age-wise in a northwest-southeast direction across the site from oldest (Knox Group) to youngest (Chickamauga Supergroup). The geologic units strike to the northeast-southwest and dip to the southeast, which is consistent with the physiography of the Valley and Ridge physiographic province. Each of the formations (as mapped) is oriented northeast to southwest and dips 30 degrees to 38 degrees southeast, consistent with the regional structural trends. Of the five dolomitic-dominated formations associated with the Knox Group, the Kingsport Formation and Mascot Dolomite have been mapped across the northwest half of the HCS, with the Mascot Dolomite most dominant. Of the seven limestone-dominated formations associated with the Chickamauga Supergroup, only four have been mapped within the HCS. The Pond Springs Formation is the most dominant, with the largest distribution across the site. To a lesser extent, the Murfreesboro/Pierce, Lebanon, and Ridley Limestones are also present near the surface, with possible exposure aligned along the southeast side of the HCS (TRISO-X, 2025b).

Formations likely to be present as consolidated bedrock and/or associated residuum soils beneath the HCS are, by increasing depth, the Lebanon, Ridley, Murfreesboro/Pierce, and Pond Springs Formations and the Mascot Dolomite and Kingsport Formations. The characteristics of these formations are detailed and shown on figure 3.3.3-1 of the TRISO-X ER.

The Mascot Dolomite underlain by the Kingsport Formation dominates the northwest half of the site. The overlying limestones, present in the southeastern half of the site, include the Pond Springs (deepest, overlying unconformably the Mascot as an unconformity), Murfreesboro/Pierce, Ridley, and Lebanon (progressively shallower) Formations (Lemiszki, 2000, 2015).

3.4.1.2.3 Site Subsurface Conditions

Section 3.3.3.2 of the TRISO-X ER describes work performed onsite to characterize the subsurface conditions at the HCS.

The understanding of geologic conditions at the HCS is based upon subsurface investigation activities that included geophysical survey, drilling/soil boring and subsequent installation of groundwater monitoring wells as part of the hydrologic investigation and a separate drilling program consisting of geotechnical borings to support facility design. The groundwater well installation program and geotechnical characterization program provided information to characterize the geology directly beneath the HCS. Locations of geotechnical borings and the monitoring wells initially installed at the site are illustrated on figure 3.3.3-3 of the TRISO-X ER. Figure 3.3.3-4 of the TRISO-X ER provides a representative “fence” diagram cross-section view of the underlying lithology. Findings from the TRISO-X ER are summarized below (TRISO-X, 2025b).

Drilling logs from the groundwater monitoring wells (GW-1, GW-1R, GW-2, GW-3, and GW-4) depict a heterogeneous residuum beneath the HCS. Wells were drilled using sonic methods to collect continuous core. In general, the upper stratum encountered at these well locations consists of a moderately thick to thick residuum ranging from 13.5 feet (4.1 m) below ground surface (bgs) to 50 feet (15.2 m) bgs. The residuum is composed of slightly silty clays and lean clays with varying amounts (5 percent to 30 percent) of fine to coarse chert and dolomitic fragments from 0 foot to 36 feet (0–11.0 m) bgs that typically overlay a silt stratum of varying thickness and at varying depths from 5 feet (1.5 m) to 25 feet (7.6 m) bgs. At well locations GW-1, GW-1R, and GW-3, overburden and bedrock encountered appear to be representative of residual soils, weathered to moderately weathered dolomite, associated with the Knox Group, likely the Mascot Dolomite. In contrast, geotechnical subsurface exploration included the advancement of 36 geotechnical test borings (B-1 to B-36) (figure 3.3.3-3 in the TRISO-X ER) at predetermined locations across the site. Exploration included extending the borings to either refusal, target rock core lengths, or target depths of 30 feet (9.1 m) or 100 feet (30.5 m). Seven of the borings (B-01, B-02, B-03, B-05, B-07, B-09, and B-10) were extended through the overburden into the bedrock using diamond core barrel drilling wireline drilling methods. Samples were recovered using Shelby tubes at prescribed intervals within cohesive soils. A field geologist provided oversight and onsite documentation of the exploration and characterization of the soil samples with respect to material type and consistency, and the bedrock core was logged at these seven locations for lithology, weathering, and physical weaknesses. Selected soil samples were retained for analysis by geotechnical laboratories in conjunction with facility engineering.

Based on the geotechnical borings conducted within the proposed footprint of the HCS, overburden consisting of residual soils was encountered in each boring at depths ranging from about 3.6 feet (1.1 m) to 31.5 feet (9.6 m) bgs.

Voids caused by dissolution of carbonate rocks and deep weathering along prevailing fractures and strike-oriented bedding can form conduits within the dolomite and limestone. Multiple voids were encountered during the geotechnical drilling program. Voids (open and/or clay-filled) ranged from as thin as 0.2 feet (0.1 m) to as thick as 4.1 feet (1.2 m) within the seven borings that penetrated and cored rock (B-01, B-02, B-03, B-05, B-07, B-09, and B-10). Fifteen of the 21 voids encountered occurred within the upper 25 feet (7.6 m) bgs. These voids were found within limestone, limestone interbedded with shale, and dolomite. The majority of these voids were filled with stiff clay.

Geotechnical boring B-01 penetrated the greatest number of voids (11). Six of these voids were encountered at depths up to 36 feet (11.0 m) within the overlying limestone. The remaining five were encountered much deeper, within the underlying dolomite, beginning at approximately 82.2 feet (25 m) bgs, with the largest estimated to be a 2.6-foot (0.8-m) vertical opening and the other four much smaller, forming openings of 0.2 to 0.5 foot (0.06 to 0.15 m). The largest void at B-01 (82.2 feet bgs) was encountered 25 feet (7.6 m) below the transition from limestone to dolomite.

The largest void among all the borings, estimated at 4.1 feet (1.2 m) thick in the vertical, was encountered in relatively shallow limestone at 9.4 feet (2.9 m) bgs in boring B-09. This large void was found beneath a shallower void (1.5 feet [0.5 m], vertical) encountered in the same boring at 6 feet (1.8 m) bgs.

A surface geophysical investigation conducted at the HCS identified the potential for the presence of voids not encountered in the geotechnical subsurface exploration. To further characterize the subsurface conditions, an additional six borings were advanced at predetermined locations representing the area where the FFF buildings (including the process buildings) would be in the HCS. Voids within the limestone bedrock were encountered during the supplemental geotechnical drilling program. Voids ranged from as thin as 0.1 foot (0.03 m) to as thick as 4.7 feet (1.4 m) within four of the six borings. Occurrence of voids was limited to the upper 45 feet (13.8 m) bgs. These voids were found within limestone and limestone interbedded with shale. No large voids were encountered around the target depths of anomalies reported in the surface geophysical investigation.

3.4.1.2.4 Site Karst Conditions

Based on the information presented in the TRISO-X ER and collected for this environmental impact statement (EIS), karst conditions are present at the HCS and its vicinity. As noted, regional and site stratigraphy find that the site area is underlain by carbonate rock. Presence of karst conditions is indicated by the carbonate rock stratigraphy and physiographic province in Tennessee. A review of USGS topographic mapping identified karst terrain features both onsite and in the immediate vicinity of the HCS. A large sinkhole feature is mapped adjacent to the western boundary of the HCS. Further, a karst swale and potential disappearing stream were noted crossing the site in the area upslope from the sinkhole.

Karst features previously reported on lands adjacent to the HCS have included springs and sinkholes of various sizes (U.S. Department of Energy [DOE], 2013). Based on the topography of the HCS, several shallow draws and depressions exist, which may reveal karst features beneath the surface. One such feature is represented by a possible sinking stream within the western portion of the HCS that has been mapped by the USGS as an intermittent stream but was not identified during the onsite delineation of surface waters on the HCS conducted by TRISO-X (see section 3.5.1.4). Subsurface karst features were identified by the drilling program summarized in the TRISO-X ER and as described in section 3.4.1.2.3.

3.4.1.2.5 Faults in the Site Vicinity

The following discussion of geologic faulting in the vicinity of the HCS is based on information in section 3.3.3.3 of the TRISO-X ER. Figure 3.3.3-5 in the TRISO-X ER provides a representative cross-sectional view of the faults in the vicinity of the HCS.

The Whiteoak Mountain Fault is the predominant fault within the HCS's vicinity. This fault is a thrust fault located just to the southeast of the HCS, along the north side of Pine Ridge (see figure 3.3.3-1 of the TRISO-X ER). The geologic structure of the Valley and Ridge physiographic province is characterized by numerous elongate folds and thrust faults that trend northeast-southwest. In the southern section of the province, the faults, and in most places the bedding, dip southeast. These orientations are the result of folding and fracturing during a mountain building episode 230 to 260 million years ago. However, no evidence exists that any of the thrust faults in the Valley and Ridge physiographic province are active faults still undergoing movement. Geologic evidence indicates that the final episode of movement occurred during the Pennsylvanian or Permian periods or at least 230 million years ago (Tennessee Valley Authority [TVA], 2009).

3.4.1.2.6 Seismicity of the Site Vicinity

The HCS is in the East Tennessee Seismic Zone (ETSZ), a geographic zone with increased seismic activity that lies (approximately) between northeast Alabama and southwest Virginia. The ETSZ is illustrated on the USGS Seismic-Hazard Maps for the Conterminous United States (Peterson et al., 2014). Information about the ETSZ and related seismic information are presented in section 3.5.5 of the TRISO-X ER and summarized below.

The ETSZ is the second-most active zone in the eastern United States in terms of small magnitude (M<5) seismicity, second in frequency to the New Madrid Seismic Zone. Activity in the ETSZ has remained high for several decades; however, there have only been a few events with magnitudes as large as M 4.6 (Hatcher et al., 2012). Generally, earthquakes in the ETSZ produce minor or no damage: the largest observed earthquakes have produced only minor damage to buildings, typically chimney collapse, cracks in plaster, and broken windows, consistent with intensity VI on the Modified Mercalli Intensity (MMI) scale (Stover and Coffman, 1993).[5] The USGS "Did You Feel It?" website (USGS, 2021b) collects and compiles individual observations of macroseismic effects from earthquakes as reported by citizens in the aftermath of an earthquake. A map of cumulative responses in the United States from 1991 to 2017 shows that in eastern Tennessee the observed intensities ranged from II to V MMI. Figure 3.3.5-1 of the TRISO-X ER identifies recent seismic events within the ETSZ between 2000 and 2021 (TRISO-X, 2025b).

3.4.2 Environmental Impacts—Geology

3.4.2.1 Construction

Construction of the proposed FFF would involve construction of foundations into the largely residual soils formed from the in-place weathering of the underlying bedrock as described in the

[5] An earthquake's magnitude characterizes the relative size of the earthquake. Magnitude is based on measurement of the maximum motion recorded by a seismograph. A commonly used scale to measure magnitude is the Richter scale. An earthquake's intensity is a non-mathematical scale based on the observed or perceived effects of an earthquake at a specific location (USGS, 2023a).

TRISO-X ER. Local hazards are those associated with site-specific properties of the soil and bedrock. Subsurface materials encountered during construction are expected to consist predominantly of unconsolidated materials including fill, residual soils, and dolomite bedrock. Additionally, as summarized in section 3.4.1.2, surficial and subsurficial karst features have been identified on the HCS and its vicinity. Without erosion and sediment controls during construction, sediment-laden runoff could enter nearby karst features and deposit sediment within subsurface voids, impact groundwater quality, and/or enter nearby waterways and adversely affect surface water quality.

Impacts on surface and groundwater quality are assessed in section 3.5. In short, TRISO-X designed a stormwater management system, including onsite stormwater detention basins, that would be required to follow TDEC stormwater regulations and the City of Oak Ridge's Stormwater Management Ordinance (City of Oak Ridge, 2016; TDEC, 2014). TRISO-X has obtained a TDEC National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit (TNR136931) and will comply with the permit conditions and requirements during construction. With proper geotechnical investigation and use of engineering designs and construction techniques to account for karst features, the impacts to geology during construction are considered to be SMALL.

3.4.2.2 Operation

The NRC staff identified potential impacts associated with the karst environment that could occur during the operational phase of the FFF. These potential impacts include increased sinkhole activity/sinkhole formation and water quality, and quantity impacts to karst features in the FFF area. Stormwater management practices that contribute to increased infiltration (such as the onsite stormwater detention basins) could accelerate carbonate rock dissolution and promote sinkhole development beneath the FFF. Onsite sinkhole development could disrupt stormwater management and trigger the need for sinkhole mitigation measures. Additionally, placement of foundation materials into the karst voids has the potential to alter groundwater flow patterns, leading to increased groundwater flow and carbonate rock dissolution along alternate flow paths.

TRISO-X proposes to construct the stormwater detention basins with a high-density polyethylene liner on top of clay backfill to minimize infiltration. Additionally, geotechnical investigations of the HCS indicate more than 6 feet of soil would be present between the bottom of the detention basin and the top of rock. As noted in sections 3.4.2.1 and 3.5, TRISO-X would be required to follow TDEC stormwater regulations, the City of Oak Ridge's Stormwater Management Ordinance, and the permit conditions of the NPDES Construction Stormwater General Permit.

Potential changes to groundwater flow and associated changes in karst topography are discussed further in section 3.5. In short, if groundwater flow conditions were altered by stormwater practices or the foundations of the FFF, changes in karst topography could occur at an accelerated rate. However as noted in Section 3.4.1.1.3, the geologic processes for karstification/sinkhole development are known to be natural, ongoing geologic processes within the site's vicinity. As such, the development of new karst features could occur under natural or developed site conditions. Therefore, the potential impacts on the geology of the HCS due to stormwater management practices and the presence of the FFF foundations among the karst topography are considered to be SMALL.

3.4.2.3 Decommissioning

Decommissioning activities would be similar to and involve similar impacts to those described above for construction.

3.4.3 Mitigation—Geology

TRISO-X's proposed stormwater management design for facilities located in karst terrain would mitigate stormwater management concerns at the HCS. In addition, FFF operations would include a characterization of groundwater movement in the karst bedrock between the HCS and the associated springs and discharge points. To this end, the FFF stormwater management program would be designed as described in the *Tennessee Permanent Stormwater Manual*. In particular, the requirements and guidelines in Appendix B of the manual for Karst Terrain will be applied to the FFF. To further reduce impacts, the NRC staff recommend that TRISO-X develop a sinkhole mitigation plan that would detail the procedures TRISO-X would follow to minimize the impacts of a sinkhole collapse.

3.4.4 Soils

The soils data summarized herein for the HCS and its vicinity are originally presented in section 3.3.4 of the TRISO-X ER (TRISO-X, 2025b). For the purposes of this section, the soils information is limited to that provided by U.S. Department of Agriculture (USDA)/Natural Resources Conservation Service (NRCS) publications and/or databases. Other sections of this EIS contain soil data that have been generated for other purposes, such as geotechnical studies.

3.4.4.1 Affected Environment—Soils

The TRISO-X ER identified 36 soil map units digitally within a 3-mile radius of the HCS. However, current digital soils data are not available for approximately 54 percent of the area within the 3-mile radius due to the site's historical designation as federal property. Digital soils data are not provided for federal property (NRCS, 2022). Details of this digital search of soil maps can be found in the TRISO-X ER. The current NRCS Web Soil Survey shows that no soil data are available for the HCS and its immediate vicinity. Consequently, the 1942 Soil Survey for Roane County (Swann et al., 1942) was identified in the TRISO-X ER as being the best available soil data for the HCS and its vicinity. The site has not been developed previously so the soil characteristics are likely unchanged since the early survey.

Thus, soils data from the 1942 USDA Soil Survey for Roane County were used to review the mapped soils in the 151 acres encompassing the HCS. According to the survey, most of the site is mapped as Fullerton, Colbert, or Talbott soils, which are uplands soils derived from the residuum of either cherty dolomitic or clayey limestone. The mapped Fullerton cherty silt loam (Fc) occupies upland backslopes of rolling and hilly areas. Summary descriptions of the soil units are given in section 3.3.4.2 of the TRISO-X ER. A map of the soil units is shown on figure 2 of the FFF's stormwater pollution prevention plan (SWPPP).

3.4.4.2 Environmental Impacts—Soils

Up to approximately 110 acres would be disturbed during construction of the FFF. Construction activities would entail excavation and grading within the FFF footprint, according to TDEC request. If excavation depth exceeds more than a depth of two feet, TRISO-X may be required to pursue additional permits from DOE or the state.

Based on the preliminary grading analysis of the site, approximately 560,234 cubic yards (yd^3) of soil would be excavated to support construction activities. TRISO-X assumes this material would be unsuitable for backfill and would require disposal at an approved, existing offsite landfill location. The assumption that existing site soils would not be suitable for backfill means that construction of the FFF would require the transport of approximately 362,661 yd^3 of suitable, clean material from an existing permitted offsite borrow site. After construction is completed, TRISO-X would plant non-invasive herbaceous vegetation in areas that would not be permanently developed as part of the FFF.

TRISO-X would stockpile construction materials on level or only gently sloped lands to minimize erosion. Where slopes are steeper, TRISO-X would implement appropriate erosion control measures, such as berms, to minimize erosion. Other best management practices (BMPs) that TRISO-X would implement as erosion prevention and sediment controls include silt fences, straw bales, ditch check dams, and concrete washout containment.

The NRC staff anticipates that soil disturbance associated with construction would be confined to the HCS because TRISO-X has proposed BMPs to manage and minimize erosion. Therefore, impacts on soils would be SMALL.

During operation of the FFF, TRISO-X would adhere to a radiological environmental monitoring program (REMP) in compliance with NRC standards for protection against radiation (TRISO-X, 2024c, 2025b, 2026). As part of this program, TRISO-X would collect soil samples at the FFF for radiological analysis. Baseline samples would be collected when beginning operations and on a semi-annual basis during operation. Sample locations would be concentrated along the prevailing wind directions at the HCS and at the outfall of the west detention basin of the FFF stormwater management system. The monitoring program would allow TRISO-X to ensure radiological concentrations remain below regulatory limits at the HSC boundary and offsite.

After completion of construction activities, no further impacts on soils at the HCS are anticipated. TRISO-X would confirm successful revegetation of the non-developed portions of the HCS. As such, sediment erosion would be minimized and impacts on soils during operation would be expected to be SMALL.

TRISO-X would decontaminate and decommission the FFF in accordance with applicable NRC license termination requirements. TRISO-X would conduct soil testing to identify areas potentially contaminated by site activities. Any soils exhibiting elevated levels of constituents of concern would be excavated and removed or otherwise mitigated as appropriate in accordance with NRC and EPA guidelines. TRISO-X would conduct decontamination and decommissioning processes in a manner that would minimize soil erosion and compaction or alteration of onsite drainage patterns, to the extent practicable. Soils excavated and removed from the HCS would be transported to an appropriate licensed disposal facility. TRISO-X would replace the excavated contaminated soils with clean replacement fill and/or topsoil, as necessary to restore the original land use of the site.

Overall, impacts on shallow soils upon completion of the decontamination and decommissioning process would be SMALL.

3.4.4.3 Mitigation—Soils

TRISO-X anticipates construction of the FFF would require excavation, grading, and other land-disturbing activities across the 110-acre site. TRISO-X would dispose of excavated soils at an existing, approved offsite landfill. To minimize erosion, TRISO-X would stockpile excavated materials on level or gently sloped lands. Where slopes are steeper, TRISO-X would implement appropriate erosion control measures including berms, silt fences, straw bales, ditch check dams, geotextiles, riprap, and use of a sedimentation basin and storm drain inlet/outlet protection.

TRISO-X would decontaminate and decommission the FFF in accordance with applicable NRC license termination requirements. TRISO-X would conduct soil testing to identify areas contaminated by site activities and would excavate and remove any soils with elevated levels of constituents of concern or implement other mitigative measures as appropriate in accordance with NRC and EPA guidelines. TRISO-X would also conduct decontamination and decommissioning in a manner that would minimize soil erosion, compaction, or alteration of onsite drainage patterns, to the extent practicable. Soils excavated and removed from the HCS would be transported to an appropriate licensed disposal facility.

Other BMPs proposed by TRISO-X to minimize soils impacts include the following:

- TRISO-X would grade the temporary construction laydown/parking area as needed to decompact the soil and revegetate the area with non-invasive herbaceous plant species.
- TRISO-X would establish and implement an approved Decommissioning Plan for ultimate NRC release of the site for unrestricted use and license termination.

3.5 Water Resources

This section presents a description of water resources, including surface water, groundwater, floodplains, and wetlands within and in the vicinity of the Horizon Center site (HCS).

3.5.1 Affected Environment

3.5.1.1 Surface Water

3.5.1.1.1 Surface Water Features and Flow

The proposed fuel fabrication facility (FFF) lies within the East Fork Valley between two parallel ridges: Black Oak Ridge to the north and East Fork Ridge to the south (U.S. Geological Survey [USGS], 2019a; USGS, 2019b). There are several intermittent streams in the vicinity of the HCS that join an artificial waterway, the East Fork Poplar Creek (EFPC), just to the south of the HCS (USGS, 2023b). The HCS lies within the EFPC Hydrologic Unit Code (HUC) 12 subwatershed (HUC 060102070302) of the Tennessee Region drainage basin (USGS, 2023b). The drainage basin for EFPC near the southwestern end of the HCS is 20.38 square miles and includes a large portion of the city of Oak Ridge (TRISO-X, LLC [TRISO-X], 2025b). EFPC flows to Poplar Creek southwest of the HCS, where it joins the Clinch River approximately 2.7 miles from the HCS and ultimately the Tennessee River approximately 12 miles to southwest (USGS, 2023b). Figure 3.5-1 presents waterbodies within a 3-mile radius of the HCS, and figure 3.5-2 presents surface drainages near the HCS.

TRISO-X conducted a Tennessee Hydrologic Determination and investigation of Waters of the U.S. (WOTUS) at the HCS and the surrounding lands. The findings are presented in the *TRISO-X Facility Environmental Report Waters of the U.S. Delineation Technical Report – Horizon Center Site – Lot 6* prepared by Wood Environmental and Infrastructure Solutions, Inc. (Wood; 2022c). The investigation mapped and identified one ephemeral and two intermittent waterbodies to the northeast and just outside of the HCS as presented in figure 3.5-1 (Wood, 2022). There are several additional tributaries in the general vicinity of the HCS, including Gum Hollow Branch, Pinhook Branch, Bear Creek, Davidson Creek, Oxier Creek, and Webster Branch (USGS, 2023b). Data from the USGS National Map identified an additional intermittent stream entering the HCS from the north and then turning to the southwest and ending offsite at a bowl-like depression identified as a sinkhole in two U.S. Department of Energy (DOE) reports (DOE, 1996, 2003a). The onsite investigation of the potential waterbody within the HCS showed that it did not exhibit characteristics of a stream or a wet weather conveyance as defined by the State of Tennessee, such as the channel having a bed and bank, and instead was considered to be a vegetated swale and assumed not a WOTUS. U.S. Fish and Wildlife Service (FWS) National Wetlands Inventory (NWI)-mapped wetland and waterbody features are provided in figure 3.5-2 (FWS, 2023b). The WOTUS delineation technical report was submitted to the Tennessee Department of Environment and Conservation (TDEC) for a hydrological determination and the U.S. Army Corps of Engineers (USACE) for a jurisdictional determination. The TDEC concurred with the findings of the report (TDEC, 2022a). The USACE provided a preliminary jurisdictional determination on March 15, 2023, that concluded the HCS does not contain WOTUS (USACE, 2023a). The vegetated swale and potential karst features within and near the HCS are further discussed in section 3.4.

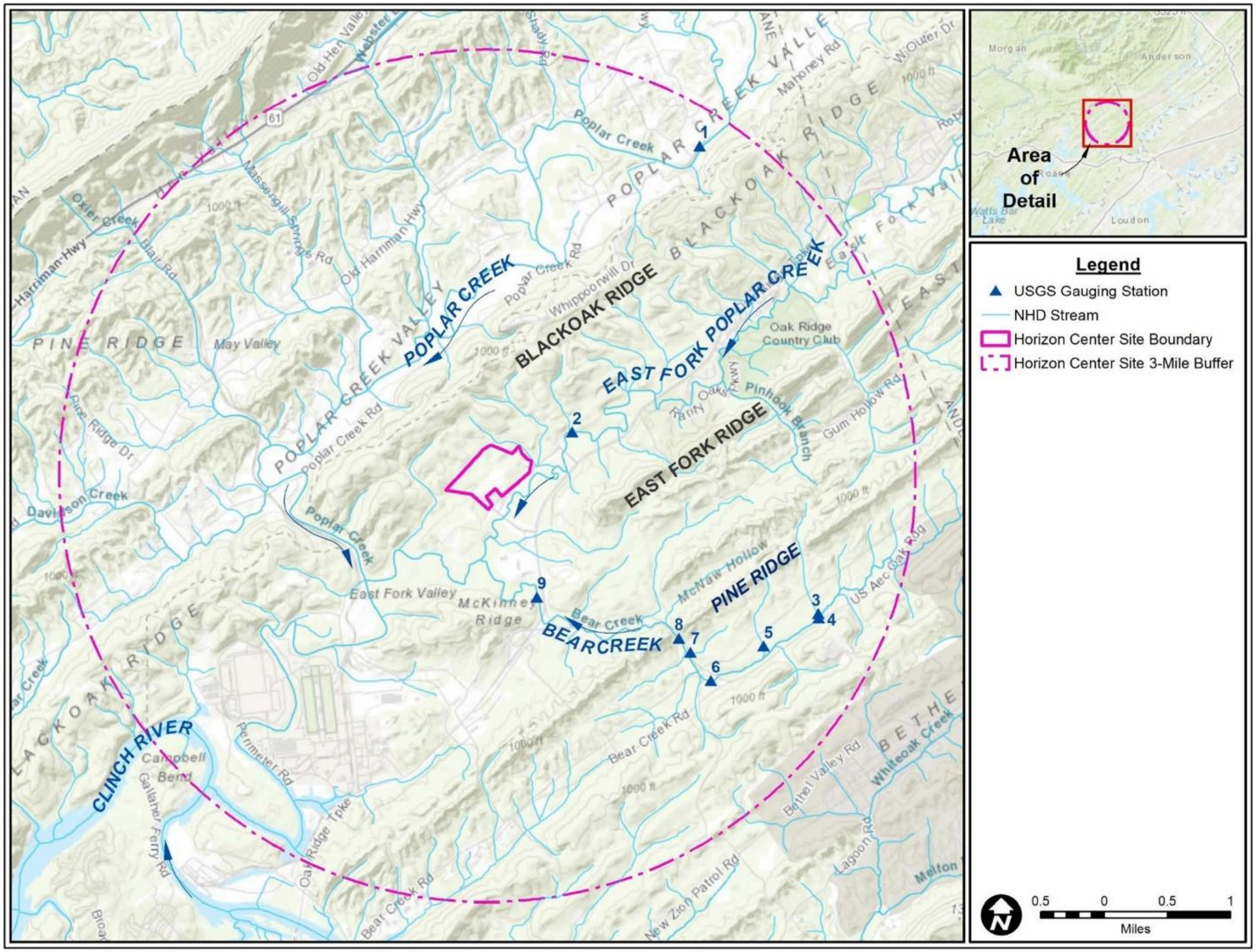


Figure 3.5-1 Surface drainages in the vicinity of the HCS (Source: TRISO-X, 2025b)

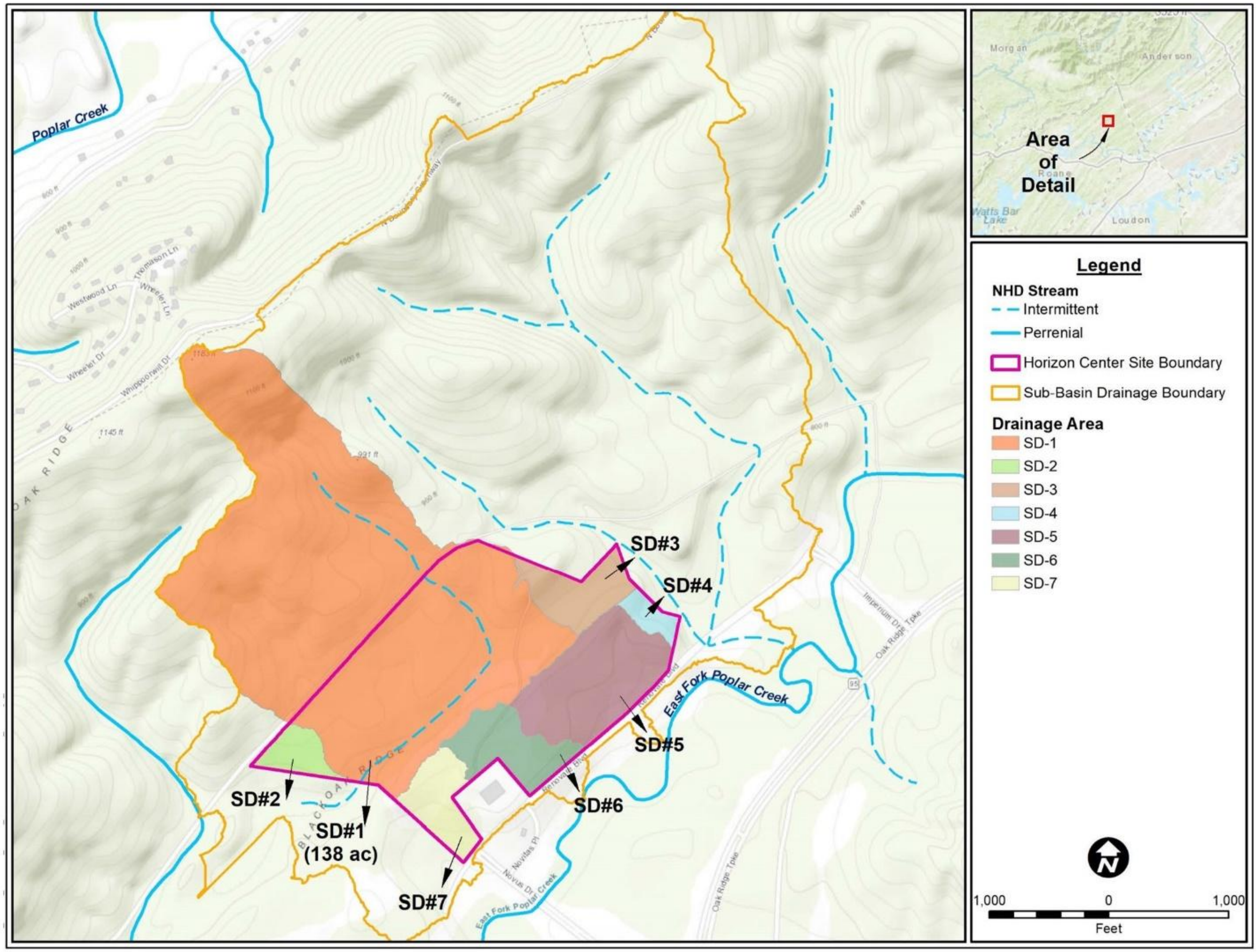


Figure 3.5-2 Surface drainages near the HCS (Source: TRISO-X, 2025b)

Surface water drains from the HCS, which also receives inputs from areas to the north including the south-facing slopes of Black Oak Ridge. Based on topographic maps of the area and TRISO-X's interpretation, there are seven locations where flow leaves the HCS as concentrated or potentially concentrated flow. The surface drainage (SD) areas are shown in figure 3.5-2. The majority of the drainage area discharge locations drain to the EFPC except for the SD#1 and SD#2 surface drainages, which drain to the karst depression southwest of the HCS (TRISO-X, 2025b).

3.5.1.1.2 Surface Water Use

The counties around the HCS use surface water as the primary source for water use. Water use data from 24 public water providers within the five counties around the HCS (Roane, Knox, Loudon, Anderson, and Morgan) provided a total public water supply of 91.99 million gallons per day (MGD), which accounts for 97 percent of water use in this region (USGS, 2022). The remaining 3 percent of water supply was obtained from groundwater sources. Of the 24 public water suppliers, the Kingston Tennessee River Water Plant and the Rockwood Water System are the only suppliers obtaining surface water from locations downstream of the HCS (Robinson, 2018). Both suppliers are in Roane County and, combined, typically withdraw an average of 4.9 MGD (City of Kingston, 2026; Rockwood Water, Sewer, & Gas, 2021). The Tennessee River, Clinch River, and Watts Bar Lake are managed by the Tennessee Valley Authority (TVA) dam and reservoir systems to meet state power, navigation, water supply, flood control, recreation, and water quality objectives (TVA, 2020).

Self-supplied industrial surface water use within the five counties surrounding the HCS totaled 8.73 MGD in 2015 (USGS, 2022); however, no self-supplied industrial surface water use was recorded for Roane County (USGS, 2022).

3.5.1.1.3 Surface Water Quality

There are no surface water features such as rivers, streams, lakes, or ponds within the HCS; therefore, surface water quality reviewed in this section is for surface water features in the vicinity of the HCS, including the EFPC and unnamed tributaries to the EFPC. To evaluate water quality in proximity to the proposed FFF, TRISO-X conducted sampling at seven locations east, south, and west of the HCS. However, during the sampling effort, two of the sampling locations east of the HCS were eliminated following the first sampling event due to changes in the proposed FFF design, and a third sampling location east of and immediately adjacent to the HCS was dry or the flow was too low to sample during three of the four sampling events. The remaining locations were sampled seasonally from summer 2021 through spring 2022. Results of the water quality sampling are provided in the TRISO-X environmental report (ER; TRISO-X, 2025b). The results indicated that the majority of sampled parameters were within the acceptable ranges of the TDEC standards for fish and aquatic life and the U.S. Environmental Protection Agency (EPA) national primary drinking water regulations relating to maximum contaminant levels for inorganic chemicals and radionuclides. However, fecal coliform and total coliform levels exceeded TDEC criteria, and alpha radiation particles exceeded the EPA national primary drinking water regulations in the fall of 2021 at a sampling location in the EFPC due south of the HCS. The previous summer and subsequent winter and spring results did not detect alpha radiation (TRISO-X, 2025b).

Additionally, the Oak Ridge Reservation's (ORR's) integrated monitoring and surveillance program monitors surface water quality of metals and inorganic compounds in the EFPC annually (TDEC, 2020). Monitoring in 2018 and 2019 found that uranium concentrations were over three times higher than the EPA maximum contaminant levels for drinking water at one EFPC monitoring location (TDEC, 2020; TRISO-X, 2025b). Historical contamination of the EFPC, including contamination with mercury and monomethyl mercury, is well documented, and 2018–2019 monitoring results indicated that four locations in the creek exceeded the 0.051-microgram-per-liter (µg/L) Tennessee recreation criteria. Additionally, nitrate, nitrite, and phosphorus concentrations also had exceedances and are of concern within the EFPC (TDEC, 2020).

Fish tissue sampling in the EFPC conducted by the DOE showed elevated mean total mercury concentrations and polychlorinated biphenyls (PCBs) in redbreast sunfish and rock bass well above the TDEC water quality criteria that triggers impairment and the water quality criteria for the Tennessee recreation designated-use classification for PCBs (DOE, 2020a).

Section 303(d) of the Clean Water Act authorizes the EPA to assist states in developing total maximum daily loads (TMDLs) and listing impaired waters. TMDLs establish a maximum amount of a pollutant allowed in a waterbody and are a planning tool and starting point for restoring water quality. The objective of TMDLs is to establish water quality objectives that will reduce pollution from point and nonpoint sources and that will improve or maintain water resources. The Clinch River watershed has been the subject of four TMDL studies completed for pathogens, siltation and habitat alteration, *Escherichia coli*, and PCBs and chlordane (TDEC, 2020). A 2006 study showed that the EFPC averages a sediment load of 567 pounds per acre per year (lb/ac/yr) as compared to the target sediment load of 279 lb/ac/yr (TDEC, 2006). A study from 2005 showed that fecal coliform exceeded TDEC criteria, and 21 miles of the EFPC were listed as an impaired water (TDEC, 2005). The high levels of fecal coliform were determined to result from a collection system failure of the City of Oak Ridge sewage treatment plant, and 21 miles of the EFPC were also listed as impaired in 2008–2013 water quality monitoring (TDEC, 2017).

In 2015, the TDEC developed the *Draft Tennessee Nutrient Reduction Framework,* intended to guide permitting and implement nutrient reduction strategies for the Lower Clinch River watershed and associated lakes (TDEC, 2015).

3.5.1.2 Groundwater

This section describes the groundwater conditions, use, and quality at the HCS. The USGS defines groundwater as “water that exists underground in saturated zones beneath the land surface” (USGS, 2023c).

The HCS is in the Valley and Ridge physiographic province, which includes the Chickamauga Group, the Knox Group, and Conasauga Group primary aquifers. The aquifers of the Valley and Ridge physiographic province are typically overlain by aquitards including the Fort Payne Formation, Chattanooga Shale, Rockwood Formation, Sequatchie Formation, and Reedsville Shale and are underlain by the Nolichucky Shale, Dismal Gap Formation, Rogersville Shale, Friendship Formation, Pumpkin Valley Shale, and Rome Formation (Lloyd and Lyke, 1995). These geologic units are discussed further in section 3.4. Generally, groundwater movement in this area is associated with local flow systems that occur in the valleys between ridges and along stream networks with most groundwater movement taking place within 300 feet of the ground surface (Lloyd and Lyke, 1995).

Groundwater flow in the vicinity of the HCS was determined by TRISO-X’s interpretation of groundwater collected from wells and geologic bores excavated for the proposed action.

Groundwater flow generally enters the site from the north and flows south-southeast across the HCS. TRISO-X studies of groundwater wells in 2021 and 2022 indicate groundwater flows from the HCS intersect the EFPC (TRISO-X, 2025b).

3.5.1.2.1 Groundwater Use

The majority of groundwater use in the vicinity of the HCS is for irrigation and agricultural production. This section discusses both regional and local groundwater use as related to the HCS and its vicinity.

3.5.1.2.2 Regional Groundwater Use

In eastern Tennessee, withdrawals of fresh groundwater from Valley and Ridge physiographic province aquifers in 1985 were approximately 82 MGD. Groundwater from these aquifers accounted for approximately 16 percent of the total groundwater withdrawn in the State of Tennessee in 1985 (Lloyd and Lyke, 1995).

The EPA designates aquifers that supply 50 percent of the drinking water for their service area and where there are no reasonably available alternative drinking water sources if the aquifer were to become contaminated as sole source aquifers. A review of the EPA Sole Source Aquifer Program interactive map showed that there are no sole source aquifers underlying the HCS (EPA, 2023c).

The HCS is approximately 6.6 miles southwest of Oak Ridge, Tennessee. Historical operations at the ORR have caused contamination of surface water and sediment outside of the ORR property boundaries. Groundwater monitoring has shown that low levels of contamination have migrated to and across the Clinch River, offsite of the ORR. The EPA is investigating the potential for offsite groundwater contamination as part of ORR cleanup activities (EPA, 2021a).

3.5.1.2.3 Local Groundwater Use

TRISO-X has developed a well screening report using several database sources including TDEC (TDEC, 2022b), the Oak Ridge Environmental Information System (OREIS), and the National Water Quality Monitoring Council's portal service for public access to federal agencies (including USGS databases) (TRISO-X, 2025b; USGS, 2022). The area evaluated included a 3-mile radius around the HCS. Figure 3.5-3 shows the area evaluated and the groundwater wells identified in the area.

In total, 37 groundwater use wells were identified in the TDEC database within 3 miles of the HCS and include 34 residential, one farming use, and two wells with unknown use. Municipal groundwater supply wells are considered confidential under Tennessee Code Annotated 10-5-504(a)(21)(A) and Tennessee Compilation Rules and Regulations 0400-01-01-.01(4)(c); however, TDEC has indicated that no public supply wells exist in the vicinity of the HCS (TDEC, 2022c). A small portion of a public supply wellhead protection area is within the 3-mile radius that was evaluated in the well screening report; however, the wellhead protection area is currently listed as inactive.

The OREIS and USGS databases identified 952 groundwater monitoring and observation wells occurring within the 3-mile radius evaluated. The wells are associated with nearby DOE and East Tennessee Technology Park (ETTP) facilities as well as parts of the general area defined as the ORR.

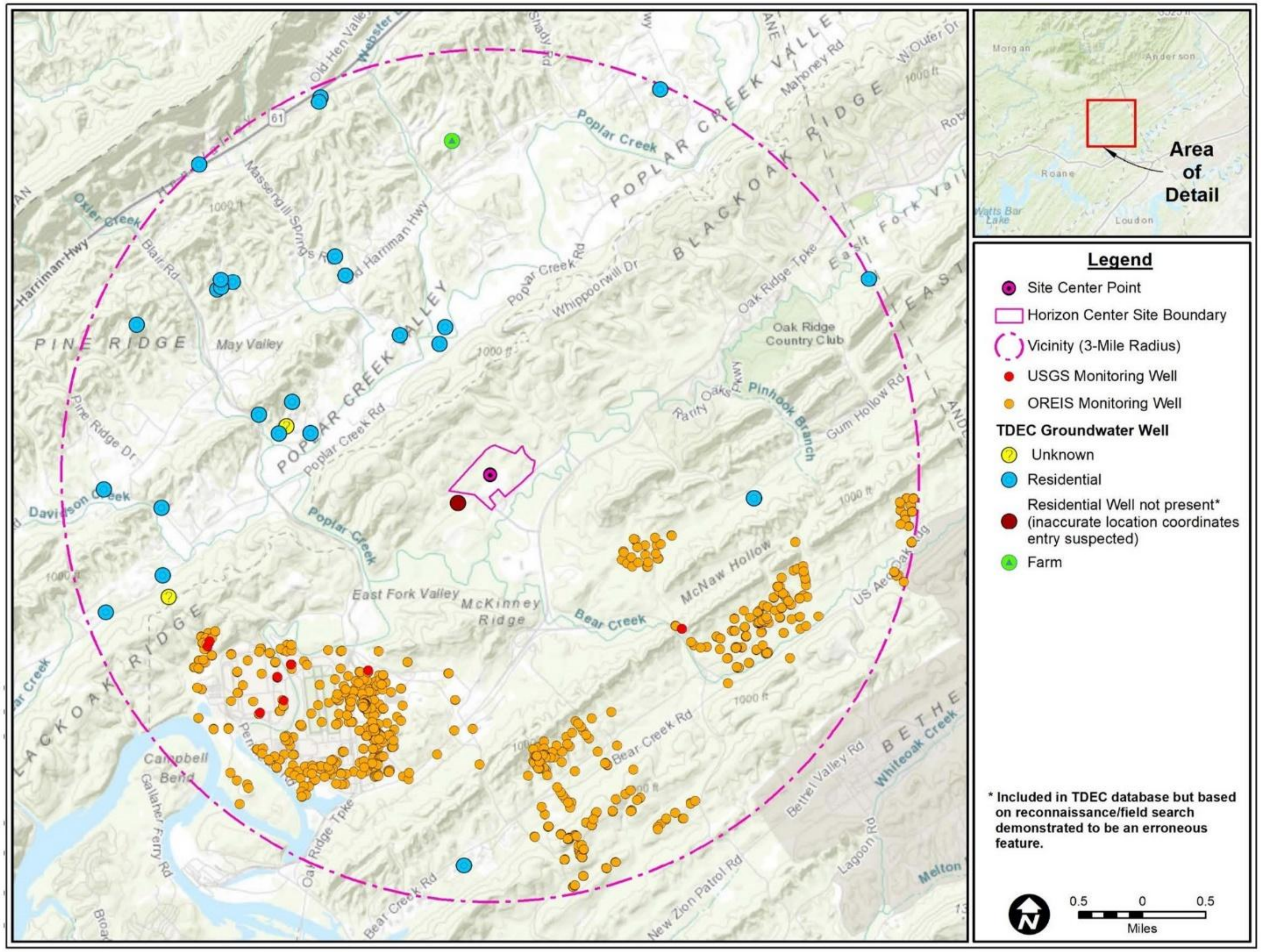


Figure 3.5-3 Groundwater wells evaluated in the vicinity of the HCS (Source: TRISO-X, 2025b)

3.5.1.2.4 Groundwater Quality

Groundwater quality refers to the chemical characteristics associated with water occurring under the ground. Groundwater can dissolve metals and minerals from the rocks that it is in contact with or can be contaminated by substances that are able to enter the groundwater system. This section describes the existing groundwater quality within the HCS.

Regional Groundwater Quality

In the Valley and Ridge province, aquifers have a water quality similar to shallow wells and springs. The typical amount of total dissolved solids concentration is 170 milligrams per liter or less and the water is hard, containing calcium-magnesium-bicarbonate. Groundwater that moves rapidly through the aquifer typically has lower concentrations while high concentrations are associated with groundwater that is moving more slowly, has long flow paths, or has generally been in contact with minerals for longer (Lloyd and Lyke, 1995).

Local Groundwater Quality

Groundwater at the HCS is characterized by data from monitoring wells that TRISO-X constructed in 2021. In total, four onsite wells, two offsite wells, and a subsequent seventh well that TRISO-X constructed in February 2022 were used by TRISO-X in conjunction with geotechnical borings to interpret groundwater conditions. Monitoring wells were completed within the upper bedrock and to depths of approximately 75 feet from ground surface. All but one well, which encountered limestone, are situated within dolomite bedrock. Karst features have been reported on properties adjacent to the HCS and include springs and sinkholes. The NWI-mapped intermittent stream, determined to be a vegetated swale during the onsite investigation, has the potential to be a karst feature and ultimately terminates at a depressional area southwest of the HCS that is considered to be a sinkhole. Additionally, voids were identified during drill logging of monitoring wells and geotechnical borings. Karst is discussed in more detail in section 3.4.

Groundwater levels obtained from the monitoring wells, interpreted groundwater flow, calculated groundwater average linear velocity, and analyses of hydraulic parameters including hydraulic conductivity and storativity are presented in the TRISO-X ER (TRISO-X, 2025b). Hydraulic conductivity is the measure of how easily water can pass through soil or rock. A high hydraulic conductivity indicates that water can pass easily through the material while a low value indicates a lower permeability. Storativity is a measure of the volume of water that would be discharged from an aquifer per unit area of the aquifer or how much water a unit of aquifer can hold. The average linear groundwater velocity, calculated based on the hydraulic conductivity and range of gradients divided by the effective porosity observed at the site, ranged from 0.004 feet per day to 3.12 feet per day. The results of the hydraulic conductivity and storativity analyses determined that the bedrock materials underlying the HCS have a low water yield and low to moderate hydraulic conductivity (TRISO-X, 2025b).

Groundwater quality at the HCS was determined through groundwater sampling conducted seasonally from the summer of 2021 through the spring of 2022. The overall sample analytical results indicated that the groundwater at the HCS is of good quality, with low total dissolved solids that ranged from 110 to 390 milligrams per liter. Trace metal concentrations and radioactivity were relatively low. Fecal coliform and total coliform results were elevated to levels that would indicate impaired groundwater. However, none of the groundwater analyses exceeded TDEC or EPA regulatory values. The monitoring results for all parameters and wells are provided in the TRISO-X ER (TRISO-X, 2025b).

3.5.1.3 Floodplains

Floodplains are generally flat areas of land next to rivers, streams, and creeks that flood during high-flow events. The Federal Emergency Management Agency (FEMA) is the official public source for flood hazard information and provides flood maps that identify flood zones and floodways throughout the United States.

According to FEMA Flood Insurance Rate Map (FIRM) panels 47129C0450C, 47145C0110F, 47105C0025D, and 47145C0130F, the entirety of the HCS is within Zone X, which is defined by FEMA as “areas determined to be outside of the 0.2 percent annual chance floodplain.” The 0.2-percent-annual-chance floodplain is also known as the 500-year floodplain. The closest mapped FEMA floodway is over 4,000 feet from the HCS (FEMA, 2023).

In addition to FEMA’s mapping, the TVA completed a floodplain study of areas along the EFPC in 1991. The study indicates the maximum 100-year flood elevation in the vicinity of the HCS is 764.9 feet mean sea level at Mile 2.94 (upstream from HCS) and 759.9 feet at Mile 2.14 (in the vicinity of the HCS). The lowest ground elevation at the HCS is approximately 760 feet (Leidos, 2020).

3.5.1.4 Wetlands

Wetlands are characterized as transitional areas between open water and dry land and are often found along bays, lakes, rivers, and streams. The USACE defines wetlands as “those areas that are inundated or saturated by surface or groundwater 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” (USACE, 2023b).

TRISO-X reviewed NWI maps of the HCS and subsequently conducted onsite wetland surveys at the HCS and surrounding areas in 2021 as described in the *TRISO-X Facility Environmental Report Waters of the U.S. Delineation Technical Report – Horizon Center Site – Lot 6* report prepared by Wood (2022c). NWI-mapped wetlands are not identified through onsite investigations. Rather, they are determined through reviews by the FWS of aerial imagery and other collateral data. As such, in comparison to the NWI map, wetlands (and waterbodies) may be present, absent, or occur outside of the areas identified during ground investigations. The NWI map encompassing the HCS and its vicinity shows an intermittent stream entering the HCS from the north and extending westward beyond the boundary of the HCS and a Palustrine Forested Broad-leaved Deciduous Temporarily Flooded (PFO1A) wetland south of the HCS surrounding the route of the EFPC and along and within the northeast border of the HCS. The onsite wetland surveys did not identify any wetlands or waterbodies within the HCS. The NWI-mapped intermittent stream aligns with the location of the vegetated swale discussed in sections 3.5.1.1 and 3.5.1.2. Wetland surveyors observed no indicators of wetland or stream features within the swale. Likewise, wetland surveyors determined the PFO1A wetland within the northeast boundary of the HCS on the NWI map was also not present. Surveyors only documented an intermittent stream beyond the HCS boundary; as such, and no wetlands or wetland features are present within the HCS (Wood, 2022c).

3.5.2 Environmental Impacts

3.5.2.1 Surface Water Impacts

Impacts on surface waters at the HCS may result from erosion runoff, spills and leaks of equipment fuels, lubricants and materials, and stormwater discharges. This section describes the potential impacts associated with the construction, operation, and decommissioning of the proposed FFF.

3.5.2.1.1 Construction

Construction of the FFF would involve clearing of vegetation, excavation, and grading to prepare the site for construction activities. The removal of vegetation and movement of soil creates the potential for sedimentation to occur at waterbodies, sinkholes, and wetlands in proximity to the HCS that would receive stormwater from the FFF. There are no wetlands, waterbodies, sinkholes, lakes, or ponds within the HCS and therefore direct effects on these resources are unlikely to occur. Nearby surface waters, sinkholes, and wetlands could also be impacted by fuel, lubricant, and construction material spills. Construction activities create the potential for sediment to enter the nearby sinkhole, which could affect associated subsurface karst voids and groundwater discharge points. Construction of the proposed FFF would also alter surface water flow in the HCS due to changes in grade and construction of the FFF stormwater management system.

All the SD areas shown in figure 3.5-2 would be affected by construction of the FFF. Construction would have the largest effects on SD areas 1, 5, and 6. Construction effects on SD locations 2, 3, 4, and 7 would be minimal, as they are smaller in area and are in the portions of the HCS that would be least affected by direct construction activities. SD area 1 encompasses almost half of the HCS and includes the vegetated swale that extends through the northwest portion of the HCS. Most of the FFF buildings would be constructed within SD area 1. Construction activities would include filling the swale and the rest of SD area 1 portion of the HCS as needed to raise the surface elevation to the final grade of the FFF. A drainage ditch spanning the approximate width of SD area 1 would be constructed to replicate the drainage functions of the vegetated swale and convey surface drainage through a stormwater detention basin and off the HCS at the SD1 location (refer to figures 3.5-2 and 3.5-3). Surface drainage through SD areas 5 and 6 would be disrupted by construction of the parking areas, temporary construction staging areas, and the main entrance roadway. Stormwater runoff during construction would be discharged through a temporary sediment basin constructed at the SD 5 location. Permanent detention basins would be constructed at the SD 5 and 6 locations for stormwater management during operation of the FFF (refer to figures 3.5-2 and 3.5-3).

TRISO-X would comply with TDEC regulations and the City of Oak Ridge's Stormwater Management Ordinance throughout the construction phase (City of Oak Ridge, 2016; TDEC, 2012; TDEC, 2014). To that end, TRISO-X has obtained coverage under TDEC National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit (TNR136931) prior to construction of the proposed FFF. As a component of permit compliance, TRISO-X has developed a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP outlines temporary and permanent stormwater management best management practices (BMPs) and construction erosion and sediment control (ESC) practices. When appropriate for petroleum storage and usage, Spill Prevention, Control, and Countermeasures (SPCC) plans are also required as part of permit compliance. The practices outlined in these documents include BMPs and procedures intended to prevent to the extent possible and mitigate potential impacts from erosion and spills or releases. The SWPPP would be updated and modified as required during construction to ensure construction meets the regulatory standards enacted by the TDEC, City of Oak Ridge, and requirements stated in the SWPPP and SPCC. An Underground Injection Control (UIC) Class V injection well permit is not required by the TDEC for stormwater that would flow to the offsite sinkhole, as stormwater would be discharged to the surface and not directly to the subsurface.

TRISO-X would implement mitigation measures to control erosion and sedimentation, has developed a SWPPP and would develop a SPCC plan, and would implement and update the prescribed BMPs during construction to address potential impacts from discharge of sediment or contaminants to surface water (Sargent and Lundy, 2022). TRISO-X would also obtain all necessary permits such as the NPDES construction Stormwater General Permit prior to starting construction. Therefore, impacts on surface water resources from construction of the FFF are anticipated to be SMALL.

3.5.2.1.2 Operation

The FFF would not discharge liquid process wastewater into its stormwater management system or into the Oak Ridge sewer system. During operation of the FFF, TRISO-X would adhere to a radiological environmental monitoring program (REMP) in compliance with NRC standards for protection against radiation (TRISO-X, 2024c, 2025b, 2026). As part of this program, TRISO-X would collect stormwater samples for radiological analysis. Samples would be collected on a quarterly basis from the forebays of the detention basins of the FFF stormwater management system. The monitoring program would allow TRISO-X to ensure radiological concentrations remain below regulatory limits at the HSC boundary and offsite.

There are no waterbodies located within the HCS. However, stormwater discharges during operation of the FFF could potentially affect surface waters offsite. Stormwater drainage from the HCS would be substantially altered once the FFF is constructed. TRISO-X would fill the vegetated swale, which conveys surface water flow of a majority of the HCS and the drainage area north of the HCS (i.e., SD area 1), and would convert much of the existing land to impervious pavement within the southern half of the HCS to build the FFF parking areas and roadways.

The stormwater management system at the FFF would be designed and operated in compliance with TDEC regulations and the City of Oak Ridge's Stormwater Management Ordinance, which includes specific requirements for stormwater management system design and operation in karst areas (Oak Ridge, 2016; TDEC, 2014). The FFF stormwater management system would consist of a series of drainage ditches that would convey stormwater runoff to three dry extended detention basin systems (figure 3.5-4). The detention basin structures would each consist of two parts, a forebay and a main detention basin. The drainage ditches would primarily be unlined (one of the ditch systems leading to the SD1 detention basin would be concrete lined) and the forebays would be unlined to allow for potential infiltration of stormwater prior to it reaching the main detention basins. The main detention basins would be lined to prevent infiltration. Stormwater would be conveyed to the forebays by the drainage ditches. Once the forebays are filled, stormwater would pass over a weir into the main detention basin. Once in the detention basin, the stormwater would be retained for 48 to 72 hours to allow suspended solids within the stormwater to settle. After this period, the stormwater would be released from the detention basin through an outlet structure leading off the HCS. Section 4.4.2 of the TRISO-X ER provides more specific details regarding the sizes and design of the forebays and detention basins (TRISO-X, 2025b).

The City of Oak Ridge Stormwater Management Ordinance requires stormwater management systems to provide a runoff reduction volume (RRV) as mitigation for increases in runoff that are associated with development. The RRV would be achieved through a combination of infiltration along the drainage ditches and within the forebays and extended detention in the main detention basins. Extended detention basins are defined by the EPA as stormwater storage basins that detain runoff for a minimum of 24 hours for suspended solids settling and peak flow reduction (EPA, 2021b). Modeling conducted by TRISO-X indicates the peak discharge rates for the 10-, 25-, 50- and 100-year and 24-hour storm events would be lower post-construction of the FFF and its stormwater management system than the existing conditions (TRISO-X, 2025b).

The runoff reduction criterion of the City of Oak Ridge Stormwater Management Ordinance 1-2016 requires there to be no discharge of runoff from the first one inch of rainfall at a developed site. TRISO-X modeling indicates the FFF would not fully meet this requirement. However, the ordinance allows developments that are unable to fully meet this criterion to satisfy the requirement by treating the difference in runoff volume by a BMP that is recognized to remove 80 percent of total suspended solids in the runoff (Oak Ridge, 2016). TRISO-X would achieve this secondary criterion through the extended detention of stormwater runoff in the detention basins, which is stated by TDEC to provide 80 percent reduction of total suspended solids (TDEC, 2014).

TDEC provides guidance for construction in karst areas where site stormwater discharge may reach a sinkhole. This guidance includes criteria stating there should be no increases in flow rates or ponding elevations in the sinkhole area. TRISO-X modeling of rainfall runoff and surface water flow for the 2- and 10-year 24-hour storm events indicate operation of the FFF would not result in increased flow rates or ponding elevations. TRISO-X's modeling indicates that the peak inflow to the sinkhole for 2- and 10-year 24-hour events would be reduced from 28.2 cubic feet per second (cfs) and 124.6 cfs to 6.18 cfs and 44.5 cfs, respectively. TRISO-X's modeling indicates the runoff volume to the sinkhole for 2-year, 24-hour event would be reduced from 5.88 acre-feet (ac-ft) to 5.72 ac-ft and the peak runoff volume to the sink hole for the 2-year and 10-year events would be reduced from 5.877 ac-ft and 15.015 ac-ft to 2.370 ac-ft and 11.455 ac-ft, respectively (TRISO-X, 2025b).

Although modeling indicates runoff at the FFF would occur at reduced rates as compared to current conditions at the HCS, the concentration of the surface water within the stormwater management system ditches and forebays and the resulting infiltration could cause localized transient water table rise, or mounding, in these areas. The extent of mounding that may occur would be influenced by the volume of runoff in the ditches and forebays and the characteristics of the unsaturated zone and level of the water table in these areas. TRISO-X would address this during final design of the FFF and the stormwater permitting process (TRISO-X, 2025b).

The FFF would not affect surface water use, as all water for the FFF for both potable and industrial use would be obtained from the City of Oak Ridge, and wastewater would be treated as required and discharged to the City of Oak Ridge municipal sanitary sewer collection system or collected, removed, and treated offsite. As described, stormwater from buildings, parking areas, and grounds would be drained to the stormwater detention basins that would be designed to store the runoff water volume generated by the first 1 inch of precipitation. Once this detention basin is at capacity, additional water could flow offsite to surface water features. Water associated with stormwater runoff would be expected to convey small amounts of oil, grease, and metal from parking areas and roads. Water runoff from facilities including electrical transformers, mechanical yards, and aboveground tank containment areas would be collected, treated, and disposed of separately from stormwater discharge. The process facility would incorporate internal containment measures that would limit the potential for chemicals stored at the facility to be released to soils, surface water, and groundwater (TRISO-X, 2025b). Therefore, impacts on surface water resources from operation of the FFF are anticipated to be SMALL.

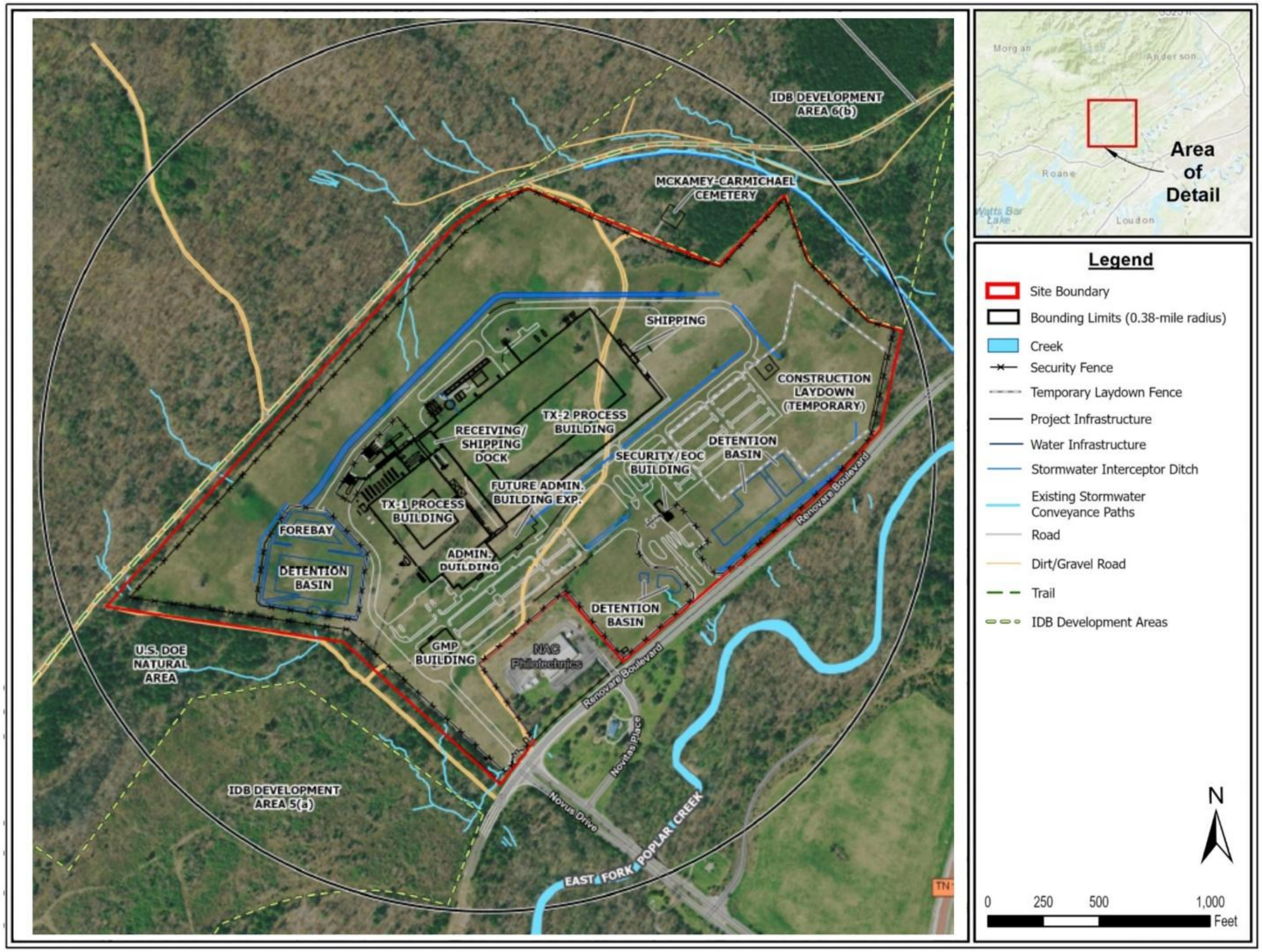


Figure 3.5-4 Fuel fabrication facility stormwater detention basins (Source: TRISO-X, 2025b)

3.5.2.1.3 Decommissioning

Decommissioning procedures would be expected to produce many of the same impacts as construction. TRISO-X would implement, where applicable, many of the same mitigation measures used during the construction phase and would develop and adhere to a decommissioning plan that is approved by the Nuclear Regulatory Commission (NRC). If decommissioning of the FFF would disturb more than 1 acre of land, an NPDES construction stormwater permit would be required prior to ground disturbance. Therefore, impacts on surface water resources from decommissioning of the FFF are anticipated to be SMALL.

3.5.2.2 Groundwater Impacts

3.5.2.2.1 Construction

Buildings associated with the FFF would have foundations of less than 2.5 feet and would not affect groundwater levels, availability, or flow patterns. Water infiltrating into the ground along the drainage ditches and detention basin forebays could cause mounding of groundwater and subsequently affect surficial groundwater flow surrounding the HCS. The effect of the mounding would be to potentially slow infiltration of stormwater, and it is unlikely to have a significant effect on groundwater supply or flow at the HCS. However, minor changes to groundwater and surface water flow that would occur during construction could affect karst features within and in proximity to the FFF. Changes in surface water and surficial groundwater flow could cause accelerated development of existing karst features such as voids and sinkholes and reactivation of dormant sinkholes. During construction, the potential will exist for sediment discharges to the sinkhole, its associated subsurface voids, and surface discharge points.

During construction of the FFF, infiltration of stormwater runoff and leaks or spills of fuels and lubricants associated with construction equipment could potentially affect groundwater quality of near-surface aquifers. TRISO-X's NPDES permit would set limits on the amounts of pollutants entering ephemeral drainages that may have a hydraulic connection to aquifers at the HCS. To prevent spills and minimize impacts from spills, TRISO-X would abide by its SPCC plan. Additionally, the NPDES permit and associated SWPPP would specify additional mitigation measures and BMPs that TRISO-X would implement to prevent and clean up spills. Erosion and sediment controls outlined in the SWPPP would be implemented to minimize the potential for sediment discharges. The SPCC plan and SWPPP would be updated as needed during construction to ensure risks and potential impacts are appropriately mitigated (TRISO-X, 2025b).

Construction of the FFF would have minor effects on groundwater and surficial groundwater flow. Impacts associated with karst development are discussed in the operations section below (3.5.2.2.2). Therefore, impacts on groundwater resources from construction of the FFF are anticipated to be SMALL.

3.5.2.2.2 Operation

TRISO-X has indicated that water required for operations of the FFF would be supplied by the City of Oak Ridge. Therefore, no impacts to groundwater supply associated with operation of the FFF are anticipated.

Water infiltrating into the ground along the drainage ditches and detention basin forebays could cause mounding of groundwater and subsequently have an effect on surficial groundwater flow in the HCS. The effect of the mounding would be to potentially slow infiltration of stormwater, and it is unlikely to have a significant effect on groundwater supply or flow at the HCS. This effect would be directly related to precipitation events when large amounts of water would infiltrate into the ground where it would be conveyed as part of the stormwater management system and would subside following the drainage of the detention basins.

Changes to surface water and surficial groundwater flow could result from construction of the FFF due to increased infiltration and changes to flow volumes and discharge locations. Changes to surficial groundwater and surface water flow could affect and exacerbate existing karst features such as voids and sinkholes located both onsite and offsite of the FFF. Changes in flow could cause increased development of existing features, activation of dormant features, and development of new features. Increased development of karst features over time at the HCS could allow stormwater to bypass permanent stormwater BMPs and directly enter subsurface voids and related karst features. TRISO-X should consider adding an inspection program for the stormwater detention basins and facility during maintenance for sinkhole development. Sinkholes can be stabilized via a variety of methods including reverse-grade backfilling, grouting, or subsurface engineering structures. The method ultimately used depends on various factors and the characteristics of the sinkhole.

The remaining potential impacts to groundwater resources would be from releases of contaminants from the FFF. In addition to its SWPPP, TRISO-X would implement a nonradioactive waste management program based on pollution prevention (TRISO-X, 2025b). The process facility would incorporate internal containment measures that would limit the potential for chemicals stored at the facility to be released into soils, surface water, or groundwater. For chemicals stored outside of the process facility, storage tanks would feature double walls, and interstitial monitoring would be used on underground tanks. Water runoff from facilities, including the electrical transformer, mechanical yards, and aboveground tank containment areas, would be collected, treated, and disposed of separately from stormwater discharge. Routine inspection, maintenance, and response procedures are provided in the TRISO-X SPCC plan, and implementation of these measures would further reduce the potential for impacts of chemicals on groundwater.

TRISO-X would also establish an effluent monitoring program to manage effluent concentrations and to ensure that nonradiological materials in plant effluent are as low as possible (TRISO-X, 2025b). The NRC would require an emergency plan that includes protocols on how to handle an emergency at the FFF. If a release is identified, groundwater wells would be sampled, and results compared to preconstruction background data collected as discussed in section 3.5.1.2. As needed, TRISO-X would implement appropriate mitigation measures in accordance with NRC and EPA guidelines (TRISO-X, 2025b).

The FFF would not discharge liquid process wastewater into its stormwater management system or into the Oak Ridge sewer system. During operation of the FFF, TRISO-X would adhere to a radiological environmental monitoring program (REMP) in compliance with NRC standards for protection against radiation (TRISO-X, 2024c, 2025b, 2026). As part of this program, TRISO-X would collect groundwater samples for radiological analysis. Samples would be collected from the four onsite groundwater wells at the FFF on a quarterly basis. The monitoring program would allow TRISO-X to ensure radiological concentrations remain below regulatory limits at the HSC boundary and offsite.

Operation of the FFF would have minor effects on groundwater and surficial groundwater flow. Changes to karst topography would occur relatively slowly over time and TRISO-X would inspect the stormwater basin and facility during maintenance for sinkhole development. Therefore, impacts on groundwater resources from operation of the FFF are anticipated to be SMALL.

3.5.2.2.3 Decommissioning

Decommissioning procedures would be expected to produce many of the same impacts as construction. TRISO-X would implement, where applicable, many of the same mitigation measures used during the construction phase and would develop and adhere to an NRC-approved decommissioning plan. Impacts on groundwater resources from decommissioning of the FFF are anticipated to be SMALL.

3.5.2.3 Floodplain Impacts

The FFF would be constructed outside of the 500-year floodplain and above the projected maximum 100-year flood elevation in the vicinity of the HCS. The FFF would not impact mapped flood zones or floodways. Additionally, the FFF would include a stormwater management system including a detention and retention basin that would be capable of managing the 100-year precipitation event. Therefore, it is unlikely that the FFF would impact floodplains or be impacted by floods during construction or operation, and any potential impacts associated with floodplains would be SMALL.

3.5.2.4 Wetland Impacts

No wetlands were identified within the HCS. However, there is potential that sediment from construction activities or fuels and lubricants leaked or spilled from construction equipment or during operation of the FFF could be carried via stormwater into wetlands outside of the HCS and potentially degrade them. TRISO-X has obtained a construction NPDES permit, and would comply with all permit requirements and conditions. Additionally, TRISO-X would follow the procedures and implement the BMPs and protocols contained within the SPCC and SWPPP. Due to the lack of wetlands in the HCS and the mitigation measures contained within the SPCC and SWPPP, potential impact of the proposed FFF on wetlands would be SMALL.

3.5.3 Mitigation

Potential impacts to surface water could occur through release of sediment during construction or through fuels, lubricant, and materials potentially released during construction and operation of the FFF. Spills occurring during construction, operation, and decommissioning of the FFF could be transported via stormwater and surface water to karst features, groundwater, and wetlands. Mitigation for potential surface water impacts including NPDES permit conditions and BMPs in the SWPPP and SPCC would minimize potential impacts on surface water and on potentially receiving resources such as karst features, groundwater, and wetlands in proximity to the HCS. Stormwater at the FFF would be detained prior to leaving the HCS, and stormwater associated with aboveground tanks, transformers, and mechanical yards would be collected and disposed of separately from stormwater associated with building, parking lots, and open areas. The stormwater basins have been designed with two separate sections including the forebay and main detention section. Stormwater would enter the forebay where suspended solids and sediment would settle to the bottom of the forebay. Stormwater would then flow to the main detention section where additional sediment and suspended solids would settle prior to stormwater being discharged to the existing karst swale and ultimately the offsite sinkhole. Implementation of the detention basin with forebay is anticipated to reduce constituents within stormwater to be at or below the limits required by TDEC (TRISO-X, 2025b). To mitigate the potential for sinkhole development at the stormwater detention basins, TRISO-X would line the detention basins with high-density polyethylene liners and clay backfill below the liners to prevent infiltration within the basins. TRISO-X would also periodically inspect the basins for indications of subsidence or potential sinkhole formation. To further reduce impacts, the NRC staff recommends an additional mitigation action that TRISO-X develop a sinkhole mitigation plan that would detail the procedures TRISO-X would follow to minimize impacts on groundwater in the case of a sinkhole collapse.

TRISO-X would also establish an effluent monitoring program to manage effluent concentrations and to ensure that nonradiological materials in plant effluent are minimized (TRISO-X, 2025b). The NRC would require an emergency plan that includes protocols on how to handle an emergency at the facility. If a release is identified, groundwater wells would be sampled and results compared to preconstruction background data. The process facility would incorporate internal containment measures that would limit the potential for chemicals stored at the facility to be released to soils, surface water, groundwater, and wetlands.

3.6 Ecological Resources

This section describes the characteristics of terrestrial and aquatic plants and animals potentially affected by the construction, operation, and decommissioning of the fuel fabrication facility (FFF) at the Horizon Center site (HCS). This section also discusses special-status plant and animal species that occur or have the potential to occur at the HCS and habitats that are important to those species.

In June 2022, Wood Environment & Infrastructure Solutions, Inc. (Wood) produced an *Ecological Resources Technical Report* that TRISO-X, LLC (TRISO-X) used as the basis for the ecological resources section of the environmental report (ER) included as part of TRISO-X's license application to the Nuclear Regulatory Commission (NRC; TRISO-X, 2025b; Wood, 2022b). The report characterized the terrestrial vegetation and wildlife, aquatic species, and threatened and endangered species and their preferred habitats that were documented or could potentially be present at or in the vicinity of the HCS. The report consisted of data that were collected in the summer and fall of 2021 and spring of 2022.

3.6.1 Affected Terrestrial Resources

The HCS is within the Southern Limestone/Dolomite Valleys and Low Rolling Hills Level IV Ecoregion within the Ridge and Valley physiographic province of eastern Tennessee as designated by the U.S. Environmental Protection Agency (EPA; Griffith et al., 1998). The Southern Limestone/Dolomite Valleys and Low Rolling Hills ecoregion is relatively low-lying and located between the Blue Ridge Mountains and the Cumberland Plateau. Prevalent natural communities within the southern Limestone/Dolomite Valleys and Low Rolling Hills include Appalachian oak forest, bottomland oak and mesophytic forests, and cedar barrens. The HCS is a previously cleared 110-acre parcel that consists primarily of open, herbaceous vegetation and about 5 acres of mixed and evergreen forest. The natural vegetation cover in the undeveloped areas surrounding the HCS is indicative of the communities expected in the ecoregion.

3.6.1.1 Vegetation

The vegetative community covering the majority of the HCS is regularly mowed and maintained. Herbaceous vegetation consists primarily of Chinese lespedeza (*Lespedeza cuneata*) with occasional patches of poverty oatgrass (*Danthonia spicata*). In low-lying areas where mowing is more difficult, islands of scrub-shrub persist, commonly consisting of sawtooth blackberry (*Rubus argutus*), sweetgum (*Liquidambar styraciflua*), redbud (*Cercis canadensis*), and black cherry (*Prunus serotina*). Vegetation along the periphery of the mowed areas is indicative of the post site-clearing flora communities that would be present at the HCS in the absence of regular mowing. These communities primarily consist of woody species dominated by sawtooth blackberry, Japanese honeysuckle (*Lonicera japonica*), and autumn olive (*Elaeagnus umbellata*) and herbaceous species such as Chinese lespedeza, soft brome (*Bromus hordeaceous*), weeping lovegrass (*Eragrostis curvula*), perennial ryegrass (*Lolium perenne*), Kentucky bluegrass (*Poa pratensis*), Appalachian ragwort (*Packera anonyma*), tall goldenrod (*Solidago altissima*), tall fescue (*Schedonorus arundinaceus*), yellow crownbeard (*Verbesina occidentalis*), plantains (*Plantago* spp.), asters (*Symphyotrichum* spp.), Virginia strawberry (*Fragaria virginica*), and lyreleafe sage (*Salvia lyrata*) (Wood, 2022b).

Mixed forest is the dominant forest landcover type within a 5-mile radius of the HCS; however, due to the periodic clearing activities conducted at the site, forest habitat represents only 4.8

acres of the HCS. Tree species at the site include southern red oak (*Quercus falcata*), tulip poplar (*Liriodendron tulipifera*), and snags of American elm (*Ulmus americana*) (Wood, 2022b).

Nonnative invasive species are prevalent at the HCS, likely due to the previous clearing of the site. Common nonnative invasive plants documented at the HCS include Japanese honeysuckle, Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), autumn olive, Chinese lespedeza, and Japanese stiltgrass (*Microstegium vimineum*).

No special-status plant species were documented during field surveys at the site. A full list of plants observed during the 2021 and 2022 surveys is provided in the *Ecological Resources Technical Report* (Wood, 2022b).

3.6.1.2 Terrestrial Wildlife

This section describes the terrestrial wildlife that could be present at the HCS and its vicinity. TRISO-X conducted surveys for mammals, birds, reptiles, and amphibians over three survey periods encompassing summer, fall, and spring, respectively.

Mammal species documented during surveys at the HCS and its vicinity include bobcat (*Lynx rufus*), coyote (*Canis latrans*), eastern cottontail (*Sylvilagus floridanus*), eastern mole (*Scalopus aquaticus*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), and white-tailed deer (*Odocoileus virginianus*). No special-status mammal species were documented during field surveys at the site. White-tailed deer, gray squirrel, and eastern cottontail are recreationally valuable as game species. A full list of the mammal species observed or having potential to occur at the HCS is provided in the TRISO-X ER (TRISO-X, 2025b).

Bird species, or avifauna, documented during surveys of the HCS and its vicinity include American crow (*Corvus brachyrhynchos*), American goldfinch (*Spinus tristis*), blue jay (*Cyanocitta cristata*), Carolina chickadee (*Poecile carolinensis*), Carolina wren (*Thryothorus ludovicianus*), common yellowthroat (*Geothlypis trichas*), downy woodpecker (*Dryobates pubescens*), eastern phoebe (*Sayornis phoebe*), field sparrow (*Spizella pusilla*), mourning dove (*Zenaida macroura*), northern cardinal (*Cardinalis cardinalis*), white-eyed vireo (*Vireo griseus*), tufted titmouse (*Baeolophus bicolor*), wild turkey (*Meleagris gallopavo*), and yellow-breasted chat (*Icteria virens*). No special-status avifauna were documented during field surveys nor are they expected to occur at the site. A full list of the avifauna species observed or having potential to occur at the HCS is provided in the TRISO-X ER (TRISO-X, 2025b).

Reptiles and amphibians (i.e., herpetofauna) documented during surveys of the HCS and its vicinity include the black racer snake (*Coluber constrictor*), black rat snake (*Pantherophis obsoletus*), blue-tailed skink (*Plestiodon fasciatus*), eastern box turtle (*Terrapene carolina carolina*), eastern fence lizard (*Sceloporus undulatus*), southern leopard frog (*Lithobates Sphenocephalus*), and spring peeper (*Pseudacris crucifer*). No special-status herpetofauna were documented during field surveys nor are they expected to occur at the site. A full list of the herpetofauna observed or having potential to occur at the HCS is provided in the TRISO-X ER (TRISO-X, 2025b).

3.6.2 Impacts on Terrestrial Resources

3.6.2.1 Construction

Construction of the FFF is likely to entail clearing, grading, or other impacts on the entire 110-acre parcel. As such, any existing vegetation or wildlife habitat at the HCS would be lost. Direct impacts from construction would be limited to the boundaries of the HCS; therefore, potential impacts on wildlife or wildlife habitat in the lands surrounding the HCS would be indirect impacts (e.g., impacts related to construction noise or artificial lighting). TRISO-X expects construction to last approximately 5 years. Construction noise from vehicles and heavy machinery would persist at the site throughout the construction period. Construction would primarily occur during daylight hours, but some nighttime construction may be required, and TRISO-X would use artificial lighting to illuminate the construction site during these periods.

As described in section 3.6.1.2, the HCS consists primarily of periodically mowed, upland herbaceous vegetation with scattered pockets of scrub-shrub vegetation and approximately 5 acres of mixed evergreen and deciduous forest. The loss of the open herbaceous and scrub-shrub habitat and a small pocket of forested habitat would have minor impacts on the vegetative and wildlife communities in the vicinity of the HCS. The open habitat of the HCS was artificially created when the parcel was cleared in previous years. The dominant herbaceous vegetation at the site is the highly invasive Chinese lespedeza (U.S. Department of Agriculture [USDA], 2002). The presence of common wildlife species that are adapted to disturbed environments and are prevalent throughout the lands in the vicinity of the HCS (e.g., American crows, coyotes, raccoons, and eastern squirrels) illustrates the moderate quality of the habitat, the loss of which would have minor impacts on wildlife populations. The loss of scrub-shrub and forested habitat would also have minor impacts on vegetative and wildlife communities due to the prevalence of the same habitat types throughout the lands in the vicinity of the HCS.

Construction noise, artificial lighting, and human activity associated with construction could cause indirect impacts on wildlife adjacent to the HCS. For example, construction noise and other human activities can mask breeding calls of birds or force noise-sensitive individuals to move away from the construction area and expend more energy finding replacement habitat. This disruption of normal behavioral patterns could lead to reduced feeding, increased risk of predation, delayed reproduction, and increased juvenile mortality for wildlife in the vicinity of the HCS (Barber et al., 2011).

Similarly, artificial lighting can cause adverse impacts on wildlife. Artificial lighting can hide natural light sources (e.g., moonlight), and fatalities of avian species due to artificial lighting are well documented. Avian fatalities are associated with attraction to light sources, especially in low light, fog, and when there is a low cloud ceiling (Orr et al., 2013). However, research also indicates artificial lighting can have a positive effect on some avian species. For example, artificial lighting has been shown to be beneficial for nocturnal foragers (e.g., Santos et al., 2010; Welbers et al., 2017).

The level of wildlife displacement would depend on the sensitivity of the specific species, and the surrounding forested vegetation would likely attenuate construction noise and artificial light quickly with distance from the HCS. Additionally, most of these impacts would only last for the duration of construction. Therefore, the NRC staff concludes construction impacts on terrestrial resources would be SMALL.

3.6.2.2 Operation

The majority of the HCS would be maintained as an industrial site (i.e., consisting of buildings, pavement, or gravel) during operation of the FFF. TRISO-X would plant non-invasive herbaceous vegetation throughout the areas of the HCS that would not contain facilities or parking areas. Replanting and maintaining the site with non-invasive herbaceous vegetation would provide a minor benefit to the vegetative community at the HCS by removing the presence of invasive species such as Chinese lespedeza. However, fencing surrounding the HCS and the presence of the FFF and associated human activity would minimize access to the site by most of the wildlife species documented to currently use the site.

Noise associated with operation of the FFF, including vehicular traffic arriving and departing the FFF, would be a long-term impact for the duration of the FFF license period. However, as during construction, noise during normal and power outage emergency operation would dissipate rapidly with distance from the HCS. Impacts associated with operational noise would be similar to those of construction. However, much of the wildlife documented in the vicinity of the HCS consists of common species that are habitat generalists (e.g., racoons, coyotes) and are likely accustomed to or would readily habituate to the operational noise. Other species that are not able to habituate may be displaced and would be forced to find replacement habitat. Given the broad expanse of forested habitat surrounding the HCS, the impacts on wildlife that would be displaced are likely to be minor.

The buildings constituting the FFF could serve as obstructions for avifauna present in the vicinity of the HCS. However, the buildings are estimated to be approximately the same height as the canopy of the surrounding forested areas. Six ventilation (vent) stacks at the FFF would have heights of approximately 100 feet, which would be approximately 40 feet taller than the average height of the surrounding forest canopy. However, the construction-related clearing of the HCS would result in a broad space between the adjacent forested habitat and the buildings and vent stacks, thereby minimizing the likelihood of inadvertent collisions with buildings and vent stacks by avifauna using the forested habitat. As noted for construction impacts, artificial lighting associated with the FFF could also affect wildlife in the vicinity of the HCS—both in the surrounding forested habitat and through avian (and bat) attraction to light sources, especially in low light, fog, and when there is a low cloud ceiling.

The FFF would require artificial lighting in the parking lot areas, building entrances, and loading docks, and for security perimeter monitoring. However, TRISO-X expects most of the lighting to be localized around the perimeter of the process buildings. Additionally, TRISO-X would adhere to local zoning ordinances and the HCS deed restrictions for artificial lighting, which prescribe the use of downcast lighting with non-luminous tops and generally recommend that exterior lighting be designed in accordance with the recommendations of the International Dark Sky Association (Oak Ridge Industrial Development Board, 2013).

Generally, operation impacts on terrestrial resources would be similar in scope but more long term than construction impacts. However, the NRC expects that these impacts would be minor. Although some habitat would be lost due to the presence of the FFF, the Horizon Center Industrial Park (HCIP), specifically the natural areas surrounding the lots proposed for development such as the HCS, was designed to accommodate development of the HCS for industrial use while causing minor impacts on the surrounding wildlife and wildlife habitat (see section 3.1.1; U.S. Department of Energy [DOE], 1996, 2013). Studies conducted by the DOE indicate the natural areas have been effective in their design to-date (DOE, 2013). Therefore, the NRC staff concludes that the operation impacts of the FFF on terrestrial resources would be SMALL.

3.6.2.3 Decommissioning

Impacts on terrestrial resources associated with decommissioning of the FFF would be consistent with those of the construction phase. Accordingly, the NRC staff concludes the impacts on terrestrial resources associated with decommissioning of the FFF would be SMALL.

3.6.3 Affected Aquatic Resources

As noted in section 3.5, TRISO-X reviewed National Wetlands Inventory (NWI) maps of the HCS and subsequently conducted onsite wetland and waterbody surveys at the HCS and surrounding areas in 2021 as described in the TRISO-X ER (TRISO-X, 2025b). The results of the onsite surveys indicated there are no wetlands or waterbodies on the HCS. There are, however, streams and wetlands in the lands adjacent to the HCS including the East Fork Poplar Creek (EFPC), an adjacent palustrine forested broad-leaved deciduous temporarily flooded (PFO1A) wetland south of the HCS, and an intermittent and ephemeral stream, respectively, northeast of the HCS.

The ephemeral stream does not support the presence of fish species. The intermittent stream and the EFPC both support communities of fish and other aquatic species. Common species observed in the intermittent stream during aquatic community sampling conducted by TRISO-X in 2021 and 2022 include blacknose dace (*Rhinichthys atratulus*), emerald shiner (*Notropis atherinoides*), striped shiner (*Luxilus chrysocephalus*), and crayfish (*Orconectes* spp.) (TRISO-X, 2025b). The EFPC contains fish and other aquatic species typical of low-flow tributary streams. Since 1986, the number of pollution-sensitive species (i.e., species whose presence indicates pollution) has increased (DOE, 2020a). Common fish species documented in the Clinch River near the confluence of the EFPC and the Clinch River include black redhorse (*Moxostoma duquesnei*), bluegill (*Lepomis macrochirus*), gizzard shad (*Dorosoma cepedianum*), green sunfish (*Lepomis cyanellus*), Mississippi silverside (*Menidia audens*), redear sunfish (*Lepomis microlophus*), sauger (*Sander canadensis*), spotted sucker (*Minytrema melanops*), white bass (*Morone chrysops*), yellow bass (*Morone mississippiensis*), and yellow perch (*Perca flavescens*). Freshwater mussels have also been documented in the Clinch River near its confluence with the EFPC. Species of freshwater mussels include elephant ear (*Elliptio crassidens*), fragile papershell (*Leptodea fragilis*), giant floater (*Pyganodon grandis*), pimpleback (*Quadrula pustulosa*), pink heelsplitter (*Potomilus alatus*), purple wartyback (*Cyclonaias tuberculata*), and the invasive zebra mussel (*Dreissena polymorpha*) (Tennessee Valley Authority [TVA], 2013).

3.6.4 Impacts on Aquatic Resources

Due to the absence of waterbodies or wetlands at the HCS, direct impacts on aquatic resources associated with construction, operation, and decommissioning of the FFF would be SMALL.

Indirect impacts on aquatic resources could occur in association with stormwater runoff from the HCS during all three phases of the project. Potential impacts on aquatic resources within nearby waterbodies could occur through release of sediment during construction or through fuels, lubricants, and materials potentially released during construction and operation of the FFF. Spills occurring during construction and operation of the FFF could be transported via stormwater runoff. TRISO-X would implement best management practices (BMPs) associated with its National Pollutant Discharge Elimination System (NPDES) permit conditions, stormwater pollution prevention plan (SWPPP), and spill prevention, control, and countermeasures (SPCC) plan to minimize potential impacts on aquatic resources. Therefore, the NRC staff concludes that indirect impacts on offsite aquatic resources during construction, operation, and decommissioning of the FFF would be SMALL.

3.6.5 Affected Federally Designated Special-Status Species

The NRC has an obligation under section 7 of the Endangered Species Act (ESA) to determine whether a proposed project may affect Federally listed or species proposed to be listed under the ESA. The implementing regulations for section 7(a)(2) of the ESA define “action area” as all areas affected “directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 Code of Federal Regulations [CFR] 402.02, “Definitions”). The action area includes the 110-acre HCS, the surrounding area where operational noise can be audible to wildlife, and the area to which runoff and effluent discharges drain. Consideration is given to all direct and indirect effects of the proposed FFF, to species that migrate through the area, and to species that could colonize the area in the future.

The ESA also requires designation of “critical habitat” for Federally listed species, unless such a designation would not be prudent or if critical habitat for the given species is not determinable (see 50 CFR 424.12, “Criteria for designating critical habitat”). Critical habitat is broadly defined as habitat within the geographical area occupied by a species that contains physical or biological features that are essential for conservation of the species or specific areas outside the geographical area occupied by the species that are deemed essential for conservation of the species. These areas include sites with food and water, breeding areas, cover or shelter sites, and sufficient habitat to provide for normal population growth and behavior. One of the primary threats to endangered and threatened species is the destruction or modification of essential habitat areas by uncontrolled land and water development.

In March of 2022, TRISO-X requested the U.S. Fish and Wildlife Service (FWS), through its Information for Planning and Consultation (IPaC) system, for a list of threatened or endangered species that could occur at the HCS or in its vicinity. In May of 2025, the NRC staff obtained an updated species list from the FWS IPaC system (FWS, 2025). The 2025 IPaC output identified three endangered or proposed endangered species, four threatened or proposed threatened species, and one species listed as experimental and non-essential that could occur at the HCS or in its vicinity (table 3.6-1). There is no designated critical habitat for any threatened or endangered species present within the action area (FWS, 2025).

Table 3.6-1 Threatened and endangered species potentially present at the HCS

Common name	Scientific name	Federal status	Suitable habitat present in the action area?
Indiana bat	*Myotis sodalis*	Endangered	Yes
Gray bat	*Myotis grisescens*	Endangered	Yes
Tricolored bat	*Perimyotis subflavus*	Proposed Endangered	Yes
Virginia spiraea	*Spiraea virginiana*	Threatened	No

Common name	Scientific name	Federal status	Suitable habitat present in the action area?
White fringeless orchid	*Platanthera integrilabia*	Threatened	No
Spotfin chub	*Erimonax monachus*	Threatened	No
Monarch butterfly	*Danaus plexippus*	Proposed Threatened	Yes
Whooping crane	*Grus americana*	Experimental population	No

Source: FWS, 2025

3.6.5.1 Bats

The action area encompassing the HCS contains suitable summer roosting and foraging habitat for several bat species based on the forested areas and sparsely spaced trees. The gray bat (*Myotis grisescens*) and Indiana bat (*Myotis sodalis*) are included in the FWS IPaC review as endangered, and the tricolored bat (*Perimyotis subflavus*) is included as proposed endangered (FWS, 2025).

Indiana bats migrate seasonally between caves, where they hibernate during winter months, and their summer range, where they roost in dead, dying, or living trees with cracks, crevices, or exfoliating bark. Suitable summer habitat for Indiana bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields, and pastures.

Tricolored bats in Tennessee hibernate in caves and mines. Suitable summer habitat for tricolored bats also consists of a wide variety of forested/wooded habitats, where they roost, forage, and travel, and may include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, and old fields and pastures, as well as linear features such as fencerows, riparian forests, and other wooded corridors. Tricolored bats primarily roost in forested habitat among leaf clusters of live or recently dead deciduous hardwood trees. Tricolored bats have also been documented roosting in pine needles, eastern red cedar, artificial roosts (i.e., human-constructed structures), and, rarely, caves. They are known to successfully roost and forage in forested areas near anthropogenic structures and buildings.

Gray bats are one of the few species of bats in North America that inhabit caves year-round, occupying cold hibernating caves or mines in the winter and warmer caves during summer. Foraging by gray bats during summer is strongly correlated with open water of rivers, streams, lakes, and reservoirs. Gray bats are highly dependent on aquatic insects, especially mayflies, caddisflies, and stoneflies, though they will also opportunistically consume beetles and moths.

FWS has noted the lands in the general vicinity of the HCS provide significant summer roosting habitat for Indiana, and tricolored bats (FWS, 2022). Likewise, substantial karst features present in the area surrounding the HCS provide potential summer roosting habitat for gray bats (FWS, 2022). However, there are no known maternity roost trees in the action area and none of the karst features in the action area contain aboveground openings to crevices or caves suitable for hibernating or roosting bats (TRISO-X, 2025b). Environmental surveys conducted in 2021 indicated there are seven potential roost trees within the HCS. The identification of the trees as potential roost trees was based on the physical characteristics of the individual trees (i.e., trees and/or snags greater than 3 inches diameter at breast height that have exfoliating bark, cracks, crevices, and/or hollows) without specific regard to their locations within the HCS (TRISO-X, 2025b). The TRISO-X ER provides the locations and descriptions of the potential roost trees.

Bat species occurring in the vicinity of the HCS are likely to forage in upland and bottomland woodlots with relatively open understories, areas where wooded edges abut open spaces like waterbodies, streams, fields, pastures, wetlands, and open corridors that are in proximity to a potential roost tree (Wood, 2022b). TRISO-X did not conduct surveys specifically for bats (e.g., mist netting) in the action area. TRISO-X is assuming these species may be present during the summer roosting periods for the purposes of avoidance, minimization, and mitigation measures.

3.6.5.2 Plants

Virginia spiraea (*Spiraea virginiana*) is a Southern Appalachian species found in the Appalachian Plateau or the southern Blue Ridge Mountains in Alabama, Ohio, West Virginia, Virginia, Tennessee, North Carolina, Kentucky, and Georgia. Virginia spiraea life history requirements are strongly tied to high-gradient streams on larger creeks and rivers. It primarily occurs along scoured banks of second- and third-order streams or on meander scrolls, point bars, natural levees, and other braided features of lower reaches of streams. Suitable habitat for the Virginia spiraea is not present in the action area.

The white fringeless orchid (*Platanthera integrilabia*) is a perennial herb that currently occurs in Alabama, Georgia, Kentucky, Mississippi, South Carolina, and Tennessee. White fringeless orchid habitat has historically been described as partially shaded areas with sandy and acidic soils in wet areas like seeps, bogs, or swamps, but it may also occur in areas with differing light and moisture availability. However, the species is commonly associated with sphagnum moss (*Sphagnum* spp.), an acidophilic species of moss often found in bogs, and often occurs in wooded wetland areas dominated by red maple, white oak, and black gum. Environmental surveys conducted during the summer and fall of 2021, and the spring of 2022 did not find presence or suitable habitat for the white fringeless orchid within the action area (Wood, 2022b).

3.6.5.3 Aquatic Species

The spotfin chub (*Erimonax monachus*) is a ray-finned fish that occurs in the Holston River drainage (Virginia and northeastern Tennessee), Emory River drainage (lower Clinch River, Tennessee), and the Little Tennessee River drainage (North Carolina and Tennessee). The species is thought to be selective of boulder and bedrock substrates in medium- to high-velocity flows and medium depths (typical of runs). The species is thought to be selective of boulder and bedrock substrates in medium- to high-velocity flows and medium depths (typical of runs) (FWS, 2023c). Suitable habitat for the spotfin chub is not present in the action area.

3.6.5.4 Monarch Butterfly

On December 12, 2024, the Service proposed to list the monarch butterfly (*Danaus plexippus*) as a threatened species under the ESA throughout its geographic range, which includes Tennessee; the USFWS has not yet issued a Final Rule. The Service has only proposed critical habitat for the monarch butterfly in California (89 FR 100662-100716).

Monarch butterflies are solely dependent on milkweed (*Asclepias* sp.) during their caterpillar stage and require ample sources of nectar from flowering plants to fuel their migrations (85 *Federal Register* [FR] 81813). In general, any area with milkweed present in North America is considered a breeding area for monarch butterflies. Monarch butterflies are generally present in east-central Tennessee from April through October. TRISO-X's vegetation surveys in 2021 and 2022 documented uncommon occurrence of milkweed in the action area; however, no individual monarch butterflies were observed in the action area (Wood, 2022b).

3.6.5.5 Whooping Crane

Whooping cranes (*Grus americana*) currently exist in the wild at three locations in North America and in captivity at 12 sites. There is only one self-sustaining wild population, the Aransas-Wood Buffalo National Park population, which nests in Wood Buffalo National Park and adjacent areas in Canada and winters in coastal marshes in Texas at Aransas. There is a small captive-raised, non-migratory population in central Florida and a small migratory population of individuals introduced beginning in 2001 that migrates between Wisconsin and Florida (and potentially through Tennessee). Whooping cranes breed, migrate, winter, and forage in a variety of wetland and other habitats, including coastal marshes and estuaries, inland marshes, lakes, ponds, wet meadows and rivers, and agricultural fields (FWS, 2023d). For purposes of complying with section 7 of the ESA, experimental populations are treated as proposed for listing on private lands. As such, Federal agencies are not required to consult with the FWS regarding the species. No suitable migratory habitat for the whooping crane is present in the action area.

3.6.5.6 Migratory Birds

The Migratory Bird Treaty Act (MBTA) protects a total of 1,007 migratory bird species (75 FR 9282). The FWS identified 11 species as Birds of Conservation Concern (BCCs) that may occur in or near the action area: black-billed cuckoo (*Coccyzus erythropthalmus*), Canada warbler (*Cardellina canadensis*), cerulean warbler (*Dendroica cerulea*), chimney swift (*Chaetura pelagica*), eastern whip-poor-will (*Antrostomus vociferus*), golden-winged warbler (*Vermivora chrysoptera*), Kentucky warbler (*Oporornis formosus*), prairie warbler (*Dendroica discolor*), prothonotary warbler (*Protonotaria citrea*), red-headed woodpecker (*Melanerpes erythrocephalus*), and wood thrush (*Hylocichla mustelina*) (FWS, 2025). The FWS administers the MBTA to prevent the take, harassment, harm, or collection of migratory birds and/or their eggs and nests (50 CFR 10.12, "Definitions"). The HCS and its vicinity include forests that could provide habitat for important life history functions of migratory birds. Near the HCS, migratory birds rely on riparian, forested, grassland, and wetlands areas for foraging, resting, and avoiding predators.

During TRISO-X's fall 2021 seasonal survey, 51 birds, comprising a total of 7 species, were observed onsite. The most abundant species observed included northern cardinal, tufted titmouse (*Baeolophus bicolor*), common yellowthroat (*Geothlypis trichas*), yellow-breasted chat (*Icteria virens*), and field sparrow (*Spizella pusilla*). None of the birds observed onsite or offsite were protected bird species or BCCs. The mourning dove was the only recreationally valuable game species observed onsite (Wood, 2022b).

3.6.5.7 Bald and Golden Eagles

The take of bald eagles (*Haliaeetus leucocephalus*) is prohibited under both the MBTA and the Bald and Golden Eagle Protection Act of 1940, as amended (50 CFR Part 22, "Eagle Permits").

The Bald and Golden Eagle Protection Act prohibits anyone from taking or disturbing bald eagles or golden eagles (*Aquila chrysaetos*), including their nests or eggs, without an FWS-issued permit. The bald eagle is also a State-listed vulnerable species. Golden eagles are not known to breed in the United States east of the Mississippi River; however, they do migrate through the eastern United States to and from Canada and are known to overwinter in primarily forested habitat of the Appalachian Mountains (Katzner et al., 2012). Bald eagles typically breed in the winter in forested areas near large bodies of water, such as rivers, large lakes, or streams that support an adequate food supply (FWS, 2023e). During the 2022 seasonal field survey, one bald eagle was observed offsite near the Philotechnics building. No bald eagles were observed within the action area, and suitable habitat for bald eagles is not present within the action area (Wood, 2022b).

3.6.6 Affected State-Designated Special-Status Species

Under the Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act of 1974 (TN Code § 70-8-101-112, 2021), 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. A review of the Tennessee Department of Environment and Conservation (TDEC) rare species database in June 2025 identified 48 species listed as rare in Tennessee that are known to occur in the areas encompassed by the Bethel-Valley, Tennessee, and/or Elverton, Tennessee, topographic map quadrangles, which encompass the HCS (TDEC, 2025). A table of all State-listed species with the potential to occur in the vicinity of the HCS is included in the TRISO-X ER (TRISO-X, 2025b). No rare, threatened, or endangered species (wildlife or plants) were documented within the HCS as part of the 2021 and 2022 seasonal field surveys. Additionally, field surveyors concluded there were no high-quality native plant communities or suitable habitat present at the HCS for any of the State-listed species (TRISO-X, 2025b).

3.6.7 Impacts on Special-Status Species

On February 2, 2023, the NRC sent a letter to the FWS describing the proposed FFF and requesting information and input from the FWS to identify notable environmental resources or issues of concern that should be considered in assessing the impacts of the proposed facility (NRC, 2023b). In a follow-up telephone call, the FWS requested that the NRC provide an analysis of the potential for effects on threatened and endangered species and additional details regarding the project. On September 20, 2023, the NRC sent a request to the FWS to initiate informal consultation for the proposed FFF and for the FWS to provide concurrence under section 7 of the ESA for the NRC's effect determinations regarding potential impacts on the threatened, endangered, and proposed endangered species potentially present in the action area encompassing the HCS (NRC, 2023c). In a letter dated October 12, 2023, the FWS concurred with the determinations of the NRC staff and concluded that the requirements of section 7 of the ESA had been fulfilled (FWS, 2023a).

In August 2025, the NRC sent a follow-up email to inform the FWS of changes to the design of the proposed FFF (NRC, 2025). This letter stated that modifications to the FFF design would not change the determinations provided in the September 20, 2023, letter and that construction, operation, and decommissioning of the FFF would not jeopardize the continued existence of the monarch butterfly. Table 3.6-2 provides the effects determinations for the ESA-listed species and the species proposed for listing that could potentially be present at the HCS.

Table 3.6-2 Effects determinations for the threatened and endangered species potentially present at the HCS

Species	Status	Effects determination
Indiana bat (*Myotis sodalis*)	Endangered	May affect, not likely to adversely affect
Gray bat (*Myotis grisescens*)	Endangered	May affect, not likely to adversely affect
Tricolored bat (*Perimyotis subflavus*)	Proposed endangered	May affect, not likely to adversely affect
Virginia spiraea (Spiraea virginiana)	Threatened	No effect
White fringeless orchid (*Platanthera integrilabia*)	Threatened	No effect
Spotfin chub (*Erimonax monachus*)	Threatened	No effect
Monarch butterfly (*Danaus plexippus*)	Proposed threatened	Not likely to adversely jeopardize the continued existence of the species

The NRC staff based its effect determinations for the Indiana, gray, and tricolored bats on the following assessments, which are detailed in the NRC's report to the FWS enclosed with its letter requesting informal consultation (NRC, 2023c). There are no known hibernacula within Roane County for any of the species. Consequently, bat habitat in the action area encompassing the HCS is limited to summer roosting and foraging habitat. There are no known maternity roost trees in the action area, and none of the karst features in the action area contain aboveground openings to crevices or caves suitable for roosting gray bats (TRISO-X, 2025b). The HCS contains seven trees that are greater than 3 inches in diameter at breast height; have exfoliating bark, cracks, crevices, and/or hollows; and are therefore considered suitable roost trees for bats. TRISO-X has stated it intends to clear these potential roost trees during the winter season when bats would be hibernating and therefore not be present at the HCS. Based on the locations of the trees and general probability, as determined by the FWS (2023f), the likelihood is very low that the potential roost trees at the HCS are maternity roost trees, and their loss would not adversely affect bat species in the action area.

Construction, operation, and decommissioning of the FFF would also have a discountable effect on foraging bats in the action area. Indiana bats primarily forage above, within, or along edges of forested habitat. Gray bats forage almost exclusively over open water, and tricolored bats forage primarily along riparian forest edges and over open water. For each species, loss of habitat at the HCS would be discountable due to the abundance of higher-quality foraging habitat nearby.

Lastly, other impacts associated with construction, operation, or decommissioning of the FFF such as noise, lighting, and human activity associated with construction would be temporary and would occur within lower-quality foraging habitat. Should the disturbances disrupt foraging or migrating bats, they could temporarily avoid the area and readily find higher-quality habitat nearby. Neither construction, operation, or decommissioning would result in long-term behavioral changes in the bat species that would be able to be meaningfully measured, detected, or evaluated, and therefore, would be discountable. Accordingly, the NRC staff determined that construction, operation, and decommissioning of the FFF may affect, but would be *not likely to adversely affect* Indiana, gray, and tricolored bats.

As noted in sections 3.6.5.2 and 3.6.5.3, suitable habitat for the threatened Virginia spiraea and white fringeless orchid and the threatened spotfin chub, does not exist within the action area encompassing the HCS. Accordingly, the NRC staff determined that construction, operation, and decommissioning of the FFF would have *no effect* on these species.

As noted in section 3.6.5.4, suitable habitat in the form of milkweed was documented at the HCS during vegetation surveys. Therefore, removal of these plants during construction would comprise removal of monarch butterfly habitat. However, no individual monarch butterflies were observed during site surveys and the prevalence of the milkweed at the HCS was characterized as uncommon. The NRC staff characterize the monarch butterfly habitat at the HCS as low quality, given that the parcel is periodically mowed with no known adherence to commonly recommended monarch butterfly mowing and management best practices (e.g., Monarch Joint Venture 2025). Therefore, the NRC staff determined that construction, operation, and decommissioning of the FFF would not jeopardize the continued existence of the monarch butterfly.

NRC staff determined that construction, operation, and decommissioning of the FFF would not significantly impact migratory birds or bald eagles. As noted in section 3.6.5.6, no BCCs were observed during surveys at the HCS (Wood, 2022b). Likewise, no bald eagles were observed within the action area, and suitable habitat for bald eagles is not present within the action area (Wood, 2022b). Impacts on non-BCC migratory birds would also be minimal, as the types of species documented at the HCS during surveys are common and abundant and there is ample suitable nesting, roosting, and foraging habitat in the areas immediately surrounding the HCS. Further, TRISO-X has proposed to clear trees during winter months to avoid impacts on bat species. This would also minimize impacts on migratory birds that may potentially nest within the HCS. None of the bird species observed during surveys are known to nest in shrubby areas in open fields. Therefore, clearing the HCS during construction would be unlikely to directly impact nesting migratory birds.

In a letter dated October 12, 2023, the FWS concurred with the determinations of the NRC staff and concluded that the requirements of section 7 of the ESA had been fulfilled (FWS, 2023a). On August 6, 2025, the NRC informed the FWS that the changes to the FFF design would not change the determinations of *not likely to adversely affect* federally endangered species (NRC, 2025). In the October 12, 2023, letter, the FWS provided recommendations for TRISO-X to minimize potential effects from temporary or permanent artificial lighting associated with construction, operation, and decommissioning of the FFF within 1,000 feet of suitable habitat for roosting bats. These recommendations consist of the following:

1. Use downward-facing, full cut-off lights when installing new or replacing existing permanent lights (with the same intensity or less for replacement lighting); and

2. If using the backlight, uplight, and glare (BUG) system developed by the Illuminating Engineering Society, all three ratings (backlight, uplight, and glare) should be as close to zero as possible, with the priority given to an uplight rating of zero.

To-date, TRISO-X has proposed to follow artificial lighting guidelines provided in the City of Oak Ridge zoning ordinance (City of Oak Ridge, 2022), which states artificial lighting shall be installed in such a manner that the light source will be sufficiently obscured to prevent glare on public streets and walkways or on the surrounding area.

3.6.8 Mitigation

The primary mitigation that TRISO-X would implement to avoid or minimize impacts on ecological resources would be planning to clear trees within the boundaries of the HCS during the winter months (November through March) to avoid potential impacts on roosting endangered or proposed endangered bats and nesting birds.

Other mitigation TRISO-X has committed to implementing are the methods described in section 3.5 to minimize potential impacts on surface water and on resources potentially receiving runoff such as karst features, groundwater, and wetlands in proximity to the HCS. TRISO-X would adhere to conditions included in its NPDES permit and implement BMPs described in its SWPPP and SPCC plan to minimize or manage releases of sediment during construction and fuels, lubricant, and materials potentially released during construction and operation of the FFF. TRISO-X's implementation of these methods would reduce the likelihood of project impacts on aquatic resources and other wildlife associated with waterbodies and wetlands in the vicinity of the HCS.

As noted in section 3.6.7, the FWS provided recommendations for TRISO-X to minimize potential effects from temporary or permanent artificial lighting associated with construction, operation, and decommissioning of the FFF within 1,000 feet of suitable habitat for roosting bats. These recommendations consisted of the following:

1. Use downward-facing, full cut-off lights when installing new or replacing existing permanent lights (with the same intensity or less for replacement lighting); and

2. If using the backlight, uplight, and glare (BUG) system developed by the Illuminating Engineering Society, all three ratings (backlight, uplight, and glare) should be as close to zero as possible, with priority given to an uplight rating of zero.

3.7 Historic and Cultural Resources

A historic/cultural property refers to a building, structure, district, object, and/or site that is listed in or is eligible to be listed in the National Register of Historic Places (NRHP). These properties are determined to be important in history or prehistory per the Criteria and Criteria Considerations defined in 36 Code of Federal Regulations (CFR) 60.4, "Criteria for evaluation." In addition to possessing historic significance, historic properties must retain most if not all aspects of integrity, as defined in National Register Bulletin 15, which include location, setting, design, materials, workmanship, feeling, and association (National Park Service, 1997).

The National Historic Preservation Act (NHPA) of 1966 sets out the process that federal agencies must follow to account for effects to historic properties listed in or eligible for the NRHP. Under Section 106 of the NHPA (36 CFR Part 800, "Protection of Historic Properties"), federal agencies are required to consider the effects of their undertakings if there is a potential to affect historic properties. This process consists of initiating the Section 106 process, identifying historic properties, assessing effects to historic properties, and resolving adverse effects when they exist.

TRISO-X, LLC (TRISO-X) initiated consultation with the State Historic Preservation Office (SHPO) for the proposed fuel fabrication facility (FFF) during the pre-licensing phase in 2021 and conducted cultural resource investigations in late winter/early spring of 2022. These investigations included background research for contextual information and previously recorded resources, field survey, and field site analysis for NRHP eligibility and effects. The results of this investigation were used to engage in consultation with the Tennessee Historical Commission-SHPO (THC-SHPO) and tribal representatives as part of the formal Section 106 process. This section outlines the results of the investigations.

3.7.1 Cultural History

The 2022 Phase I cultural report outlines the prehistoric and historic context for the region that assists in interpreting land-use patterns (Raymond et al., 2022). There are four main periods important to understanding the prehistory of East Tennessee: the Paleoindian (10,000–8,000 B.C.), the Archaic (8,000–1,000 B.C.), the Woodland (1,000 B.C–A.D. 900), and the Mississippian (A.D. 900–1,540). Note that no prehistoric artifacts/sites were identified within the project area by TRISO-X. As such, the summary of the prehistoric context of the area is intentionally brief. Further details are available in the *Phase I Cultural Resource Survey for the TRISO-X Fuel Fabrication Facility Horizon Center Site* (Raymond et al., 2022). The contact/protohistoric period (A.D. 1540–1672) occurred during early expeditions to the area by the French and Spanish. The historic period began with the establishment of Tennessee as a state in 1796 and the founding of Roane County in 1801.

Most of the cultural resources recorded in the region date to the historic period. Among the more important themes in the development of land-use patterns, besides agricultural production, is the development of the atomic energy program in the region during World War II. Approximately 56,200 acres were acquired by the Federal Government for development of the Manhattan Project in 1942. Entire communities were purchased and removed to provide housing and facilities for these efforts. The community of Wheat, which was located near the K-25 Gaseous Diffusion Process Facility (K-25), was removed, other than a few resources, such as the Wheat Baptist Church and the African Burial Grounds.

In the place of these small rural communities, the Federal Government developed the K-25 facility and associated infrastructure. K-25 was among the most prominent of these buildings. The facility was a mile-long building, intended to enrich uranium to send to the nearby Y-12 facility for processing. Housing was provided for wartime workers engaged in atomic energy production at encampments such as Happy Valley and the town of Oak Ridge, the latter of which ballooned to 75,000 people by 1945. The K-25 plant was shuttered in 1985.

3.7.2 Area of Potential Effect

TRISO-X established the Area of Potential Effect (APE) for the proposed FFF in coordination with the THC-SHPO based upon the maximum area of ground disturbance for construction of the FFF, which is the extent of the HCS. The APE consists of 110 acres, north of Renovare Boulevard, in Oak Ridge, Roane County, Tennessee. The historic architectural survey included the direct 110-acre APE plus a historic architectural viewshed consisting of a 0.5-mile buffer around the HCS. All properties that were 50 years of age or older were documented within the APE and historic architectural viewshed for this project in January 2022 (Raymond et al., 2022).

3.7.3 Background Research and Previously Recorded Properties

Prior to conducting field work, Secretary of the Interior-qualified archaeologists and architectural historians performed background research to identify previously recorded historic and cultural resources and to develop a historic context through which the project area can be understood.

Archaeological results were obtained from the Tennessee Division of Archaeology in July 2021 and January 2022 for the area within a 2-mile buffer of the APE. Records examined included the Tennessee Division of Archaeology's geographic information system (GIS) archaeology database, state site forms, and cultural reports. This research revealed that there are no archaeological sites or surveys within the APE. There are, however, 22 archaeological sites and 9 surveys recorded within the 2-mile buffer. Of the 22 recorded sites, 15 sites are from the historic period, and 7 sites are prehistoric in nature. These resources include historic grist mills, rural domestic properties, cemeteries, remains of the community of Wheat, and barns. Two of the sites are recommended eligible for the NRHP: (1) 40REG195, the remains of a late-nineteenth-century grist mill and (2) 40REG197, the remains of an early-nineteenth-century farmstead. The remainder are either unassessed for NRHP eligibility or recommended not eligible.

Historic architectural records were obtained from the THC-SHPO's Historical Architectural Survey GIS System (THC Viewer) and a review of THC information files. There are 19 properties previously recorded within a 2-mile buffer (used only for background research) of the 0.5-mile historic architectural viewshed APE, as described in section 3.7.2 above. Of the 19 properties, 2 are listed in the NRHP. The George Jones Memorial Baptist Church (RE-1371/NRIS 92000408), also known as Wheat Church, was listed in the NRHP in 1992. The frame gable-front church, which was constructed in 1901, was listed under Criterion A for its association with the social history of Wheat and under Criterion C as a good example of a common rural vernacular church type. The Oak Ridge Turnpike Checking Station (NRIS 92000412) was listed in 1992 for its important association with the military history of Oak Ridge. The Oak Ridge Turnpike Checking Station was constructed in 1947, and its use was discontinued in 1959. It was one of three checking stations that regulated access into the K-25 plant. There is a main station building and a guardhouse associated with this property. According to the 2022 Phase I cultural report, the remaining THC survey resources have been previously determined not eligible (Raymond et al., 2022).

3.7.4 Field Survey Results

The field survey was conducted by Secretary of the Interior-qualified archaeologists and architectural historians in the respective APEs for this project in January 2022. The archaeological survey consisted of 815 shovel test probes and pedestrian surveys in areas of high disturbance. Five archaeological sites were recorded as part of the project: 40REG637, 40REG638, 40REG639, 40REG640, and 40REG641. Two of the sites were located within the APE, while three were adjacent to the area directly northeast of the APE, referred to as the study area by the surveyors. Note that the study area originally investigated was larger than the APE now proposed for the project. As can be seen in table 3.7-1, avoidance is recommended for 40REG639 and 40REG640, as both sites are located outside the APE, and thus outside the area of ground disturbance. The two sites located within the APE, 40REG637 and 40REG638, were recommended not eligible for the NRHP. The THC-SHPO concurred with this recommendation in correspondence dated April 14, 2022.

Table 3.7-1 Archaeological sites summary

Site no.	Site type	Site description	Recommendation
40REG637	Historic domestic dwelling	Mid-19th–early 20th century	Not eligible for NRHP
40REG638	Historic domestic dwelling	Early 19th–early 20th century	Not eligible for NRHP
40REG639	Historic domestic dwelling	Early 19th–late 19th century	Avoidance or additional work required
40REG640	Historic domestic dwelling	Early-to-mid 19th–late 19th/early 20th centuries	Avoidance or additional work required
40REG641	Historic domestic dwelling	Late 19th–early 20th century	Not eligible for NRHP

An additional historic cultural resource, the McKamey and Carmichael Family Cemetery (AEC-69), was recorded adjacent to, but not extending into, the project's APE. This property is a mid-nineteenth-century family cemetery where burials continued into the mid-twentieth century. The cemetery contains 22 marked burials; most gravestones are in poor condition. Per TRISO-X's recommendations, agreed upon by the THC-SHPO, a 100-foot protective buffer surrounding the cemetery has been established. No shovel probes were excavated within the 100-foot buffer, and a pedestrian survey did not indicate any potential for burials in the buffer zone. The earliest legible marker indicates a burial for Mary J. Carmichael in 1867. The latest burial that could be deciphered is for Sarah Carmichael, buried in 1947. Little archival research was available for this cemetery, and available materials did not indicate importance under NRHP eligibility Criteria A (i.e., associated with important events that have contributed to the broad pattern of our history), B (associated with lives of persons significant in our past), or D (yielded or likely to yield information important in prehistory or history). Additionally, the cemetery did not meet Criterion C (i.e., embodying distinctive characteristics) as an example of a significant design. Following the guidance under Criteria Considerations C and D, the cemetery was recommended not eligible for the NRHP. However, due to the potential to uncover human burials outside the fence enclosure, this cemetery, along with its associated 100-foot buffer zone, was recommended for avoidance by TRISO-X or additional geophysical work and/or archaeological monitoring to determine if there are burials outside the cemetery's fenced area. The APE encroaches upon the 100-foot buffer but does not impact the fenced boundary of the cemetery. If the impact to the buffer cannot be avoided, further investigation (additional geophysical work and/or archaeological monitoring as described above) will be necessary.

Current access to this cemetery is along a path from the North Boundary Greenway trail to a two-track road that passes through the HCS's east perimeter. The proposed FFF would cut off the two-track road. TRISO-X is not proposing to construct a new path to the cemetery. Potential visitors, if any, would need to find and use a new path on their own. Although recommended, it is not required for landowners to maintain a path to cemeteries under Tennessee law (THC, 2023b). However, the intentional blocking of access to a cemetery is prohibited.

Within the 0.5-mile historic architectural viewshed, there is one property that was of sufficient age for recordation. The Silvey Family Cemetery (AEC-62) is located on the north side of West Quarry Road, northeast of the APE. The approximately 768-square-foot cemetery is enclosed by a decorative cast-iron fence that includes the Silvey family surname on the main gate. The cemetery appears to have no formal design. There are approximately six marked burials, of which one contains a standing gravestone. The standing headstone marks the burial of Marinda Forrester Silvey, wife of Peter Silvey, who died December 10, 1901. According to U.S. census records, the Silvey family immigrated to Roane County in the 1830s. The 1860 U.S. Census documents Peter Silvey as a farmer and Marinda as "keeping house" (Raymond et al., 2002). The cemetery is in poor condition. Following the guidance under Criteria Considerations C and D, the Silvey Family Cemetery was recommended not eligible for the NRHP. The THC-SHPO agreed with this recommendation in April 2022, and therefore, the cemetery was determined not to possess significance under Criterion A, B, C, or D.

3.7.5 Tribal Coordination

As detailed above, no potential tribal sites were identified during the survey. Tribal coordination was conducted by the Nuclear Regulatory Commission (NRC) from January to August 2023. The NRC distributed a letter notification of the project and invitation to participate as consulting parties (CPs) to 15 tribal stakeholders with potential interest in the area. Of these, two tribal representatives responded in February 2023 with interest in participating: (1) the Alabama-Coushatta Tribe and (2) the Eastern Band of Cherokee Indians of North Carolina. The 2022 Phase I cultural report was sent to these CPs for comment on April 3, 2023. No reply was received, and a follow-up email was sent from the NRC to the CPs on July 7, 2023. No additional input was received from the tribal CPs regarding the 2022 Phase I cultural report as of early August 2023.

On September 5, 2023, NRC sent a letter to the THC-SHPO, noting that tribal consultation was concluded and that the 2022 Phase I cultural report is endorsed by the NRC in its entirety (NRC, 2023a). See table 3.7-2 below for a summary of Tribal consultation efforts for this project.

Table 3.7-2. Tribal coordination summary

Tribal name	Contact for coordination	ADAMS accession number for initial consultation correspondence (from NRC) Jan 2023	Response to initial consultation correspondence (to NRC)	ADAMS accession number for tribal response
Absentee Shawnee Tribe	Governor John Raymond Johnson	ML23005A073	None received	N/A
Alabama-Coushatta Tribe of Texas	Chairwoman Nita Battise	ML23005A078	Interested, email received February 14, 2023	ML23064A271
Alabama-Quassarte Tribal Town	Chief Wilson Yargee	ML23005A080	None received	N/A
Cherokee Nation of Oklahoma	Mr. Chuck Hoskin, Jr., Principal Chief	ML22349A679	None received	N/A
Coushatta Tribe of Louisiana	Chairman David Sickey	ML23005A087	None received	N/A
Eastern Band of Cherokee Indians of North Carolina	Principal Chief Richard Sneed	ML23005A094	Interested, email received 2/21/23	ML23065A262
Eastern Shawnee Tribe of Oklahoma	Chief Glenna J. Wallace	ML23005A096	None received	N/A
Jena Band of the Choctaw Indians	Principal Chief B. Cheryl Smith	ML23005A112	None received	N/A
Kialegee Tribal Town	Mekko Brian Givens (mekko means “chief”)	ML23005A115	None received	N/A
Muscogee (Creek) Nation of Oklahoma	Principal Chief David Hill	ML23005A134	None received	N/A
Seminole Nation of Oklahoma	Principal Chief Gregory Chilcoat	ML23005A135	None received	N/A
Seminole Tribe of Florida	Chairman Marcellus W. Osceola Jr.	ML23005A136	None received	N/A
Shawnee Tribe of Oklahoma	Chief Ron Sparkman	ML23004A178	None received	N/A

Tribal name	Contact for coordination	ADAMS accession number for initial consultation correspondence (from NRC) Jan 2023	Response to initial consultation correspondence (to NRC)	ADAMS accession number for tribal response
Thlopthlocco Tribal Town	Town King Ryan Morrow	ML23004A177	None received	N/A
United Keetoowah Band of Cherokee Indians	Chief Joe Bunch	ML23004A174	None received	N/A

3.7.6 Historic and Cultural Resource Impacts

There are no historic properties listed in or eligible for the NRHP in the APE or within the historic architectural viewshed. Therefore, there would be no impacts to historic properties from construction, operation, and decommissioning of the FFF. There are two archaeological sites that were identified within the APE: 40RE638 and 40RE639. Both sites are historic dwellings that date from the nineteenth through early twentieth century. These sites were determined not eligible for listing in the NRHP, and no further archaeological work is necessary. In addition, the McKamey and Carmichael Family Cemetery (AEC-69) is located adjacent to, but outside, the APE. The APE encroaches upon the 100-foot protective buffer proposed by TRISO-X but does not overlap with the fenced boundary of the cemetery. If impact to the buffer cannot be avoided, further investigation (i.e., geophysical investigation, archaeological monitoring) will be necessary. The THC-SHPO reviewed these findings and agreed with the recommendations summarized above. Tribal consultation, as summarized above, has resulted in no additional comments regarding the proposed FFF and findings presented here.

Based on the information provided, NRC made a determination of “No Historic Properties Affected.” The THC-SHPO, via letter to the NRC dated September 11, 2023, stated that the cultural resources report met the applicable standards and guidelines (THC, 2023a).

3.7.6.1 Construction and Decommissioning

Sites 40RE637 and 40RE638 and a portion of the 100-foot buffer surrounding the McKamey and Carmichael Family Cemetery are located within the APE. It is possible that construction activities such as clearing and grading could impact these sites, but sites 40RE637 and 40RE638 were recommended as not eligible for listing on the NRHP and require no further investigation or protection. No other sites were found within the APE. Ground disturbance activities associated with the development of the perimeter security fence would occur within the 100-foot buffer surrounding the McKamey and Carmichael Family Cemetery. Note that the current fenced boundary of the cemetery is completely outside of the APE and would not be impacted by project development. Additional archaeological investigation that involves the use of near-surface geophysics to identify any unmarked graves and archaeological monitoring of all work within the 100-foot buffer would be required to minimize impacts to this cemetery.

No resources over 50 years of age were identified in the historic architectural survey of the 0.5-mile viewshed surrounding the APE. The rugged topography of the region, distance of the historic resources beyond 0.5 mile from the APE, and extensive forested vegetation obscure the visibility of the project area.

Impacts associated with decommissioning would be similar in footprint and nature to construction.

Therefore, impact to cultural and historic resources during construction and decommissioning is SMALL.

3.7.6.2 Operation

During FFF operation, impacts would be SMALL as additional ground-disturbing activities are not anticipated, and the rugged terrain and existing vegetation would continue to obscure visibility of the operating FFF from historic architectural resources.

3.7.6.3 Mitigation

As noted in section 3.7.6.1, given that the perimeter security fence of the FFF would be constructed within the 100-foot buffer surrounding the McKamey and Carmichael Family Cemetery, TRISO-X has proposed the following mitigative measures to minimize impacts on human remains potentially present within the buffer area:

- Use of near-surface geophysics to identify unmarked graves.
- Archaeological monitoring of all work within the 100-foot buffer area.

3.8 Noise

This section describes the existing noise levels in the area surrounding the proposed fuel fabrication facility (FFF) and the potential direct or indirect noise impacts caused by construction, operation, and decommissioning of the FFF. Noise associated with the proposed FFF is considered in the environmental impact statement (EIS) because it may interfere with people and wildlife present in the surrounding area.

3.8.1 Affected Environment

The definition of noise is “unwanted or disturbing sound.” Sound measurements are described in terms of frequencies and intensities. The decibel (dB) is used to describe the sound pressure level. Sound levels can vary for indoor and outdoor noise sources. For example, a jet flying overhead at 1,000 feet will produce a sound level of 100 A-weighted decibel (dBA), the same as standing inside a subway train. A typical outdoor commercial area will produce a sound level of 65 dBA, which is equivalent to a normal conversation held indoors, and a quiet rural nighttime environment will mimic an empty concert hall at 25 dBA.

The U.S. Environmental Protection Agency’s (EPA’s) guidelines recommend that outdoor noise levels do not exceed a day-night average sound level (L_{dn}) of 55 dBA (EPA, 1974). The State of Tennessee has not developed noise regulations that specify acceptable community noise levels. In 2023, Roane County began deliberations for passing a noise ordinance; however, the County had not passed an ordinance as of the writing of this document.

The City of Oak Ridge established noise level limits in Oak Ridge’s zoning ordinance (amendments through November 2022), Article XII, Section 12.04. For adjacent residential land uses, the maximum noise limit from 7 am to 10 pm is 80 dBA and from 10 pm to 7 am is 75 dBA. For adjacent business and industrial land uses, the maximum noise limit from 7 am to midnight is 80 dBA and from midnight to 7 am is 80 dBA. Additionally, the sound level shall 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, 2022b).

Extensive forested buffers separate the Horizon Center Industrial Park (HCIP) from surrounding land uses. From an acoustics perspective, these densely forested areas provide additional attenuation of industrial park noise for receptors in the vicinity. There are multiple ridges that are oriented northeast to southwest near the Horizon Center site (HCS). Black Oak Ridge is located adjacent to the north of the HCS. The dense forest, in addition to the ridge, provides a natural barrier to noise coming from the HCS that could extend to the north.

The HCIP is partially developed. Philotechnics, adjacent to the proposed FFF location, is an industrial facility specializing in radioactive waste repackaging. The headquarters of the Community Reuse Organization of East Tennessee (CROET) is also located in the HCIP. The nearest residential development is located approximately 0.6 mile northwest of the HCS boundary off Poplar Creek Road. The North Boundary Greenway trail is a noise-sensitive resource used as a recreational trail, bordering the HCS to the west.

3.8.1.1 Existing Noise Levels at the HCS

The North Boundary Greenway trail, a low-density recreational trail used for hiking and biking, is the only noise-sensitive land use in the vicinity of the FFF. About 0.5 mile of the trail runs adjacent and parallel to the western boundary of the HCS. The trail is currently separated from the HCS by a band of trees ranging in width from approximately 100 feet at the southwestern corner of the HCS to approximately 30 feet at the northwestern corner of the HCS. TRISO-X, LLC (TRISO-X) plans to remove a portion of this band of trees in 2024 to install fencing along the perimeter of the HCS as part of construction activities. Construction, operation, and decommissioning of the FFF will increase noise levels on the North Boundary Greenway Trail where it is adjacent to the HCS. However, the short duration that the average trail/recreational user will spend in the area is expected to minimize exposure to noise from the FFF. There are no other recreational facilities, schools, churches, or other noise-sensitive receptors adjacent to the HCS that could potentially be impacted by noise from the proposed FFF. Other land uses in the vicinity include industrial and commercial businesses associated with the HCIP to the south, as well as undeveloped forested land.

To obtain baseline noise levels at the HCS and at property boundaries, ambient noise measurements in four locations were taken in January 2022 (TRISO-X, 2025b). One location was the boundary of Philotechnics, one was at the boundary of the CROET property, and two were at the North Boundary Greenway trail. Based on the results of the noise measurements, the L_{dn} at the HCS property boundary for existing conditions ranged from 51.8 to 53.1 dBA, below the EPA L_{dn} guideline of 55 dBA.

Other noise sources observed during the measurement period included traffic on nearby Tennessee State Route 95 (TN 95; Oak Ridge Turnpike) and local roadways, as well as drill rig activity on the HCS property. Sporadic sources of noise during the measurement period included recreational users of the North Boundary Greenway trail and occasional overhead airplane traffic.

3.8.2 Environmental Impacts

3.8.2.1 Construction

Current design plans for the FFF include the construction of two process buildings (TX-1, TX-2), an administration building, graphite matrix powder (GMP) building, and a security/emergency operation center building. Onsite development plans include external ground-based equipment, drainage features, parking and construction areas, and entrance roads.

During construction of the FFF, most construction activity would occur near the footprints of the process buildings toward the center of the HCS at distances of approximately 400 to 660 feet from the closest property boundary. Table 3.8-1 lists the types of equipment that would be expected to be used during construction. Much of the equipment would likely operate simultaneously. Although multiple pieces of equipment operating simultaneously will increase the noise emanating from a construction site, construction noise is primarily governed by the loudest pieces of equipment operating at a given time, as the loudest pieces of equipment dictate the maximum noise levels at a site (Federal Highway Administration, 2011). Decibels are measured on a logarithmic scale; therefore, the increase in noise resulting from multiple pieces of construction equipment operating simultaneously is not assessed by the standard addition of the individual decibel values. Based on logarithmic addition, two noises of equal level (plus or minus 1 dB) would combine to raise the noise level by 3 dB higher than that of the loudest noise source; two pieces of equipment differing by 2 to 3 dB would increase the combined noise level by 2 dB; and two pieces of equipment differing by 4 to 9 dB would increase the combined noise level by 1 dB. Beyond 10 dB, the combined noise level of two pieces of equipment would be that of the louder of the two pieces of equipment (Federal Highway Administration, 2011). For example, a crane and a dozer, each operating at 85 dBA at 50 feet individually, would create 88 dBA of noise at 50 feet when operating simultaneously, and a concrete saw (90 dBA at 50 feet) and a crane (85 dBA at 50 feet) would create 91 dBA of noise at 50 feet when operating simultaneously. Thus, even when operating simultaneously, noise levels from construction equipment at the expected construction sites of the HCS would be expected to attenuate to levels comparable to those listed for a distance of 394 feet, as shown in table 3.8-1, at adjacent properties (the three loudest pieces of equipment operating simultaneously would be expected to attenuate to 74 dBA at 394 feet) and would not exceed the City of Oak Ridge zoning ordinance maximum noise level of 80 dBA (City of Oak Ridge, 2022b).

Table 3.8-1 Attenuated noise levels expected for operation of representative construction equipment

Source	Attenuated noise levels (dBA)			
	50 feet (15 m)	98 feet (30 m)	197 feet (60 m)	394 feet (120 m)
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
Flatbed 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

Source: Federal Highway Administration, 2006
Note: Distances shown are the distances from the noise source

Construction noise would generally be intermittent over the approximately 5-year construction period and would only be perceptible to receptors in the immediate vicinity of the HCS where moderate noise levels are compatible with the industrial zoning designation. Users of the North

Boundary Greenway trail may experience elevated noise levels along the segment of trail immediately adjacent to the HCS, but construction noise would dissipate at distances farther from the site, and noise impacts would not significantly detract from the overall use of the trail. Overall, noise impacts associated with construction on the land uses surrounding the FFF would be temporary and SMALL.

Construction activities would require the use of heavy equipment for clearing, excavating, grading, and construction of the buildings. Increased traffic noise to and from the HCS is anticipated during the construction phase, due to construction workforce vehicle traffic, truck deliveries, and offsite shipments of construction debris. As vehicles would access the HCS from TN 95 via roadways that serve only the HCIP (i.e., Renovare Boulevard, Imperium Drive, and Novus Drive), noise-sensitive receptors along local/collector roadways and residential streets would be avoided. Thus, noise impacts from construction traffic would be SMALL.

Wildlife present on and in areas adjacent to the HCS are expected to be generally habituated to preexisting noise levels and occur within a preexisting industrial park; therefore, impacts to wildlife for the construction phase of the project would be SMALL.

In summary, noise impacts resulting from the construction of the FFF would be localized and SMALL.

Additional and more detailed information regarding noise in relation to the FFF is provided in TRISO-X's environmental report (ER) sections 3.7 and 4.7 (TRISO-X, 2025b).

3.8.2.2 Operation

Much of the equipment used during operation of the FFF would be housed in the interior of the process buildings. Noise generated in the interior of the building would not be at a level that is detectable at offsite receptors. There would be four main types of external equipment that may generate notable noise during normal operation: transformers; cooling towers; air-cooled chillers, pressure regulators, and dust collectors; and rooftop heating, ventilation, and air conditioning (HVAC) equipment such as air handling units and condensers (table 3.8-2).

Table 3.8-2 Noise-generating equipment used during operation at the FFF

External facility equipment	Estimated number of units under normal operation	Noise level (dBA) for each unit at 50 feet (15 meters)
Normal Operation Equipment		
13.2 kV-480V Transformer	6	64
Cooling Tower Cell	10	62
Air-Cooled Chiller	7	71
Rooftop Chiller	2	72
Pressure Regulator	10	72

External facility equipment	Estimated number of units under normal operation	Noise level (dBA) for each unit at 50 feet (15 meters)
Dust Collector	5	72
Rooftop HVAC Equipment (TX-1 Administration Building)	3	72
Rooftop HVAC Equipment (TX-1 Process Building – Mechanical/Electric Area)	1	72
Rooftop HVAC Equipment (TX-2 Administration Building)	3	72
Rooftop HVAC Equipment (TX-2 Process Building - Mechanical/Electric Area)	3	72
Rooftop HVAC Equipment (GMP Building)	1	72
Rooftop HVAC Equipment (Security/Emergency Operations Center Building)	1	72
Backup Equipment[1]		
TX-1 Process Building Backup Diesel Generator	1	67
TX-2 Process Building Backup Diesel Generator	1	67

[1] Backup equipment would only operate during a loss of off-site power event or during periodic testing (1 hour per week per generator).

In addition to L_{dn} day-night average sound levels, the hourly equivalent continuous sound level (L_{eq}) projections for normal operation were reviewed to determine compliance with noise limits established in the City of Oak Ridge zoning ordinance (City of Oak Ridge, 2022b). The ordinance states that the sound level at a business property boundary shall not exceed 70 dBA for more than 50 percent of a 1-hour period or 75 dBA for more than 10 percent of a 1-hour period. The predicted hourly L_{eq} sound levels at the adjacent receptors during normal operation range from 55.4 to 63.8 dBA (table 3.8-3). As these levels are below 70 dBA, noise from normal operation would comply with the City of Oak Ridge zoning ordinance noise standards. The EPA recommends a limit of 55 dBA for outdoor noise levels (EPA, 1974); however, the EPA recommendations are not applicable to the FFF because the EPA does not have regulatory authority governing noise in local communities. Noise levels at or below 55 dBA allow normal speech communication at approximately 10 feet. Regarding the North Boundary Greenway trail, general EPA guidance states that since sound exposure in recreational areas is voluntary, there is seldom any interference with the desired activity (EPA, 1974). An EPA study found that exposure to environmental noise over a 24-hour period at an average level of below 70 dB will prevent any measurable hearing loss over a lifetime (EPA, 1974).

Table 3.8-3 Estimated operational sound levels at closest receptors during normal operation

Day-night average sound levels (L_{dn})[1]	Predicted noise levels at closest noise receptors (dBA)		
	Philotechnics property boundary	CROET property boundary	North Boundary Greenway trail
EPA recommendation for outdoor spaces	55.0	55.0	55.0
Existing ambient sound level[2]	52.1	52.1	51.8
Predicted sound level during normal FFF operation[3]	67.6[4]	59.9[4]	67.7[4]
Hourly Sound Levels			
City of Oak Ridge noise level limits (L_{50})[5]	70.0	70.0	N/A[6]
Predicted sound level during normal FFF operation (hourly) (L_{eq})	63.7	55.4	63.8

L_{eq} – equivalent sound level; $L_{eq(24)}$ – equivalent sound level over 24 hours
Sources: EPA, 1974; City of Oak Ridge, 2022b
[1] L_{dn} – Day-night average sound level
[2] As measured in the ambient noise study conducted in January 2022 (TRISO-X, 2025b).
[3] Maximum L_{dn} value, assuming the four main types of external equipment described in section 3.8.2.2 are all in use concurrently.
[4] Predicted noise levels that exceed EPA-recommended L_{dn} of 55 dBA for outdoor and residential areas. However, the EPA recommendation is not a regulatory standard.
[5] "L_{50}" refers to the sound level, expressed in dBA, which is exceeded 50 percent of the time over a 1-hour period. The L_{50} limit is the lowest (most stringent) of the city's noise limits for adjacent business land uses.
[6] The City of Oak Ridge zoning ordinance does not specify noise level limits for adjacent recreational land uses.

Wildlife present on and in areas adjacent to the HCS are expected to be generally habituated to preexisting noise levels and occur within a preexisting industrial park; therefore, impacts to wildlife from operations of the FFF would be SMALL.

In summary, noise impacts resulting from the operation of the FFF would be localized and SMALL.

3.8.2.3 Decommissioning

Decommissioning of the FFF would occur over approximately 2 years and would involve removal and decontamination of the used process equipment and materials, as well as hauling of the materials offsite. These hauling activities would avoid local roads and thus have low noise impacts. The anticipated noise levels resulting from decommissioning would be temporary and like or lower than those associated with the construction phase and therefore represent a SMALL noise impact.

Wildlife present on and in areas adjacent to the HCS are expected to be generally habituated to preexisting noise levels and occur within a pre-existing industrial park; therefore, impacts to wildlife from the decommissioning of the FFF would be SMALL.

In summary, noise impacts resulting from the decommissioning of the FFF would be localized and SMALL.

3.8.3 Mitigation

During construction temporary noise impacts may occasionally exceed the City of Oak Ridge's maximum noise limit of 80 dBA and would represent an increase over existing measured noise levels. To reduce noise impacts from construction, there are various mitigation options that may be considered for application by TRISO-X's contractor where possible and appropriate. Examples of this are listed below (2025b):

- Equipping and maintaining construction equipment with the manufacturer's noise-control devices in effective operating condition;
- Utilizing quiet equipment or construction methods to minimize noise emissions;
- Operating equipment with internal combustion engines at the lowest effective operating speed to minimize noise emissions;
- Closing engine housing doors to minimize noise emissions;
- Avoiding engine idling; and
- Utilizing back-up alarms on construction equipment that are less intrusive to offsite receptors while complying with all applicable safety restrictions.

3.9 Waste Management

This section describes the potential direct or indirect impacts resulting from waste generation and management related to the proposed action. More specifically, this section describes the types of waste that would be generated by the fuel fabrication facility (FFF) and the disposition of the waste. Section 2.1.2 describes the facility operations that would generate solid, gaseous, and liquid wastes; section 2.1.3 provides an overview of the waste and effluent management; and section 2.1.4 provides an overview of monitoring and mitigation of the effluents.

3.9.1 Affected Environment

3.9.1.1 Radioactive Waste

This section describes potential impacts related to the production, processing, handling, and transportation of low-level radioactive wastes during the operation and decommissioning of the proposed FFF. No radioactive waste would be associated with the construction phase of the FFF. Radioactive waste generated during operations would include gaseous effluents, which would be released to the facility environs; low-level solid waste, which would be packaged and transported offsite for disposal at a licensed facility; and small quantities of liquid radioactive waste, which would be treated onsite or transported offsite for treatment and disposal at licensed facilities. No high-level radioactive waste would be produced at the proposed FFF. No liquid radioactive waste would be released into the facility environs under normal operations. Most liquid radioactive waste would be processed at the FFF to solidify the waste prior to disposal. No radioactive waste would be disposed of or permanently stored at the proposed FFF (TRISO-X, LLC [TRISO-X], 2025b). Gaseous effluents and the impact from the handling of these effluents and their release to the environment are discussed in section 3.10.

Radioactive waste generated during decommissioning would be mostly low-level solid waste. Process system components, structural materials, and contaminated soil or debris would be packaged and transported offsite for disposal. Minor quantities of liquids or uranium wastes may require treatment onsite prior to transport to licensed facilities. When practical, methods including processing of liquids, recycling, and reuse would be used to reduce the amount of waste produced or emitted (TRISO-X, 2025b). The FFF would produce only Class A radioactive waste, as defined under Nuclear Regulatory Commission (NRC) standards in 10 Code of Federal Regulations (CFR) 61.55, “Waste classification.” In the unlikely event that higher activity radioactive waste was produced, it would be disposed through a licensed facility that accepts Class B or Class C waste. No waste greater than Class C waste would be generated by FFF operations (10 CFR 61.55).

The decommissioning of process systems would generate the largest portion of decommissioning waste. Decommissioning of process systems may result in gaseous emissions or fugitive emissions that would be monitored similarly to gaseous emissions during operations. Demolition of contaminated structures would result in fugitive emissions that would be controlled or mitigated by prior decontamination or treatment of building materials (TRISO-X, 2025b). Additionally, used filters, dust and debris, dry active waste, handing equipment, office equipment, tools, carts, and similar materials that comprise the balance of inventory of the facility would be packaged and shipped as solid waste.

3.9.1.2 Nonradioactive Waste

The FFF would acquire, use, and store solid and liquid nonradioactive materials. A portion of these materials would become wastes. The U.S. Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA) regulations govern the disposal of solid and hazardous wastes. RCRA, subtitle C, establishes a system for controlling hazardous waste, and RCRA, subtitle D, encourages states to develop comprehensive plans to manage nonhazardous solid waste and mandates minimum technological standards for municipal solid waste landfills. The EPA has delegated the primary responsibility for implementing RCRA regulations to the State of Tennessee (Tennessee Department of Environment and Conservation [TDEC], 2023).

Solid nonhazardous waste generated during construction would consist of various excavated soil types municipal solid waste. These nonradioactive waste volumes also include pre-operational and post-operational activities. No solid waste would be buried at the FFF (TRISO-X, 2025b). During operations, process systems, effluent controls, maintenance and repairs, and administrative functions are expected to generate municipal solid waste. The solid nonradioactive waste generated during decommissioning would be similar to construction waste. (TRISO-X, 2025b).

The volume of nonradioactive waste would be controlled by recycling, reuse, and waste minimization programs. The FFF would implement waste management systems to control, handle, process, store, and transport nonradioactive waste generated during construction, operation, and decommissioning. The FFF’s nonradioactive waste management program is based on a pollution prevention and waste minimization framework (TRISO-X, 2025b). The design of the FFF would also incorporate features to minimize the release of chemicals or other nonradioactive materials into the environment. Additionally, during normal operation, the FFF would contain chemicals within closed systems and use the chemicals in controlled processes (TRISO-X, 2025b). The NRC staff expects that the waste management systems would ensure that the nonradioactive waste generated at the proposed FFF would be managed in accordance with applicable federal and State of Tennessee regulations. The proposed FFF would generate more than 1,000 kilograms (kg) of hazardous waste per month, making it a large-quantity hazardous waste generator under EPA regulations (TRISO-X, 2025b).

3.9.2 Impacts

3.9.2.1 Radioactive Waste

TRISO-X plans to ship solid radioactive waste by truck from the proposed FFF to the EnergySolutions Clive Facility located in Grantsville, Utah. The EnergySolutions Clive Facility can only accept Class A radioactive and mixed waste. If generated waste is greater than Class A, the Waste Control Specialists site in Andrews, Texas, can accept Classes A, B, and C radioactive and mixed waste. The EnergySolutions Clive Facility is approximately 1,900 miles by road from Oak Ridge. The NRC staff expects that any small quantity of liquid radioactive waste that is produced and shipped offsite for disposal would similarly be shipped to the EnergySolutions Clive Facility. The EnergySolutions Clive Facility also accepts mixed waste (i.e., waste that is both hazardous and radioactive) for processing and disposal. The waste is expected to be shipped in 55-gallon drums and B-25 boxes. The annual expected generation of radioactive waste (including liquid waste) and mixed waste during operations would be equivalent to 4,068 drums of waste plus 5 B-25 boxes. The shipments would require 12 truckloads of waste from process building 1 (TX-1) and 48 truckloads of waste from process building 2 (TX-2) on an annual basis. This volume of waste compares to 36 annual shipments of uranium feed materials and 196 shipments of fabricated fuel annually (TRISO-X, 2025b).

The estimated amount and type of radioactive waste generated during the decommissioning process, including the total estimated number of shipments, is based on the assumption that the waste would be solid waste packaged into 90 cubic foot capacity B-25 boxes. The B-25 boxes would each be conservatively assumed to be filled with 76.5 cubic feet of waste. The decommissioning would be expected to generate 8,208 B-25 boxes organized into 1,026 shipments, which is approximately two truck shipments per day (TRISO-X, 2025b). Assuming the waste would be packaged into B-25 boxes provides a conservative upper bound to the number of packages and shipments. The use of larger packages could reduce the number of packages for low density materials. For higher density materials, the number of shipments would be determined by the load capacity of trucks. The waste from decommissioning would primarily be shipped to Energy Solutions in Clive, Utah.

If the FFF were to lose access to a low-level waste disposal facility, the NRC staff expects that any low-level waste would have to be stored either within the facility until the licensed storage capacity was reached or in a new storage facility that TRISO-X would construct either onsite or at an offsite location. A new storage facility would require a new license or a license amendment. However, this is unlikely since there are currently three low-level radioactive waste disposal facilities that could accept radioactive waste and two that can accept mixed waste. The storage of low-level waste would continue until a low-level waste disposal facility became available. Radioactive material, regardless of its location, must be stored in accordance with federal and state regulations to ensure the safety of workers and members of the public.

As described in section 3.11, transportation of radioactive waste on public highways would also occur in conjunction with operation of the proposed FFF. The impacts on traffic volumes due to radioactive waste shipments during operation and decommissioning are analyzed in section 3.11. Table 3.11-3 shows that overall operations-related impact on local traffic would be limited. The volume of traffic related to the transport of radioactive waste is a small fraction of the total traffic volume impact. The traffic impacts during decommissioning would be smaller than the impacts during operation, as shown in table 3.11-4 (TRISO-X, 2025b).

When transporting waste, the FFF or commercial carriers must comply with the applicable U.S. Department of Transportation regulations in 49 CFR Part 172, “Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans,” Part 173, “Shippers—General Requirements for Shipments and Packagings,” Part 177, “Carriage by Public Highway,” and Part 397, “Transportation of Hazardous Materials; Driving and Parking Rules,” as well as the NRC packaging requirements for radioactive material in 10 CFR Part 71, “Packaging and Transportation of Radioactive Material.” The environmental impact of transporting radioactive waste on public roads is discussed under transportation accidents in section 3.13.2.3. The NRC previously evaluated the environmental impact of transporting radioactive waste on public roads and concluded that when radioactive waste transportation is performed in compliance with all federal regulations, the impact of such transportation, including transportation accidents, is SMALL (NRC, 1977b). Therefore, since waste transportation undertaken in conjunction with the operation of the proposed FFF would be in compliance with applicable U.S. Department of Transportation and NRC regulations, the NRC staff concludes that the impacts from transportation of radioactive waste produced during operation and decommissioning of the proposed facility would be SMALL.

The proposed FFF's waste management systems, engineering design features, and contamination control and radiological safety procedures would help ensure that doses to facility personnel and members of the public from the production, processing, handling, and packaging of radioactive waste are reduced to levels that are safe. In addition, all activities at the proposed FFF, including processing and handling of radioactive waste, would be conducted such that radiation doses to occupational workers and members of the public are maintained at safe levels and below the limits of 10 CFR Part 20, "Standards for Protection Against Radiation," as discussed in section 3.10. TRISO-X has also proposed a comprehensive pollution prevention and waste minimization plan to ensure that activities are conducted in a manner intended to reduce the potential for waste generation. The waste minimization program includes recycling during construction and operation, employee training, requirements to include waste minimization in day-to-day activities, and assignment of responsibilities for waste minimization (TRISO-X, 2025b). The NRC staff concludes that the impacts from production, processing, and handling of radioactive waste at the proposed FFF during operation and decommissioning would be SMALL.

3.9.2.2 Nonradioactive Waste

Solid nonhazardous waste generated during construction would amount to approximately 15,127,000 cubic feet of various excavated soil types in 9,548 truckloads and approximately 1,825,000 cubic feet of municipal solid waste in 1,152 truckloads. These nonradioactive waste volumes also include pre-operational and post-operational activities. No solid waste would be buried at the FFF (TRISO-X, 2025b). The peak generation rate for municipal solid waste would be 48 truckloads per month.

During operations, the process systems, effluent controls, maintenance and repairs, and administrative functions are expected to generate 3,913 drums of waste annually. The nonradioactive municipal waste generated during decommissioning would be bounded by the volume of construction waste (TRISO-X, 2025b). This nonradioactive waste is expected to be a small fraction of the total pickups of nonradioactive waste in the region. Nonhazardous waste would be temporarily stored onsite before being transported to the local disposal or recycling facility. Hazardous nonradioactive waste would be temporarily stored onsite and then transported to a hazardous waste treatment and disposal company for separation, processing, and disposal. The NRC staff determined that adequate storage capacity would exist within the FFF to accommodate the waste generated and stored between shipments to offsite disposal facilities.

Due to the inherent value of high-assay low-enriched uranium (HALEU) fuel materials, the FFF will reduce uranium waste by implementing programs to reuse or recycle uranium waste materials to the extent practicable. The commitment to avoid liquid discharges of radioactive material will require the FFF to implement systematic efforts to minimize liquid wastes. Liquid wastes will be solidified or shipped to offsite processors for disposal. Fuel material manufacturing would be performed within containments and enclosures that minimize the generation of radioactive waste (TRISO-X, 2025b). Based on the FFF's proposed waste management systems, processes to minimize chemical contamination, and TRISO-X's compliance with applicable federal and state regulations, the NRC staff concludes that impacts from nonradioactive waste would be SMALL during construction, operation, and decommissioning.

3.9.3 Mitigation

As noted in section 3.9.2.1, TRISO-X's waste management systems, engineering design features, and contamination control and radiological safety procedures would ensure that doses to facility personnel and members of the public from the production, processing, handling, and packaging of radioactive waste are reduced to levels that are safe.

As noted in section 3.9.2.2, TRISO-X's nonradioactive waste management program is based on a pollution prevention and waste minimization framework. The design of the FFF would also incorporate features to minimize the release of chemicals or other nonradioactive materials into the environment. No additional mitigation measures have been identified by TRISO-X or the NRC staff.

3.10 Public and Occupational Health

This section describes the potential direct and indirect impacts on public and occupational health resulting from issuance of the 10 Code of Federal Regulations (CFR) Part 70 license and operation of the proposed fuel fabrication facility (FFF) for a period of 40 years. This section also includes potential impacts of construction and decommissioning of the facility.

The potential occupational health impacts during construction would be controlled by Occupational Safety and Health Administration (OSHA) regulations (29 CFR Part 1910, “Occupational Safety and Health Standards”) that limit chemical exposures to workers. OSHA’s regulations that protect workers from chemicals would also protect the public because the control of chemicals and associated exposures on the construction site would effectively reduce the potential for fugitive emissions of chemicals to offsite locations. OSHA’s regulations would also control dusts and other inhalation hazards to workers and reduce the potential of offsite transport of dust. The site’s air permits would require controlling fugitive emissions and monitoring air particulate concentrations at the construction site perimeter (TRISO-X, LLC [TRISO-X], 2025b). Fugitive emissions are controlled using erosion controls and dust suppression. Spills of fuel or waste are addressed by procedures that minimize the likelihood of accidents. Spill response programs minimize the magnitude of impacts from inadvertent discharges (TRISO-X, 2025b). The occupational safety rates for the general construction industry in Tennessee indicate that the expected number of injuries to workers is nine to ten per year during the peak construction period and a total of 37 expected injuries during the entire construction period. Using average industry fatality rates for Tennessee, 0.24 construction fatalities are expected during the entire construction period (TRISO-X, 2025b), which means that no actual fatalities are expected during construction.

The operation of the proposed facility would result in radiological and nonradiological (i.e., chemical) exposures to members of the public and workers. The potential radiological impacts are bounded by the Nuclear Regulatory Commission (NRC) regulations that limit environmental releases and exposure of workers because the FFF would be required to operate within these regulatory limits. The NRC regulations include limits for radiation doses and a standard of operation requiring that actual doses be safe. The standards in 10 CFR Part 20, “Standards for Protection Against Radiation” require that licensees continually evaluate operational conditions to minimize radiation doses to workers and the public. The NRC regulations (10 CFR 20.1301, “Dose limits for individual members of the public”) ensure the effective dose equivalent to individual members of the public does not exceed 100 millirems (mrem) per year (mrem/yr). In addition, the U.S. Environmental Protection Agency (EPA) regulations (40 CFR Part 190, “Environmental Radiation Protection Standards for Nuclear Power Operations”) restrict the annual dose equivalent to any actual member of the public to 25 mrem/yr (0.25 mSv/yr). The EPA regulations also limit the maximum dose to any organ of the body to 25 mrem/yr for an actual person. For uranium releases, doses to the lung from inhalation are typically the limiting organ dose and are typically at least three times higher than the annual dose equivalent to the whole body (EPA, 2024). For the FFF, the effect of the EPA regulations would be to bound the effective dose equivalent to an individual member of the public to a level about one-third of the 25-mem-per-year limit.

TRISO-X’s environmental report (ER) submitted for the FFF established a goal of limiting radiation dose to 10 percent of the limit in 10 CFR 20.1301. A limit of 10 percent of 100 mrem/yr equals 10 mrem/yr (0.1 mSv/yr), which is consistent with the EPA limit because TRISO-X is proposing to limit radiation doses at the restricted area boundary. The restricted area boundary is not a location occupied by a member of the public. In response to requests for additional information, TRISO-X further committed to controlling effluents at the point of discharge from the stacks such that annual average concentrations would not exceed the regulatory standards in table 2, column 1 of appendix B of 10 CFR Part 20. Data submitted by TRISO-X in this response provided environmental dosimetry data obtained by applying an atmospheric transport and dispersion model (TRISO-X, 2023, 2025). TRISO-X has committed to use models compliant with the NRC's *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors* (Regulatory Guide 1.111; TRISO-X, 2025). The calculations provided by TRISO-X indicate that controlling effluents at the point of discharge from the stack to table 2, column 1 concentrations in appendix B of 10 CFR Part 20 for high-assay low-enriched uranium (HALEU) would result in annual radiation doses at the highest location on the fence line that are below 2 mrem/yr (TRISO-X, 2023, 2025). Further, the calculations show that at expected levels of discharge, the highest radiation dose at the fence line would be less than 3 percent of the dose determined for the maximum allowed emissions. Hence the operation of the FFF would not result in exposure to a member of the public that exceeds statutory limits of federal regulations.

Operational activities at the FFF would be subject to OSHA's occupational safety and health standards for nonradiological hazards, and in-facility gaseous emissions would not exceed OSHA's occupational safety and health standards for toxic and hazardous substances, in accordance with 29 CFR 1910 Subpart Z, "Toxic and hazardous substances." Based on a workforce of 1,569 full time employees and using a range of injury rates representing all private employment and manufacturing employment in Tennessee, the expected rate of injuries, as defined by OSHA is 42 to 54 injuries per year. The expected fatality rate is 0.056 to 0.080 per year.

The potential public and occupational health impacts of decommissioning activities involve exposures that are similar to the operational phase of the facility, but with lower quantities of radioactive and chemical materials. The NRC and OSHA regulations would continue to control public and occupational exposures and air permits would remain in effect. Worker injuries and potential accidental fatalities associated with decommissioning are expected to be bounded by construction impacts.

During decommissioning, the potential impacts derive mainly from the residues of radiological and chemical materials that were used during operation. The methods that were applied to prevent or control impacts during operation would be used during decommissioning to protect public and occupational health. Significant sources of radioactive materials and chemicals would be removed from the facility or otherwise controlled prior to structural demolition. Potential health and safety impacts related to demolition are controlled analogously to construction safety practices, with radiological and chemical safety programs as an overlay.

This section further describes the sources of operational radiation and chemical exposure, baseline health conditions, public and occupational health protection standards, and the potential direct and indirect impacts of granting the license. Section 3.3 discusses air quality controls. Additionally, section 3.8 of this environmental impact statement (EIS) discusses impacts from noise, section 3.9 discusses waste management, section 3.11 discusses transportation impacts, such as impacts of workers commuting to/from the FFF and shipment of materials, and section 3.13 discusses accident impacts. Reasonably foreseeable effects are discussed in section 3.14.

3.10.1 Sources and Pathways of Radiation and Chemical Exposure

Radiation exposure to the general public occurs naturally and continuously from radioactive materials found in the Earth's soils, rocks, and minerals. Radon is a radioactive gas that escapes into ambient air from the decay of uranium (and its progeny, radium) found in most soils and rocks. The Earth's crust has about 1 part per million (ppm) of uranium on average. Naturally occurring low levels of uranium and radium are also found in drinking water and foods. Cosmic radiation from outer space is another natural source of ionizing radiation dose. In addition to natural sources of radiation, there are artificial or human-made sources that contribute to the dose the general public receives. These consist of medical sources (such as diagnostic procedures using radioisotopes and x-rays), consumer product sources, nuclear power emissions, and commercial uses of radiation, such as highway transportation of radioactive materials (NRC, 2021c).

Residents of the State of Tennessee experience a somewhat higher natural level of radiation than the national average due to the altitude and geography of the land. Cosmic radiation at the grade elevation of the Horizon Center site (HCS) is about 31 mrem/yr) (NRC, 2021a). The State of Tennessee's average annual dose from terrestrial radiation, including radon, is 536 mrem/yr (5.36 millisieverts per year [mSv/yr]) and is applicable to the vicinity of the HCS (EPA, 2005). The NRC estimates that the dose to the public from ingested radioactivity is 31 mrem/yr (NRC, 2021a). The public receives an average dose due to human-made radiation sources of 310 mrem/yr (NRC, 2021a). The natural and human-made background radiation for residents in the vicinity of the HCS is about 910 mrem/yr (9.1 mSv/yr).

Radiological materials released into the environment from an operating FFF could be transported in a variety of ways and would expose the public through both internal and external exposure pathways. As the proposed FFF would not be licensed to discharge radioactive liquids into surface waters or groundwater, no dose to the public is anticipated from normal operations via a liquid exposure pathway. For gaseous releases, the exposure pathways would include direct radiation from deposited radioactivity on the ground, inhalation of radioactive material in the air, surface contamination, and ingestion of crops or animal products that come in contact with radioactive material in the air or in the ground.

The FFF would be constructed on undeveloped land in the HCS in Oak Ridge. The site is in an industrial park. An adjacent developed parcel is occupied by Philotechnics, a licensed nuclear facility. The other adjacent parcels are presently vacant. The X-energy helium test facility and a centrifuge development facility may be constructed on adjacent parcels. The immediate area beyond the adjacent parcels consists of rural wooded areas and light commercial and industrial use buildings. A uranium enrichment facility may be constructed and operated on land beyond the adjacent parcels.

The closest major population center is the city of Oak Ridge, which had a population of 32,614 as of July 1, 2022, per the U.S. Census Bureau (2022). The closest members of the public are at the Philotechnics site. The closest residents to the site are approximately 0.6 mile northwest of the site boundary, separated from the site by a ridge. The ridge is significant because it places the nearest residents in an adjacent valley, and gaseous effluents are expected to be transported northeast or southwest within the valley in which the FFF would be sited. There are also residential neighborhoods located to the east, approximately 1.3 miles or more from the site. The North Boundary Greenway trail, used for hiking and biking, borders the site boundary to the northwest. The closest school to the site is Linden Elementary School, located approximately 5 miles from the site. The Methodist Medical Center of Oak Ridge is the nearest hospital, located approximately 9 miles from the site (TRISO-X, 2022b).

TRISO-X would store bulk chemicals in the form of solids, liquids, compressed gases, and cryogenic liquids to support manufacturing operations at the FFF. Uranium is also a hazardous chemical and could be processed in oxide, uranyl nitrate, and ammonium diuranate or other forms during the manufacturing of fuel particles and pellets. The fuel fabrication process would involve the encapsulation of each uranium fuel particle with multiple carbonous layers. The encapsulated uranium fuel particles would be pressed into a fuel pebble that would have an additional outer layer of graphite to provide additional encapsulation of the uranium. Uranium materials would be processed indoors in batch limited quantities such that process upsets would pose minimal impacts to the environment.

Outdoor chemical and gas storage tanks for cryogenic liquids (argon), liquids, and compressed gases would be constructed of appropriate containment materials according to building and fire codes. Tanks and piping would be welded construction designs to mitigate releases. Secondary containment and monitoring would be implemented to detect and mitigate leaks in the primary containment. Underground tanks would be double-walled designs with interstitial monitoring. Tanks and transfer systems would be inspected, tested, and maintained as recommended by applicable industry codes and standards. TRISO-X provided information to supplement the ER in 2026 that provides an inventory of the chemicals and compounds that would be stored onsite at the FFF with descriptions of the potential for public health impacts if the chemicals were to be released into the environment (TRISO-X, 2026).

The potential exists for accidents leading to direct or indirect releases of radioactive and chemical materials. The accidental releases would likely be more concentrated over a shorter period than routine releases. Concentration and exposure rates help determine whether there would be acute effects or chronic effects on the public or the environment. For radiation, an acute dose usually refers to a large dose of radiation received in a short period of time, while chronic dose refers to the sum of small doses received repeatedly over a long period of time. See section 3.13 for information about the impacts of radiological and nonradiological accidents.

The FFF would be required to maintain an NRC-approved Emergency Plan (EP), which would provide resources, training, and procedures to mitigate the impact and severity of radiological or nonradiological accidents. The EP would coordinate TRISO-X's actions with the NRC, the U.S. Department of Energy (DOE), the Federal Emergency Management Agency, the City of Oak Ridge, and the State of Tennessee regarding emergency response and facility security. TRISO-X's National Pollutant Discharge Elimination System (NPDES) permit requires a spill prevention, control, and countermeasures plan during construction and operation to prevent and control accidental chemical releases.

3.10.2 Protection Standards, Programs, and Permits

The NRC has statutory responsibility, pursuant to the Atomic Energy Act of 1954, as amended (42 U.S. Code [USC] § 2011 et seq.) to protect the health and safety of workers and the public. The NRC's regulations in 10 CFR Part 20 specify annual worker dose limits, including 0.05 Sv (5 rem) total effective dose equivalent (TEDE) limits for workers. The limits for members of the public provided in 10 CFR Part 20 include an annual dose of 1 mSv (100 mrem) TEDE with no more than 0.02 mSv (2 mrem) in any 1-hour period from any external sources. There is also an annual dose limit of 0.5 mSv (50 mrem) for external sources per 10 CFR 20.1302(b)(2)(ii). Other NRC regulations limit radiation doses to the public from airborne emissions. Details are provided in table 3.10-1. These public dose limits from NRC-licensed activities are a fraction of background radiation dose to nearby residents, which is 9.1 mSv/yr (910 mrem/yr) from natural and artificial sources (TRISO-X, 2025).

The FFF would be required to meet the dose limits for individual members of the public as stated in 10 CFR 20.1301 (table 3.10-1). In addition, TRISO-X would use guidance in *Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees other than Power Reactors* (Regulatory Guide 4.20; NRC, 2012), to reduce exposures to the public from airborne radioactivity below the limits provided in 10 CFR 20.1301. TRISO-X has further committed to restrict uranium concentrations at the point of discharge from the stacks to the values in 10 CFR Part 20, appendix B, table 2, column 1. The FFF's limit on stack concentrations is expected to result in maximum doses to actual members of the public that are a small fraction (less than 2 percent) of the NRC's annual dose guidance under normal conditions. Actual operating releases are expected to be less than 3 percent of the maximum values. Offsite doses would therefore be compliant with statutory limits and consistent with safe operation of the facility.

TRISO-X would implement a radiological effluent monitoring program to meet the regulatory requirements in 10 CFR 70.59, "Effluent monitoring reporting requirements." Data from this monitoring program would be used by TRISO-X to perform semiannual assessments of emissions and doses to members of the public to ensure that limits established in 10 CFR 20.1301 are met and are ALARA (TRISO-X, 2025b).

Table 3.10-1 Annual dose limits for individual members of the public from licensed operations

Individual member of the public	Dose limit	Comment
Total effective dose equivalent	0.1 rem/yr (1 mSv/yr)	Unrestricted areas
External dose rate	0.002 rem/hr (0.02 mSv/hr)	Unrestricted areas
External dose rate	0.050 rem/yr (0.5 mSv/yr)	Continuous occupancy at unrestricted area boundary
Total effective dose equivalent	0.01 rem/yr (0.1 mSv/yr)	Emissions of airborne radioactive material[1]

[1] 10 CFR 20.1101(d) provides a guidance value of 0.01 rem/yr (0.1 mSv/yr) from emissions of airborne radioactive material, excluding radon. In addition, TRISO-X has committed to controlling emissions of airborne radioactive material at the discharge points of the stacks below 10 CFR 20, appendix B table 2 column 1 limits.

For the purpose of regulatory safety, exposure to radiation must be limited. The annual dose limit set by the NRC to protect members of the public from the harmful effects of radiation is 1 mSv (100 mrem). The guidance for airborne emissions is 0.1 mSv (10 mrem), and the FFF has made commitments that are expected to bound annual radiation doses to the public below 0.02 mSv (2 mrem) under maximum discharge conditions. The expected radiation dose to an actual person is expected to be less than 3 percent of the commitment level. The additional risk of fatal cancer associated with a dose of 0.01 mSv/yr (1 mrem/yr), calculated using the scientific methods described in the DOE's *Hazard and Accident Analysis Handbook* (DOE-HDBK-1224-2018; DOE, 2018) and applying a linear response assumption, is on the order of 1 in 2,000,000 per year. If TRISO-X were granted a license and a member of the public received 1 mrem/yr of radiation dose for 40 years, the lifetime risk of a radiation-induced cancer would not exceed 1 in 200,000, or 0.00002. This small increase in lifetime risk can be compared to the baseline lifetime risks of 0.40000 for anyone developing a cancer and 0.20000 for anyone developing a fatal cancer (American Cancer Society, 2023).

The OSHA General Industry Standards (29 CFR Part 1910) establish practices, procedures, exposure limits, and equipment specifications to preserve worker health and safety. Standards for occupational exposure to hazardous chemicals in laboratories are found at 29 CFR 1910.1450, "Occupational exposure to hazardous chemicals in laboratories," and personal protective equipment standards are found at 29 CFR 1910 Subpart I, "Personal protective equipment"; these would apply to the protection of worker health at the proposed FFF. TRISO-X would be required to meet the occupational dose limits for workers as stated in 10 CFR 20.1201, "Occupational dose limits for adults." The principal occupational limits for workers in a uranium facility are 50 mSv/yr (5 rem/yr) TEDE or the equivalent dose any organ or organs would concentrate inhaled or ingested uranium. Additional limits apply to exposure to the skin and the lens of the eye. Workers would be monitored for radiation exposure to ensure the occupational dose limits are met and maintained ALARA. TRISO-X would also be required to mitigate risk to workers from accident conditions in accordance with 10 CFR 70.61, "Performance requirements."

Based on the anticipated chemical release, the FFF would be classified as a minor-source operator (TRISO-X, 2025b), and TRISO-X's air permits would require TRISO-X to monitor and evaluate nonradiological pollutant emissions. Chemical emissions would also be monitored under TRISO-X's environmental monitoring plan. TRISO-X would apply mitigation measures to reduce the hazards of chemical spills or accidents as discussed more in section 3.13. These measures include meter vessel volume limits, level alarms and interlocks, containment enclosures, welded piping, overflow collection systems, and access controls. The FFF operations would be designed to ensure that all current and proposed chemical-use hazards are evaluated, and appropriate measures would be taken to ensure safe operations.

The industrial hazards for the FFF are those considered typical for similar industrial facilities and include exposure to chemicals and accidents ranging from minor cuts to harm from industrial machinery (TRISO-X, 2025b).

3.10.3 Public Health Impacts

Potential public health impacts could result from the release of radiological materials and nonradiological hazardous materials that would be transported from the FFF through the air, surface water, or groundwater. For nonradiological impacts, the FFF would be regarded as a minor source of air emissions. There are no planned liquid emissions.

TRISO-X would implement a radiological effluent monitoring program to meet the regulatory requirements in 10 CFR 70.59. Data from this monitoring program would be used by TRISO-X to assess doses to members of public from accidental gaseous effluents or to verify that monitored effluents satisfy public dose limits provided in 10 CFR 20.1301 (see table 3.10-1) (TRISO-X, 2025b). The reports would also be used to assess compliance with technical specifications of the license regarding emission concentrations. Doses to the public from the FFF emissions are not expected to exceed 1 mrem/yr. Environmental effluent releases would be monitored at release points or at the fence line and reported to the NRC on a semiannual basis. In addition, doses to the public would be calculated on an annual basis using NRC-approved codes. TRISO-X has committed to compliance with Regulatory Guide 1.111 methods for estimating atmospheric transport and dispersion. Regulatory Guide 1.111 includes guidance for adjusting dispersion calculation to account for terrain features in valleys. If necessary, the NRC staff will stipulate license conditions to ensure that the FFF's operations comply with the guidance of NUREG-1520 (NRC, 2015). The environmental monitoring program would also verify that there are no liquid discharges and that long-term accumulation of uranium in soil is monitored.

Because the potential health impact on the maximally exposed member of the public would be small, the potential health impact on members of the public who receive lower radiation exposures would also be small. By protecting the most exposed individual, the NRC regulations protect the entire population of potentially exposed individuals.

Based on this information, the impact of operation of the FFF for 40 years would be SMALL.

3.10.4 Occupational Health Impacts

During normal facility operations, workers would be exposed to radiological and nonradiological hazardous materials that must be within regulatory limits. The FFF would have a chemical safety program and other occupational programs in place to minimize worker health impacts, including accidents, such as electrical shock and asphyxiation, while workers are engaged in activities such as facility maintenance and testing.

The FFF would be required to meet the occupational dose limits for workers as stated in 10 CFR 20.1201. Workers would be monitored for radiation exposure to ensure the occupational dose limits are met and maintained ALARA. The FFF would also be required to limit risk to workers from accident conditions in accordance with 10 CFR 70.61 and monitor workers for radiation exposure as required by 10 CFR Part 20.

The continued operation of the FFF would result in potential direct and indirect exposure from the release of radiological and nonradiological hazardous materials resulting in potential occupational health impacts on workers. The average worker dose (TEDE) at a fuel cycle facility (involving fuel fabrication, processing, uranium enrichment, and uranium hexafluoride production facilities) in 2020 was 90 mrem (0.9 mSv; 0.09 rem) (Brock et al., 2022: table 3.1). This level of radiation exposure is about 10 percent of the radiation dose that the average citizen of Tennessee receives in a year (i.e., 910 mrem).

The impact of the proposed action would result in the potential direct and indirect exposure of workers to the release of radiological and nonradiological hazardous materials. Compliance by the FFF with NRC and OSHA regulations is a prerequisite to maintaining an operating license. The current regulatory requirements have been effective in keeping average radiation exposures in fuel cycle facilities to a small fraction of natural and human-made background radiation dose.

Therefore, the NRC staff considers direct and indirect impacts on occupational workers from the proposed granting of the FFF license for 40 years to be SMALL.

3.10.5 Mitigation

The proposed action is not anticipated to result in significant public and occupational human health effects. Current processes, programs, and regulations are in place to reduce impacts on public and occupational human health effects. No additional mitigation measures beyond those implemented under the NRC and OSHA regulations and the integrated safety analysis would be necessary.

3.11 Transportation

This section describes the transportation infrastructure and conditions in the region surrounding the proposed fuel fabrication facility (FFF) as well as the regional infrastructure and conditions that would support the construction, operation, and decommissioning of the FFF. During the construction, operation, and decommissioning stages of the proposed FFF, TRISO-X, LLC (TRISO-X) would use trucks to transport construction supplies and equipment to the proposed project area and to transport radiological and nonradiological supplies, products, and wastes from the proposed project area. The volume of estimated traffic from supply shipments, waste shipments, and workers commuting was estimated from information provided in the application. TRISO-X does not propose to use any rail, waterway, or air transport for any portion of the project.

The environmental impacts of transporting nuclear materials in feed products and finished products are described in the Nuclear Regulatory Commission’s (NRC’s) environmental impact statement (EIS) for transportation, NUREG-0170 (NRC, 1977). NUREG-0170 evaluated the radiological impacts and consequences of normal transport and of transportation accidents for a range of transportation modes and assessed the adequacy of the NRC’s regulations to provide safety assurance. NUREG-0170 assessed the risk of radiation doses to the public (and workers) under routine and accident transport conditions using conservative parameter estimates. The NRC’s concluded in NUREG-0170 that even with conservative assumptions, the transportation of radioactive materials provides adequate public safety. NUREG-2125 investigated transportation safety for spent nuclear fuel (NRC, 2014). This study reconfirms that radiological impacts from spent fuel transportation conducted in compliance with NRC regulations are low. They are, in fact, generally less than previous, already low, estimates for the transportation of radiological materials provided in NUREG-0170. NUREG-2125 concludes that regulations for the transportation of radioactive material are adequate to protect the public against unreasonable risk.

3.11.1 Affected Environment

The proposed location for the FFF is at the Horizon Center site (HCS) in Roane County in the city of Oak Ridge, Tennessee. The FFF site would be on Renovare Boulevard, which can be accessed from Tennessee State Route 95 (TN 95; Oak Ridge Turnpike) by Imperium Drive or by Novus Drive. The closest public airport to Oak Ridge and the HCS is the McGhee Tyson Airport, located approximately 23.5 miles southeast of the HCS. Oliver Springs Airport is a small, private airport 6.2 miles to the northeast of the HCS. CSX Transportation (CSXT) provides industrial rail services to Oak Ridge via a line from Cincinnati, Ohio, to Atlanta, Georgia (CSXT, 2023). The Clinch River borders the southern portion of the HCS, located approximately 3 miles away at its closest point, on the other side of the East Tennessee Technology Park (ETTP). Portions of the Clinch River are used for industry and recreation around Oak Ridge.

The proposed primary access to the FFF is from TN 95 via Novus Drive (figure 3.11-1). The intersection is located approximately 0.4 mile southeast of the proposed entrance to the FFF. A secondary access route to the FFF would be from the TN 95 and Imperium Drive intersection, approximately 0.65 mile northeast of the FFF (figure 3.11-1). Based on preliminary review of Google Streetview images (recorded February 2014), Renovare Boulevard begins from the HCS as a two-lane curbed road traveling approximately north to Imperium Drive and south to Novus Drive. TRISO-X proposes an entry road adjacent to Renovare Boulevard to facilitate access. Imperium Drive and Novus Drive are four-lane curbed roads with vegetated medians and dedicated turning lanes. They are aligned approximately east to west and provide access to

Renovare Boulevard from TN 95. TN 95 is a multi-lane state highway, provides dedicated turning lanes at both Novus Drive and Renovare Boulevard, and connects the HCS to Interstate 75 to the northeast and Interstate 40 at two interchanges southwest and south of the HCS via Gallagher Road (State Route [SR] 58) and Whipp Road (SR 95), respectively (figure 3.11-1).

TN 95 interchanges with Whipp Road (SR 95) and transitions into Oak Ridge Turnpike (SR 58)/Gallagher Road (SR 58) approximately 1 mile south of the HCS. Gallagher Road (SR 58) and Whipp Road (SR 95) are north-south multi-lane state routes and provide access to Interstate 40 at two interchanges southwest and south of the HCS, respectively. They are part of the National Highway System and serve as principal arterial routes (Tennessee Department of Transportation [TDOT], Roane and TDOT, Knoxville) for many communities in Roane, Anderson, Loudon, and Meigs Counties. Gallagher Road (SR 58) joins Interstate 40 for part of its route in Roane County, from the Kingston exit (352) east to the Oak Ridge exit (356) west of Oak Ridge. TN 95 interchanges with Interstate 40 at the Lenoir City Oak Ridge exit (364) southwest of Oak Ridge.

Figure 3.13-2 Roads and annual average daily traffic count locations in the vicinity of the HCS (Source: TRISO-X, 2025b)

Interstate 75 is a north-south-oriented highway passing through eastern Tennessee. Interstate 40 is an east-west-oriented highway crossing Tennessee. Interstates 40 and 75 interchange in two locations—Knoxville, Tennessee, for Interstate 75 northbound into Kentucky, and north of Lenoir City for Interstate 75 southbound toward Chattanooga, approximately 9 miles southeast of the HCS.

Traffic counts from the most recent available 5-year period along routes to and from the HCS are provided in table 3.11-1. Annual average daily traffic counts provide traffic volumes based on a 24-hour, two-directional count at a given location. Raw traffic data are mathematically adjusted for vehicle type, determined by an axle correction factor. The data are then statistically corrected by a seasonal variation factor that considers time of year and day of the week (TDOT, 2023). The locations of the traffic counts are shown in figure 3.11-1.

Table 3.11-1 Average annual daily traffic counts

Location	TDOT location ID	2020	2021	2022	2023	2024
Oak Ridge Turnpike (SR 95[1])	73000059	13,635	10,798	10,766	13,074	13,624
Oak Ridge Turnpike (SR 95)	10000080	16,166	13,727	16,856	16,557	18,498
Whipp Rd (SR 95)	73000058	7,453	6,052	6,382	7,359	7,140
Oak Ridge Turnpike (SR 58)	73000060	14,944	11,148	13,109	13,322	15,271
Gallaher Rd (SR 58 East of Kingston)	73000061	12,924	14,152	10,812	11,262	12,353
Blair Rd (SR 327)	73000174	3,358	2,344	2,712	2,715	2,639
HWY 95 N (SR 95)	53000001	5,599	6,025	5,886	9,194	8,358

Source: TDOT, 2025
[1] TDOT labels this as SR 95; however, it is referenced as TN 95 throughout this document.

3.11.2 Environmental Impacts

This section describes the potential impacts on transportation resources resulting from the construction, operation, and decommissioning of the proposed FFF. Sections 3.10 and 3.13 describe the impacts from the transportation of radioactive material and postulated accidents due to the normal operation of the FFF. A description of the reasonably foreseeable cumulative effects of the facility on transportation resources assuming implementation of the proposed action is presented in section 3.14.

3.11.2.1 Methodology

In section 4.2.2.2 of the TRISO-X environmental report (ER), TRISO-X proposes to use trucks and common carriers for shipments during construction and operations. Therefore, the impacts of rail traffic are not evaluated here. If rail shipments were needed for construction to bring large items to locations where rail service is available, they would not be expected to significantly impact rail traffic since the shipments would be infrequent and managed as routine railroad freight. Similarly, the impacts of air traffic are not evaluated here. If air shipments were needed for construction to bring specific items to the HCS, they would not be expected to significantly impact air traffic since the shipments would be infrequent and managed as routine air freight. Therefore, the mode of transportation for construction and operation of the FFF would consist of over-the-road trucks, ranging from heavy-duty 18-wheeled delivery trucks, concrete mixing trucks, dump trucks, and flatbed light-duty trucks. These vehicles and equipment are typical of those used in industrial/commercial construction. The primary transportation mode for the workforce to and from the FFF would be by car, truck, or van (TRISO-X, 2025b).

Section 3.11.1 describes the proposed primary and secondary access routes and the nearby interstate highways. These routes are evaluated for the construction, operational, and decommissioning phases.

3.11.2.2 Transportation Impacts During Construction

TRISO-X has estimated the construction period of the FFF to be 5 years, with a maximum of 268 construction workers onsite, an average of 20 daily material deliveries and waste removals, and 655 truckloads per day for backfill removals. Construction activity is proposed to occur generally during weekdays and daylight hours, subject to any local restrictions from the City of Oak Ridge. Thus, the maximum potential increase in traffic from the construction workforce would be 943 roundtrips per day (268, 20, and 655 roundtrips) (TRISO-X, 2025b).

The NRC staff has estimated construction-related traffic impacts based on 1,886 trips per day (i.e., 268 + 20 + 655 x 2 to account for both components of the round trip) over the first 6 months of construction, as this scenario would require the highest number of daily trips of vehicular traffic, and has modeled this count as the limiting case. In addition, TN 95 (TDOT Location ID 73000059) provides the only point of access for all workers and material delivery/removal and therefore is modeled to receive 100 percent of construction-related traffic, with the surrounding transportation infrastructure receiving a traffic volume-based distribution. Table 3.11-2 compares the anticipated increase in traffic from construction activities to average daily traffic counts from the main access point and surrounding transportation infrastructure to and from the FFF.

Table 3.11-2 Construction traffic impacts on average annual daily traffic counts

Location	TDOT location ID	5-year average daily traffic count	Percent of overall traffic	Construction-related average daily traffic count	Construction-related impact on local traffic
Oak Ridge Turnpike (SR 95)	73000059	12,379	100%	1,886	15.2%
Oak Ridge Turnpike (SR 95)	10000080	16,361	42%	793	4.8%
Oak Ridge Turnpike (SR 58)[1]	73000060	13,559	35%	657	4.8%
Gallaher Rd (SR 58 East of Kingston)[1]	73000061	12,301	32%	596	4.8%
Blair Rd (SR 327)	73000174	2,754	7%	133	4.8%
Whipp Rd (SR 95)[2]	73000058	6,877	18%	333	4.8%
HWY 95 N (SR 95)[2]	53000001	7,012	18%	340	4.0%

[1] Oak Ridge Turnpike (SR 58) and Gallaher Rd (SR 58 East of Kingston) traffic counts were averaged to represent a single traffic volume along SR 58.
[2] Whipp Rd (SR 95) and HWY 95 N (SR 95) traffic counts were averaged to represent a single traffic volume along SR 95.

There are no traffic count stations located on Novus or Imperium Drives. It is anticipated that existing traffic volumes for these local roads would be minor as they provide access to a limited number of other sites. Due to the existing municipal road infrastructure, the impacts of an access road are minimal, and at the conclusion of fill import and export activities, construction traffic would contribute less to transportation impacts.

The construction-related impact on localized traffic would be temporary and minor, primarily arising from construction-related traffic entering or exiting TN 95 from Novus or Imperium Drives. Farther away from the HCS, the construction-related traffic on TN 95 and connecting infrastructure would be more dispersed and therefore represent a smaller percentage of existing traffic, making it less noticeable.

This minor increase in traffic for local and regional car traffic would not significantly increase traffic safety problems or road degradation relative to existing conditions. Considering the combination of both transportation impacts from construction supply and waste shipments and from workers commuting, the NRC staff concludes that the transportation impacts from the construction stage of the proposed action would be SMALL.

3.11.2.3 Transportation Impacts During Operations

The NRC staff evaluated traffic impacts from shipping equipment, supplies, and produced fabricated fuel and wastes, and from workers commuting during operations. Radiological and nonradiological health and safety impacts to workers and the public under normal and accident conditions from the proposed transportation to and from the proposed FFF are addressed in sections 3.9, 3.10, and 3.13.

3.11.2.3.1 Transportation Impacts from Operational Supply Shipments and Commuting Workers

Operational activities at the proposed FFF would continue to use roadways for workforce commute and radiological and nonradiological shipments detailed below. TRISO-X estimates operations would require a peak daily, 24-hour workforce of 881 workers and an annual estimate of 1,040 nonradioactive waste removal/deliveries, 51 deliveries of uranium source material, 233 deliveries of fabricated fuel, and 60 radioactive waste removals. All shipments would be assumed to be delivered or shipped Monday through Friday during daylight business operating hours (i.e., 5 days per week for 52 weeks) (TRISO-X, 2025b). Therefore, NRC staff estimates the maximum daily trips to average approximately 1,772 (daily roundtrips for 881 workers, 4 nonradiological supply/waste deliveries and removals, and 1 radiological supply/waste). Table 3.11-3 shows the impacts of the increase in traffic on the regional transportation system from operation-related activity.

Table 3.11-3 Operation traffic impacts on average annual daily traffic counts

Location	TDOT location ID	5-year average daily traffic count	Percent of overall traffic	Operation-related average daily traffic count	Operation-related impact on local traffic
Oak Ridge Turnpike (SR 95)	73000059	12,379	100%	1,771	14.1%
Oak Ridge Turnpike (SR 95)	10000080	16,361	42%	745	4.6%
Oak Ridge Turnpike (SR 58)[1]	73000060	13,559	35%	617	4.6%
Gallaher Rd (SR 58 East of Kingston)[1]	73000061	12,301	32%	560	4.6%
Blair Rd (SR 327)	73000174	2,754	7%	125	4.6%
Whipp Rd (SR 95)[2]	73000058	6,877	18%	313	4.6%

Location	TDOT location ID	5-year average daily traffic count	Percent of overall traffic	Operation-related average daily traffic count	Operation-related impact on local traffic
HWY 95 N (SR 95)[2]	53000001	7,012	18%	319	4.6%

[1] Oak Ridge Turnpike (SR 58) and Gallaher Rd (SR 58 East of Kingston) traffic counts were averaged to represent a single traffic volume along SR 58 and determine percent of overall traffic.

[2] Whipp Rd (SR 95) and HWY 95 N (SR 95) traffic counts were averaged to represent a single traffic volume along SR 95 and determine percent of overall traffic.

The operations-related impact on localized traffic would be minor. Farther away from the HCS, the operation-related traffic on TN 95 and connecting infrastructure, such as interstate highways 40 and 75, would be more dispersed and therefore represent a smaller percentage of existing traffic, making it less noticeable.

There are no traffic count stations located on Imperium Drive or Novus Drive. It is anticipated that existing traffic volumes for these local roads would be minor as they provide access to a limited number of other sites. The minor increase to local traffic would be localized at the intersections of TN 95 at Imperium Drive and Novus Drive. Normal care would be taken by workers entering TN 95 with regard to traffic safety. The regional increase in traffic would cause negligible impact on overall traffic volumes and level of service and would not significantly increase traffic safety problems or road degradation relative to existing conditions. Considering the combination of both the transportation impacts from radiological and nonradiological shipments and workers commuting, the NRC staff concludes that the transportation impacts from the operations stage of the proposed action would be SMALL.

3.11.2.3.2 Radiological Impacts to Workers from Incident-Free Transportation

The NRC staff evaluated traffic impacts from shipping equipment, supplies, and produced wastes and from workers commuting during operations. Other impacts evaluated included the radiological and nonradiological health and safety impacts to workers and the public under normal and accident conditions from transportation to and from the proposed FFF.

Operational activities at the proposed FFF would continue to use roadways for workforce commute and radiological and nonradiological shipments. As outlined in section 3.11.2.3.1, operations would require 51 deliveries of uranium source material, 233 deliveries of fabricated fuel, and 60 radioactive waste removals annually.

The nuclear source material transported to the FFF would consist of low enriched uranium (LEU) triuranium octoxide (U_3O_8), high-assay low-enriched uranium (HALEU) U_3O_8, and HALEU dilute uranyl nitrate. The nuclear materials transported from the FFF would consist of fabricated LEU fuel, HALEU fuel and the radioactive wastes generated during the production of the fabricated fuel.

All shipments of nuclear materials and wastes would be conducted in conformance with NRC, U.S. Department of Transportation, and State of Tennessee requirements. The different feedstock materials would all be transported to the FFF by truck. The LEU U_3O_8 feedstock would originate from the Urenco USA national enrichment facility in Eunice, New Mexico; the HALEU U_3O_8 would originate from the American Centrifuge Plant in Piketon, Ohio; and the dilute uranyl nitrate would originate from the Department of Energy Savannah River Site in Aiken, South Carolina. The LEU and HALEU U_3O_8 feedstock would be shipped in Versa-Pac 55 and the uranyl nitrate feedstock would be shipped transported in LR-230 packages. The used LR-230 packages, which would likely contain trace amounts of radioactive contamination, would also be shipped back to the supplier. All of the shipment containers and methods would adhere to the requirements of 10 Code of Federal Regulations (CFR) Part 71, “Packaging and Transportation of Radioactive Material” and 49 CFR Parts 100–180 of Chapter I, “Pipeline and Hazardous Materials Safety Administration, Department of Transportation,” and approved by the NRC under docket number 71-9315. The Versa-Pac and LR-230s packages meet the surface dose rates limits of 10 CFR 71.47(a) and 49 CFR 173.441(a), and shipment batches of containers would meet the dose rate limits of 49 CFR 173.441(d). The final fuel products of the FFF would be distributed from the facility by truck in Versa-Pac 55 packages.

Low-level waste shipments would be packaged in 55-gallon drums and B-25 boxes, in accordance with 10 CFR 71.47(a) and 49 CFR 173.441(a), and analyzed for uranium content prior to shipment to licensed low-level waste disposal sites. Again, the 55-gallon drums and B-25 boxes would meet the surface dose rates limits of 10 CFR 71.47(a) and 49 CFR 173.441(a), and shipment batches would meet the dose rate limits of 49 CFR 173.441(d). Transportation impacts of radiological material are discussed in section 3.11.2.3.1. The NRC staff concludes that the transportation impacts from radiological shipments of the proposed action would be SMALL.

A discussion of radiological impacts to workers from incident-free transportation impacts is provided in section 3.13.

3.11.2.4 Transportation Impacts During Decommissioning

At the end of the license term of the proposed FFF, TRISO-X estimates that post-operational decommissioning activities would require 2 years and up to 150 workers. TRISO-X expects the average number of truck shipments from the site during decommissioning would be bounded by the average daily truck traffic during the construction phase (i.e., 20 roundtrips) (TRISO-X, 2025b). The NRC staff considers this approach reasonable because the volume of materials used to construct the proposed FFF would be expected to be approximately the same or more than the amount of demolition waste produced when the facility is decommissioned. Therefore, the total estimated decommissioning-related vehicles would be 340 trips per day. The NRC staff estimated decommissioning traffic impacts on transportation infrastructure based on a 28.7 percent increase in traffic to account for population growth as estimated in section 3.10.1.1 of the TRISO-X ER (TRISO-X, 2025b). This estimate resulted in an approximate 2.2 percent increase to local traffic. Decommissioning transportation activities relative to current data would account for a 2.8 percent increase as shown in table 3.11-4.

Table 3.11-4 Decomission traffic impacts to average annual daily traffic counts

Location	TDOT location ID	5-year average daily traffic count	Decommissioning-related average daily traffic count	Decommissioning-related impact on local traffic
Oak Ridge Turnpike (SR 95)	73000059	12,379	340	2.7%
Oak Ridge Turnpike (SR 95)[1]	73000059	15,932	340	2.2%

[1] *Oak Ridge Turnpike (TN 95) assuming future population growth of 28.7%.*

The decommissioning-related impact on localized traffic would be minor. In addition, farther away from the HCS, the decommissioning-related traffic on TN 95 and connecting infrastructure would be more dispersed and therefore represent a smaller percentage of existing traffic, making it less noticeable.

This minor increase in traffic for local and regional car traffic would not significantly increase traffic safety problems or road degradation relative to existing conditions. Considering the combination of both the transportation impacts from decommissioning waste shipments and workers commuting, the NRC staff concludes that transportation impacts from the decommissioning stage of the proposed action would be SMALL.

3.11.3 Mitigation

Transportation activities are a vital aspect of manufacturing that cannot be avoided, but negative impacts can be minimized by following established regulations. All shipments of nuclear materials, chemicals, and wastes would be carried out in conformance with NRC, U.S. Department of Transportation, and State of Tennessee requirements, including using truck placarding to identify contents and manifests. Trucks used for transport would be of the design and size deemed appropriate by the applicable regulations and subject to the necessary inspections and maintenance to ensure safe transport.

As required by the City of Oak Ridge, TRISO-X conducted a traffic study to assess the impacts of construction, operation, and decommissioning of the FFF on the intersections of Novus Drive and Imperium Drive at TN-95 (i.e., the two access roads between TN-95 and Renovare Boulevard) and Novus Drive at Palladium Way (TRISO-X, 2024d). None of the intersections currently have traffic signals. The TRISO-X traffic study conclusions recommend installation of a turning lane and acceleration and deceleration lanes on Renovare Boulevard for left and right turns, respectively, at the entrance to the FFF. TRISO-X would implement these recommendations as part of the construction of the FFF. The TRISO-X traffic study concluded the impacts on other roads and intersections assessed in the study were acceptable and these roads would not require modification (TRISO-X, 2024d). To further reduce impacts, the NRC staff recommend a mitigation that TRISO-X schedule shift changes and material deliveries outside of weekday peak hours of 7:00 AM to 8:00 AM and 4:15 PM to 5:15 PM, as defined in the TRISO-X traffic study, to the maximum extent practical. Normal care would be taken by workers and supply or waste shipments when entering or exiting TN 95 with regard to traffic safety. The proposed action is not expected to result in significant transportation impacts, and additional mitigation measures are not identified.

3.12 Socioeconomics

This section describes the socioeconomic context in which the fuel fabrication facility (FFF) is proposed. Potential direct and indirect impacts on socioeconomic metrics of the proposed FFF are discussed. The following subsections summarize the affected socioeconomic environment across these areas: (1) demography (i.e., population characteristics), (2) employment structure and personal income, (3) housing availability and affordability, (4) taxes and public finances, and (5) community services. These subsections include discussions of spatial and temporal considerations, where appropriate.

The Nuclear Regulatory Commission (NRC) staff analyzed socioeconomic data from the U.S. Census Bureau (USCB) and from other governmental sources as reported by the TRISO-X, LLC (TRISO-X) environmental report (ER; TRISO-X, 2025b). The study area for this analysis, also referred to as the region of influence (ROI), includes the following Tennessee counties: Roane, Anderson, Knox, Loudon, and Morgan (figure 3.12-1). If the FFF is licensed and constructed, it would be authorized to operate for 40 years.

3.12.1 Affected Environment

3.12.1.1 Demography

The Horizon Center site (HCS) is in Roane County, within the city limits of the City of Oak Ridge, Tennessee (figure 3.12-1). Oak Ridge spans portions of both Roane and Anderson Counties. Table 3.12-1 provides historical population estimates for the counties within the ROI and the State of Tennessee for comparison. Table 3.12-2 provides the same data for projected populations in future years.

The population in the ROI grew at a similar rate to Tennessee as a whole and is projected to grow at a slightly lower rate than the state through 2065. Historical and projected population growth varies across the ROI. Roane County has experienced materially lower growth than other counties in the ROI and is the only county in the ROI projected to experience negative population growth in future years. The ROI has a lower proportion of minority residents than Tennessee as a whole. Two groups, Black or African American Alone and Hispanic/Latino, together constitute approximately 63 percent of the minority population in the ROI (USCB, 2019).

Median household incomes vary by county, reflecting a mix of urban and rural counties in the region. The weighted average median household income for the ROI is slightly higher than the state household median income. Morgan and Anderson Counties have median household incomes below the state average, while the other counties have median household incomes similar to or above the state average. The ROI's proportion of individuals with income below the poverty level is 14.7 percent, slightly lower than the state proportion of 15.2 percent (USCB, 2019).

Table 3.12-1 Historical population estimates in the ROI

Geography	2000	2010	2020	Percent change 2000–2010	Percent change 2010–2020
Roane County	51,910	54,181	53,404	4.4%	−1.4%
Anderson County	71,330	75,129	77,123	5.3%	2.7%
Knox County	382,032	432,226	478,971	13.1%	10.8%
Loudon County	39,086	48,556	54,886	24.2%	13.0%
Morgan County	19,757	21,987	21,035	11.3%	−4.3%
ROI Total	**564,115**	**632,079**	**685,419**	**12.0%**	**8.4%**
Tennessee	5,689,283	6,346,105	6,910,840	11.5%	8.9%

Source: USCB, 2000, 2010, 2020

Table 3.12-2 Population projections for the ROI

Geography	2020	2025	2045	2065	Percent change 2020–2045	Percent change 2045–2065	Percent change 2020–2065
Roane County	53,404	53,386	51,318	49,249	−3.9%	−4.0%	−7.8%
Anderson County	77,123	78,500	81,560	84,524	5.8%	3.6%	9.6%
Knox County	478,971	494,503	568,606	647,574	18.7%	13.9%	35.2%
Loudon County	54,886	57,606	67,203	78,518	22.4%	16.8%	43.1%
Morgan County	21,035	22,100	22,440	22,521	6.7%	0.4%	7.1%
ROI Total	**685,419**	**706,095**	**791,127**	**882,387**	**15.4%**	**11.5%**	**28.7%**
Tennessee	6,910,840	7,153,758	8,068,601	9,074,458	16.8%	12.5%	31.3%

Source: Boyd Center for Business and Economic Research, 2019; USCB, 2020

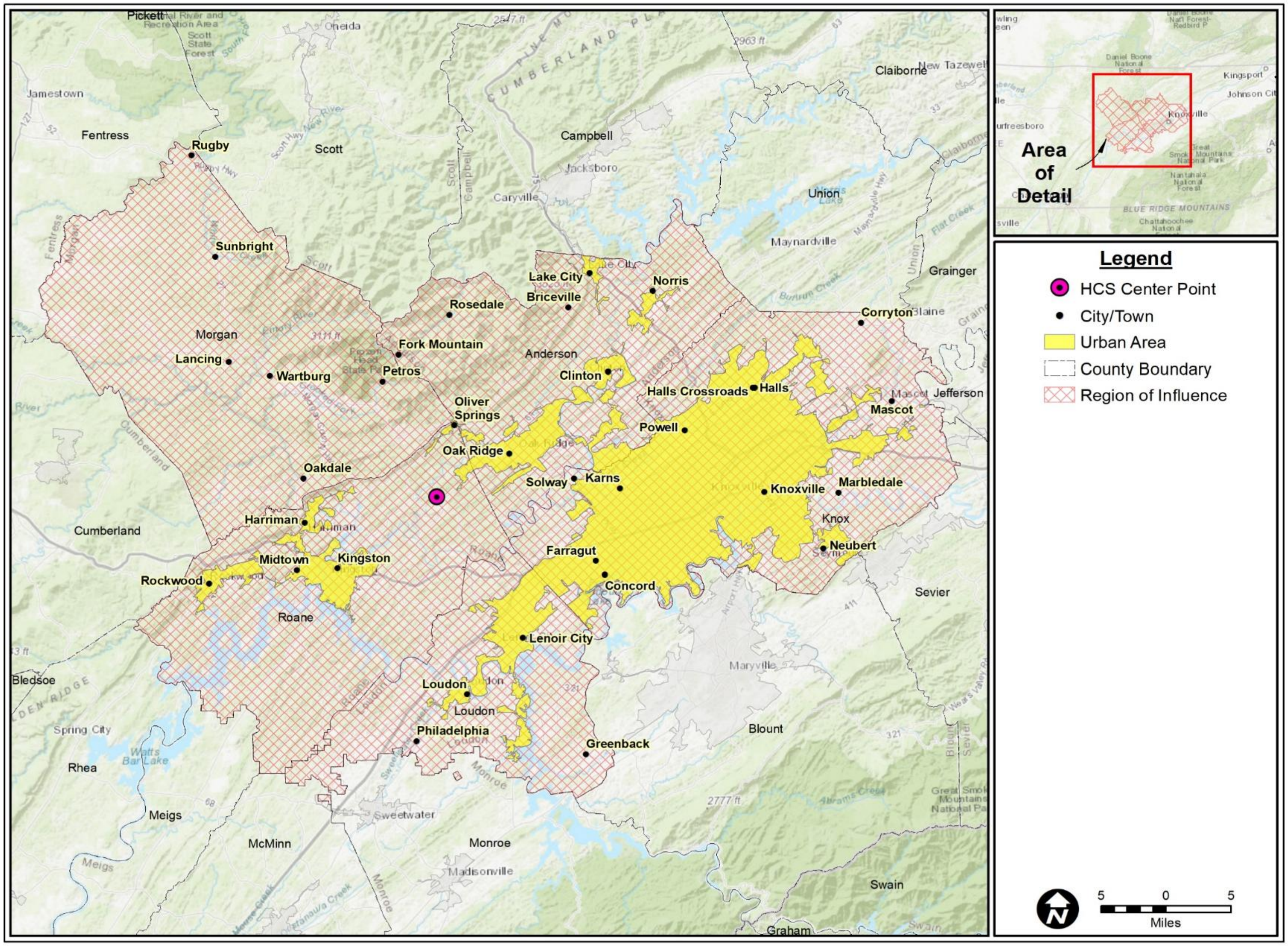


Figure 3.12-3 Socioeconomic region of influence for the FFF (Source: TRISO-X, 2025b)

3.12.1.2 Local Economy

Economic characteristics include the employment conditions, housing market conditions, and overall economic activity in the ROI. Unemployment rates in the ROI are reflective of trends that have been observed across the nation since 2000 (table 3.12-3). Unemployment was relatively low in the ROI in 2000 and then increased materially in 2010, concurrent with economic slowdown associated with the Great Recession of 2008 through 2010. By 2019, unemployment had dropped again to relatively low levels, reflecting the situation before the COVID-19 public health emergency began. Though elevated following the onset of the COVID-19 public health emergency, by summer 2023 unemployment rates across the ROI had dropped below those of 2000 (Federal Reserve Economic Data [FRED], 2023).

Table 3.12-3 Labor force and employment characteristics of the region of influence

	2023					2010	2000
Geography	Total labor force	Labor force in armed services	Employed civilian labor force	Unemployed labor force	Percent unemployed labor force	Percent unemployed labor force	Percent unemployed labor force
Anderson County	35,960	114	34,057	1,789	5.0%	7.5%	5.2%
Knox County	256,308	541	246,587	9,180	3.6%	5.6%	4.4%
Loudon County	25,756	100	24,966	690	2.7%	9.2%	3.6%
Morgan County	8,238	38	7,706	494	6.0%	8.3%	7.0%
Roane County	24,377	84	23,124	1,169	4.8%	8.4%	5.1%
ROI Total	**350,639**	**877**	**336,440**	**13,322**	**4.0%**	**6.4%**	**4.6%**
Tennessee	3,485,218	19,903	3,301,152	164,163	4.7%	8.6%	5.0%

Sources: USCB, 2000, 2010, 2024

According to TRISO-X, employment across the economic sectors in the ROI (in order) are: (1) educational services and health care and social assistance, (2) professional, scientific, and management, and administrative and waste management services, and (3) retail trade (TRISO-X, 2025b). The top five employers in the ROI are Y-12 National Security Complex (Roane County), Knox County Schools (Knox County), the University of Tennessee—Knoxville (Knox County), Oak Ridge National Laboratory (Roane County), and University of Tennessee Medical Center (Knox County) (TRISO-X, 2025b). These employers as well as other top employers in the area coincide with the overall employment by industry patterns described above, with concentrations in education, health care, and professional/scientific services.

The size of the economy in each of the five counties of the ROI for 2021, as measured by gross domestic product (GDP), are as follows (FRED, 2022a; 2022b; 2022c; 2022d; 2022e):

- Anderson County: $5.98 billion
- Knox County: $32.12 billion
- Loudon County: $2.48 billion
- Morgan County: $0.38 billion
- Roane County: $2.94 billion

The overall size of the economy of the ROI, as measured by GDP in 2021, is therefore $43.9 billion.

3.12.1.3 Housing

Based on USCB American Community Survey data from 2019-2023, which are generally indicative of trends, the local housing market, including single-family homes, mobile homes, and multi-family buildings, has over 25,000 vacant housing units across the ROI. Of these, approximately 55 percent are in Knox County, with at least 1,300 vacant units in every other county. Vacant housing units that are categorized as “for rent” total 4,450 across the ROI. Vacant housing units that are categorized as “for sale only” total 2,062 across the ROI (USCB, 2025).

3.12.1.4 Fiscal Resources and Collections

The state and local tax structure for all of Tennessee, unless specifically noted at the city or county level, is found in Title 67 of the Tennessee Code Annotated and its revisions. Income taxes, privilege and excise taxes, sales and use taxes, and property taxes contribute to the total funds for the State of Tennessee. The state has no personal income tax on salaries and wages.

Corporate income taxes are levied pursuant to guidelines contained in Title 67 of the Tennessee Code Annotated. These include franchise taxes, based on the greater of net worth or the book value of real or tangible personal property owned or used in Tennessee, and excise taxes, based on net earnings or income for the tax year. Sales tax for the state is collected at 7 percent while county plus local taxes collect a maximum of an additional 2.75 percent. In Roane County, for example, total sales tax rates including state, county, and local tax (if applicable) varies between 9.5 percent and 9.75 percent depending on location of the sale (TN.gov, 2025).

The appraised value of property is determined by the county assessor and constitutes the base for all property taxes, including those levied by cities and towns on property located within the municipality. Properties in Tennessee are reappraised on 4- to 6-year cycles. Table 3.12-4 reports tax revenue by category for the five counties within the ROI for fiscal year 2021. Total tax revenue across the five county governments in the ROI is approximately $326 million for fiscal year 2021.

According to the Tennessee Comptroller of the Treasury (2022a), assessment values for tax purposes are established at 25 percent for residential property and 40 percent for commercial and industrial property. Furthermore, combined property tax rates for both the City of Oak Ridge and Roane County, where the HCS is located, have varied between $4.57 and $5.25 per $100 assessed value (Tennessee Comptroller of the Treasury, 2022b).

Table 3.12-4 County tax revenue by category for fiscal year 2021[1]

Category of tax	Anderson County	Knox County	Loudon County	Morgan County	Roane County
Property	$20,545,803	$186,269,007	$18,394,113	$6,944,680	$19,193,515
Sales	$3,187,447	$20,394,798	$2,055,738	N/A[2]	$1,687,395
Lodging	$423,965	$7,404,768	$514,708	N/A	N/A
Business	$1,363,386	$11,541,602	$767,621	N/A	$849,951
Additional local taxes	$ 658,056	$17,009,078	$2,011,584	$1,906,705	$2,394,125
Total	$26,478,657	$242,619,253	$23,743,764	$8,851,385	$24,115,986

Sources: Anderson County, 2021; Knox County, 2021; Loudon County, 2021; Morgan County, 2021; Roane County, 2021
[1] Fiscal year 2021 extends from July 1, 2020, through June 30, 2021
[2] N/A = not available

3.12.1.5 Community and Public Services

This section provides baseline information regarding local services and infrastructure in the ROI, especially as relevant to the HCS.

3.12.1.5.1 Education

Approximately 210 primary and secondary schools exist within the ROI, including both private and public institutions (TRISO-X, 2025b). These approximately 210 schools provide education to over 90,000 students and employ over 6,900 teachers in full-time equivalent units. In addition to primary and secondary schools, several institutions of higher learning are located within the ROI, including the University of Tennessee—Knoxville, Roane State Community College, Pellissippi State Community College, Johnson University, Tusculum College, South College, Crown College, Knoxville College, and the Tennessee College of Applied Technology. In general, the population of the ROI has more advanced education than the general population in the state. In 2019, approximately 27 percent of individuals 25 years and over living in Tennessee had received a bachelor's or more advanced degree, whereas 32 percent of individuals within the ROI had received similar degrees (TRISO-X, 2025b).

3.12.1.5.2 Hospitals and Health Care

Health care services in the ROI are provided by 12 hospitals as well as numerous other licensed health care facilities. One hospital (Methodist Medical Center) is in Oak Ridge, Tennessee, and is approximately 7.5 miles northeast of HCS. The Methodist Medical Center is a 301-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, 2022).

3.12.1.5.3 Fire and Police

The City of Oak Ridge Fire Department consists of four fire stations. The closest of these to the HCS is Station 4, located approximately 2 miles southwest of the HCS (TRISO-X, 2025b). Across these four fire stations are various fire trucks, rescue vehicles, support/command vehicles, ambulances, and a hazmat truck. The Oak Ridge Police Department is the principal law enforcement agency servicing the HCS. All five ROI counties also have sheriff departments that provide additional resources as needed.

3.12.1.5.4 Transportation and Traffic

The ROI and the areas encompassing the HCS are served by a transportation network of federal and state highways, as well as freight rail lines; navigable waterways (Clinch River and Tennessee River); and a regional airport, Knoxville Downtown Island Airport. Transportation associated with construction, operation, and decommissioning of the FFF would be limited to the federal and state highways. For greater detail on transportation services and infrastructure near the HCS, see section 3.11.

3.12.1.5.5 Water and Wastewater

The HCS would be serviced with municipal water and wastewater collection by the City of Oak Ridge Public Works Department. This department obtains its water from the Melton Hill Reservoir at a maximum capacity of 9.9 million gallons per day (MGD). The average daily consumption is 7.7 MGD with maximum capacity over 2 MGD higher, at 9.9 MGD (Tennessee Valley Authority [TVA], 2019). The City of Oak Ridge is planning a new membrane filtration water treatment plant south of Bethel Valley Road on the Clinch River, with the capacity to treat 16 MGD (*Oakridger*, 2024). The new plant is expected to be in operation in 2026 (*Citizen Portal*, 2025). Wastewater is treated by the City of Oak Ridge, which has two wastewater systems representing over 30 MGD of treatment capacity (City of Oak Ridge, 2022).

3.12.2 Socioeconomic Impacts

Socioeconomic impacts are investigated across the three phases of FFF development: construction, operation, and decommissioning. During all phases, impacts are subject to uncertainty. During each phase of the project, many factors can directly or indirectly affect the local area. Unrelated future changes in the ROI like growth or decline of new or existing industries, populations, and/or economic and commuting patterns can offset any effects resulting from the NRC’s licensing decision in unanticipated ways.

Impacts to socioeconomic resources from all three phases of the proposed action are primarily associated with the segment of the workforce that would move into the ROI, the additional demands they would place on public services, and the changes in tax revenues and overall economic activity that each phase of development generates.

The socioeconomic issues that fall within the scope of this socioeconomic analysis include the direct and indirect effects on population, employment, housing, public services, and taxes in the ROI. Table 3.12-5 presents a framework for categorizing the magnitude of impacts as determined by the proportional change to baseline conditions. These levels are based on the NRC's staff's experience in evaluating the potential impacts on socioeconomic and community resources (NRC, 1996).

Table 3.12-5 Impact definitions for socioeconomic and community resources

Category and significance level of potential impact	Description of affected resources
Employment and economic activity impacts	
Small	Less than 0.1 percent increase in employment
Moderate	Between 0.1 and 1.0 percent increase in employment
Large	Greater than 1 percent increase in employment
Population and housing impacts	
Small	Less than 0.1 percent increase in population growth and/or less than 20 percent of vacant housing units required to house workers moving into the ROI
Moderate	Between 0.1 and 1.0 percent increase in population growth and/or between 20 and 50 percent of vacant housing units required to house workers moving into the ROI
Large	Greater than 1 percent increase in population growth and/or greater than 50 percent of vacant housing units required to house workers moving into the ROI
Impacts on public services and finances	
Small	Less than 1 percent increase in local revenues
Moderate	Between 1 and 5 percent increase in local revenues
Large	Greater than 5 percent increase in local revenues

Sources: NRC,1996, 2005

TRISO-X's estimates of socioeconomic activity during all phases of development are presented here in an adapted form in table 3.12-6. Economic impacts were estimated using geography- and industry- specific multiplier factors from the U.S. Department of Commerce Bureau of Economic Analysis' regional model called the Regional Input-Output Modeling System (RIMS II). These multipliers are an estimate of the extent to which one dollar spent, or one employee hired supports other spending or employment, respectively, as purchases and labor requirements ripple through the regional economy. RIMS II multipliers were applied to estimates of direct costs and direct employment during each stage of the FFF lifecycle to yield estimates of total economic output supported and labor earnings supported, respectively.

Table 3.12-6 Economic impacts by phase of development

	Construction	Operations	Decommissioning
Total phase cost	$767,990,618	(Proprietary)	$182,208,672
Impacts:			
Average annual employment (direct plus indirect)	1,593	5,090	945
Average annual salary and wage earnings (direct plus indirect)	$90,976,169	$248,606,496	$53,961,098
Total output	$1,422,625,821	(Proprietary)	$337,523,344

Source: TRISO-X, 2025b

3.12.2.1 Construction

3.12.2.1.1 Employment and Economic Activity

Selected information regarding construction is provided below:

- Total construction workforce: 166 (maximum of 332 at peak).
- Change in employment: no more than 332 direct jobs filled from within the ROI at any one time.
- Total construction expenditures: approximately $768 million over a 5-year period.
- Total economic output in the ROI resulting from construction: $1.4 billion.

Construction of the proposed FFF is not expected to change the employment level or population of the ROI in material ways. Even with a conservative estimate that all 332 workers would move into the ROI, this represents less than 0.5 percent change in total employment in the ROI. Therefore, impacts on employment are considered SMALL.

Nonetheless, the FFF would be a large employer in the area during construction and would generate tax revenue and personal income, which would stimulate the local economy through multiplier effects as FFF employees spend their income and the FFF purchases a portion of materials and services from the local economy.

The GDP of the ROI was approximately $43.9 billion in 2021. The estimated output, a measure nearly equivalent to GDP, resulting from FFF construction over the 5-year construction period is approximately $285 million annually, assuming that the total output of approximately $1.4 billion is evenly split across each year of construction. This annual amount represents approximately 0.7 percent of the 2021 GDP, a MODERATE beneficial impact.

Therefore, construction of the FFF would result in a SMALL to MODERATE beneficial impact on the regional economy and employment.

3.12.2.1.2 Population and Housing Impacts

To fully evaluate the potential impacts on population and housing from construction, the NRC staff conducted a workforce analysis with a conservative approach, including the following assumptions:

- 70 percent of the construction workforce would be drawn from outside the ROI and would move into the ROI for the duration of construction.
- For each worker moving into the ROI, two additional family members would also move into the ROI, one adult and one minor.

This is likely an overestimation because the proportion of workers sourced from the ROI is likely to be far higher and the proportion of workers bringing families is likely to be much lower, in part as a consequence of the relatively short duration of employment of up to 166 weeks, which could be sequential or spread across the 5-year construction period depending on occupation (TRISO-X, 2025b).

With these conservative assumptions, the number of construction workers moving into the ROI would be 116. Under the same set of assumptions, an additional 116 additional adults and 116 additional minors would also move into the ROI as accompanying family members, for a total of 348 additional individuals in the ROI as a result of FFF construction. The NRC staff estimate this influx of workers represents additional demand of approximately 116 housing units.

Neither the conservative estimate of the influx of workers nor their associated housing needs represent material differences from baseline. Therefore, construction of the FFF would result in a SMALL impact on population and housing.

3.12.2.1.3 Impacts on Public Services and Finances

The demand created for goods and services by the FFF construction and the spending of salaries and wages by the construction workforce of approximately $91 million dollars (TRISO-X, 2025b) over the 5-year construction period would increase government revenues from increases in sales tax and corporate income taxes. The exact level of increased government revenue is difficult to estimate accurately. For general approximation, the NRC staff assumes that the roughly $768 million anticipated construction cost would generate approximately $1.68 million per year in tax revenues that would otherwise not have been collected but for construction. This is estimated as 70 percent of all earnings related to construction multiplied by the prevailing combined (county plus municipal) sales tax rate in Roane County and Oak Ridge of 2.75 percent. As earnings are spent in the local area, sales taxes and/or property taxes are collected by the county and city governments. This represents a SMALL beneficial impact.

As a result of the above analysis, the NRC staff concludes that the socioeconomic impacts of construction of the FFF would be SMALL.

3.12.2.2 Operation

3.12.2.2.1 Employment and Economic Activity

Operation of the proposed FFF is expected to modestly change the employment and economic activity level in the ROI. The FFF would be a large employer in the ROI during operation and would generate tax revenue and personal income, which would stimulate the local economy through multiplier effects as FFF employees spend their income and the FFF purchases a portion of materials and services from the local economy.

Through an analysis of U.S. Bureau of Labor Statistics occupational employment statistics and occupation-specific workforce needs during operation, TRISO-X estimated 1,136 employees would be needed from outside the ROI to support the operational workforce (TRISO-X, 2025b). The NRC staff has accepted this analysis as reasonable. This estimate represents approximately 72 percent of the 1,569-person total workforce needed during operations. Notably, this estimate does not account for the enhanced ability to source workers from within the ROI as a result of possible training programs that may be offered in order to prepare residents in the ROI for employment at the FFF.

The 1,136 anticipated employees from outside the ROI represent approximately 0.3 percent of the 2023 employed civilian labor force in the ROI. Therefore, the NRC staff determined that employment change during operation would be a MODERATE impact.

Additionally, assuming an annual payroll of approximately $115.5 million, TRISO-X estimated that an additional $133.1 million would be added to the economy of the ROI annually as indirect salary and wage earnings, resulting in total annual salary and wage earnings of approximately $248.6 million related to operation in the ROI (TRISO-X, 2025b). Relative to the overall economy in the ROI, the NRC staff considers impacts on economic activity from FFF operation as beneficial and SMALL.

Economic activity associated with operation of the FFF beyond that quantified in the paragraph above, like elevated activity in the material supply chain, represents further beneficial impact to the ROI but is currently unquantified and is unlikely to change NRC’s assessment of the magnitude of economic impacts during operation.

3.12.2.2.2 Population and Housing Impacts

Assuming that the 1,136 employees are each accompanied by one additional adult and one additional minor, the total population increase in the ROI is estimated to be 3,408. This represents an approximately 0.5 percent increase in population relative to projected 2025 levels. Therefore, the NRC staff considers impacts on population from FFF operation as MODERATE.

These 1,136 employees and their families may require up to 1,136 housing units in the ROI. Relative to the vacant housing units available in the ROI, the NRC staff considers impacts on housing markets from FFF operation as SMALL.

3.12.2.2.3 Impacts on Public Services and Finances

The additional demands on community services resulting from operation of the FFF is anticipated to be generally proportional to the number of workers and their families moving into the ROI. However, these additional demands are generally offset by the increased revenues collected as taxes by local governments from these workers as well as from FFF operations. Incoming workers during the operations are anticipated to pay property taxes (either directly to the government or indirectly through rental payments to landlords) as well as sales taxes on local purchases. In addition, a conservative estimate of property taxes suggests the FFF would increase incremental property tax revenue at the HCS by approximately $14.7 million annually, due to higher assessed property value, split evenly between Roane County and the City of Oak Ridge (TRISO-X, 2025b). Increases in government revenues associated with sales tax, corporate income taxes, and other tax revenue are expected, and it is likely that a large fraction of these tax revenues would not be collected if TRISO-X operations were not to occur. The NRC staff estimates the increase in tax revenues represents between a 1 percent and 5 percent increase in revenues over the ROI, representing a MODERATE beneficial impact.

As a result of the above analysis, the NRC staff concludes that the socioeconomic impacts of operations of the FFF would be SMALL to MODERATE.

3.12.2.3 Decommissioning

Socioeconomic impacts during decommissioning are not anticipated to occur earlier than 2066. Given the long period between the present time and 2066, impacts from decommissioning are subject to greater uncertainty than impacts from construction and operation. This uncertainty applies both to the quantification of the activities required for decommissioning as well as the future baseline conditions to which they are necessarily compared to determine the significance of impacts per table 3.12-5. For example, the significance of impacts to the housing market during decommissioning requires estimates of housing stock and availability in 2065. In the absence of such estimates, the NRC staff used a bounding analysis to assess the possible significance of impacts.

The NRC staff anticipates that decommissioning activities would generally resemble construction in overall activity levels. Decommissioning impacts are expected to be somewhat less than for construction, with somewhat smaller impacts on the workforce (150 versus 166) and smaller economic output ($338 million over 2 years versus $1.4 billion over 5 years). Because the population projections for the ROI in 2065 estimate a population 28.7 percent larger than today's (table 3.12-2), and because most impacts are compared against a metric that is strongly correlated with population levels, the NRC staff expects that socioeconomic impacts from decommissioning would be no greater than impacts during construction. In other words, the actual impacts of decommissioning are likely to be similar to or less than for construction, while the base against which the impacts are compared are likely to be far larger, leading to lower significance of impacts relative to construction.

As a result of the above analysis, the NRC staff concludes that the socioeconomic impacts of proposed decommissioning of the FFF would be SMALL.

3.12.3 Mitigation

The NRC staff does not expect the proposed FFF to substantively impact the baseline socioeconomic conditions of the ROI beyond population levels during operations, employment during operations, and public finances during operations. Of these socioeconomic impacts, only population increases may not be primarily beneficial.

3.13 Accident Impacts

3.13.1 Affected Environment

This section discusses the environmental impacts associated with potential radiological and hazardous chemical accidents that might occur at the fuel fabrication facility (FFF). The Nuclear Regulatory Commission (NRC) staff performed an independent verification of the applicant's technical report to analyze potential accident scenarios and associated consequences at the FFF and presented the results in its safety evaluation report (SER). The NRC's SER, which is a technical evaluation of the proposed manufacturing process, is part of the regulatory process that the NRC uses to decide whether to issue a special nuclear material license for possession and use of special nuclear material for the FFF.

The term "accident," as used in this section, refers to any off-normal event that may affect the health or safety of facility workers and/or members of the public due to the release of, or exposure to, radioactive material or hazardous chemicals. The accidents described in this section are associated with processes and activities that would occur at the FFF.

Potential initiating events and credible operational accidents identified for the FFF are referred to as design-basis accidents (DBAs). Credible accident scenarios are identified by systematically identifying potential accidents and their associated probabilities. Accidents that involved chemicals, fires, mechanical failures, inadvertent criticality[6], and radiation exposures were evaluated according to submittals presented in section 3.2.1 of the license application (TRISO-X, LLC [TRISO-X], 2024c) using the methods listed in NUREG-1513, *Integrated Safety Analysis Guidance Document* (NRC, 2001). The potential accidents involving unmitigated emissions were categorized as low-, intermediate-, or high-consequence level for radiological or chemical exposures to workers or the public according to the criteria in 10 Code of Federal Regulations (CFR) 70.61(b) and (c). Consequence levels for the environment were classified as low or intermediate.

The unmitigated consequences of analyzed accidents were evaluated using methods described in NUREG/CR-6410, *Nuclear Fuel Cycle Facility Accident Analysis Handbook* (NRC, 1998). Mitigations are designed so intermediate-consequence events would be unlikely and high-consequence events would be highly unlikely. The proposed FFF accident mitigations would be designed and built to withstand any internal (e.g., caused by a component failure), or external (e.g., caused by a weather or natural phenomena event) analyzed accident, without loss of capability needed to mitigate consequences. The high-consequence accidents are called DBAs because the facility is designed to mitigate the credible accidents that are severe or moderately severe. These mitigations are required under NRC regulation 10 CFR 70 Subpart H (section 70.61).

The analyzed consequences included uptakes of soluble uranium by workers or members of the public and potential accidental release of liquids to surface water. The radiation doses associated with accidental airborne releases of high-assay low-enriched uranium (HALEU) fuel were found to dominate the final determinations of the severity of accidental releases.

[6] Criticality is defined as the condition in which each nuclear fission event releases a sufficient number of neutrons to achieve a self-sustaining series of reactions.

3.13.2 Environmental Impacts

This environmental impact statement (EIS) considers potential accidents that are bounding DBAs for the FFF and uses the impacts from those bounding accidents as the basis for determining the environmental impacts from potential accidents at the proposed FFF. Although some types of accidents could involve both radiological and chemical hazards, for this EIS, the radiological and chemical hazards of potential accidents are considered separately. Radiological consequences of accidents at the FFF are discussed in section 3.13.2.1, and the consequences of accidents that involve chemicals are discussed in section 3.13.2.2.

TRISO-X evaluated the consequences of accidents at the FFF and the controls (e.g., Items Relied on for Safety [IROFS]) it would use to prevent or mitigate the consequences of accidents against the performance requirements in 10 CFR 70.61, “Performance Requirements.” The NRC performance requirements for accidents in 10 CFR 70.61 require that TRISO-X limit the risks of credible high-consequence and intermediate-consequence radiological and/or chemical events by applying engineered controls and/or administrative controls to reduce the likelihood and consequences of these events and ensure that all nuclear processes are subcritical under normal and credible abnormal conditions. To comply with 10 CFR 70.61, TRISO-X must have controls that:

- For any credible high-consequence radiological and/or chemical accident, either reduce the likelihood of the accident such that it would be highly unlikely or reduce the consequences such that they would either be intermediate-consequence or low-consequence (i.e., less-than-intermediate consequence); and
- For any credible intermediate-consequence radiological and/or chemical accident, either reduce the likelihood of the accident such that it would be unlikely or reduce the consequences such that they would be low-consequence (i.e., less-than-intermediate consequence); and
- Limit the risk of nuclear criticality accidents by ensuring that under normal and credible abnormal conditions, all nuclear processes are subcritical (i.e., the likelihood of a criticality excursion is beyond extremely unlikely).

Threshold consequence levels that define high- and intermediate-consequence radiological or chemical accidents for the purposes of evaluating compliance with 10 CFR 70.61 are provided in section 3.13.1. An unlikely accident is an accident that is not likely to occur during the lifetime of the facility.

3.13.2.1 Radiological Accidents

This section discusses the potential onsite and offsite radiological consequences of unmitigated accidents at the FFF and controls to prevent or mitigate the potential consequences. The threshold consequence values that define high- and intermediate-consequence radiological accidents are provided in 10 CFR 70.61.

TRISO-X considered a variety of potential nuclear criticality or radioactive material DBAs, including:

- Liquid spills or fires with radiological or criticality safety consequences;
- Effluent control accidents with radiological consequences;

- Process system accidents with radiological or criticality safety consequences including mechanical failures or human errors that cause or amplify consequences;
- Loss of electrical power with radiological or criticality safety consequences; and
- Natural phenomena (i.e., external events) with radiological or criticality safety consequences (TRISO-X, 2022a: chapter 3; 2022b).

Other events were either determined to be bounded by the consequences of the analyzed events or were determined, based on low likelihood, to be beyond highly unlikely and therefore to pose an acceptably low level of risk (TRISO-X, 2024c). The facility design is required, under 10 CFR 70.64(b), to incorporate a defense-in-depth approach to accident prevention and mitigation.

In addition, TRISO-X applied a conservative method to estimate the source term, which is the fraction of the uranium inventory that would be released by an accident (NUREG/CR-6410). Because of these conservative initial conditions and assumptions, TRISO-X's bounding radiological accident is a hypothetical radioactive material release with a maximized source term and all material in the source term being released to the environment (no mitigation).

The bounding radiological accidents that could impact the public and the environment, as identified in the integrated safety analysis (ISA; ISA section 4.12.2.3.2), include:

- Major fire inside a process building; and
- Nuclear criticality inside the process building.

The consequences for the fire DBAs were determined to be high for workers and the public, but intermediate for the environment. The consequences for the criticality accident were determined to be high for workers, low for members of the public, and not applicable to environmental damages because the detrimental effect is primarily direct radiation.

Therefore, both DBAs represent accident scenarios with high consequences, and TRISO-X is required to design and operate the FFF such that the likelihood of the DBAs is highly unlikely. The threshold for a highly unlikely event is one event in 100,000 years.

Similarly, accident scenarios that were determined to result in intermediate consequences must either be mitigated to reduce the consequences to a low-consequence category or reduce the likelihood of the accident to unlikely.

TRISO-X has proposed engineering design features and administrative controls that would prevent the initiation of nuclear or radioactive material accidents or mitigate their consequences (TRISO-X, 2024c). These include controls such as:

- Hot cells, confinement boundaries, and shielding in process areas;
- Welded piping and process columns;
- Overflow collection, level monitoring, and automatic isolation controls;
- Sumps to capture and contain spilled liquids;
- Radiation monitoring;
- An emergency nitrogen purge system that would limit the likelihood of fires; and

- Design of the facility ventilation system and dissolution off-gas treatment system, including the use of filters and scrubbers to remove radioactive vapors and particulates (TRISO-X, 2024c, 2025b).

TRISO-X has also proposed additional preventative controls specific to nuclear criticality accidents, including:

- Geometry of, and spacing between, process vessels; and
- Geometry of liquid collection sumps (TRISO-X, 2025b).

TRISO-X also stated that nuclear criticality controls proposed in its preliminary safety analysis report (SAR) would be designed such that process systems would remain subcritical under normal and credible abnormal operating conditions.

The NRC staff's safety review will determine if the controls are designed, implemented, and maintained to ensure they are available and reliable to perform their preventative and mitigating functions when needed. The NRC staff will also determine whether the controls are sufficient to ensure that the likelihood and/or consequences of any credible radiological accidents at the FFF would be reduced such that the proposed facility would be in compliance with the performance requirements in 10 CFR 70.61 and concluded that the impacts from potential nuclear or radioactive material accidents at the proposed FFF would be SMALL because the likelihoods are unlikely.

3.13.2.2 Hazardous Chemical Accidents

This section discusses the potential onsite and offsite hazardous chemical exposure consequences of accidents at the FFF and engineered and administrative controls to prevent or mitigate the potential consequences. TRISO-X prepared a detailed analysis of potential chemical accidents, consequences, mitigations, and impacts in its ISA. The accidents that involve hazardous chemicals, and that could result in chemical exposure to workers or members of the public, involve possible loss of confinement due to mechanical impact, natural events, human error, and potential fires. Fire modeling indicates an unmitigated fire potentially results in the loss of confinement of multiple process vessels. The chemical hazards include:

- Nitric acid spill or fume release;
- Uranyl nitrate spill;
- Silicone compound spill;
- Ammonium hydroxide spill;
- Uranium oxycarbide spill or fume release;
- Propylene/acetylene/hydrogen release;
- Chemical burns from contaminated solutions during sample analysis; and
- Release of other chemicals, such as acetic acid, hydrogen peroxide, ammonia, carbon monoxide, or carbon dioxide, that would be present at the proposed FFF (TRISO-X, 2022a: chapter 3; 2022b).

The chemical accidents evaluated by TRISO-X are hypothetical severe chemical accidents that bound other potential chemical accidents at the FFF. The accidents involve unmitigated releases of process chemicals, including nitric acid, hydrogen peroxide, ammonia, and carbon dioxide (TRISO-X, 2024c, 2025b). The results of the chemical accident analyses were compared to the threshold consequences in 10 CFR 70.61 and to the EPA's acute exposure guidelines (EPA, 2016).

For the chemicals analyzed, the material at risk (MAR) was based on the estimated maximum inventory of each chemical at the FFF. In addition, no credit was taken for depletion or plate-out of any chemicals, either within the FFF or during transport to receptor locations (TRISO-X, 2024c, 2025b).

The bounding nonradiological accidents that could impact the public and the environment, as identified in the ISA (ISA section 4.12.2.3.2), include:

- Major fire due to a flammable gas explosion inside a process building; and
- Methyltrichlorosilane (MTS) release outside the buildings.

The ISA determined that the flammable gas explosion results in a high consequence for the public. The bounding MTS release would also create a high consequence for the public (TRISO-X, 2025b).

For evaluating possible chemical release exposures to members of the public, TRISO-X assumed that the releases would occur at ground level. TRISO-X calculated airborne chemical concentrations at the location of a maximally exposed offsite individual (MOI) at a point along the FFF site boundary and at the location of the nearest resident.

To determine human health impacts associated with the accidental release of hazardous chemicals, estimated airborne chemical concentrations are compared against protective action criteria (PAC) limits. In anticipation of a possible uncontrolled release, these limits may also be used to estimate the consequences of the possible uncontrolled release and to plan emergency responses (DOE, 2008).

The analysis presented in the ISA shows that possible chemical accidents involving releases of nitric acid and/or ammonia would pose a high risk to human health. For nitric acid and ammonia, the MOI could be exposed to concentrations that are significantly greater than PAC-3 values. At these concentrations, it is predicted that individuals could experience life-threatening health effects or death. Additionally, the individuals at the nearest residence could be exposed to concentrations that are above PAC-1 values but below PAC-2 values, and these individuals could experience transient, non-disabling health effects including notable discomfort or irritation. However, since the effects on individuals at the nearest residence would be non-disabling, the effects would likely not impair the individuals' ability to take protective action (i.e., seek shelter or evacuate to a location farther away from the FFF). A sodium hydroxide release could also cause PAC-2 limits to be exceeded at locations occupied by members of the public (TRISO-X, 2022a: chapter 3; 2022b).

In response to NRC's requests for additional information, TRISO-X indicated that accidental releases of carbon monoxide could result in maximum offsite concentrations that exceed PAC-2 levels and accidents involving acetic acid, methyltrichlorosilane liquid or methyltrichlorosilane gas could exceed PAC-1 levels (TRISO-X, 2023a).

The NRC staff considered the consequences of the chemical accidents that TRISO-X stated would be bounding chemical accidents for the FFF. The NRC staff determined that unmitigated, credible accidents at the proposed FFF could be high-, intermediate-, or low-consequence for chemical exposure to members of the public or facility workers, depending on the type and quantity of chemicals involved.

TRISO-X has proposed various controls (including passive and active engineering design features and administrative controls) that would prevent the initiation of hazardous chemical accidents or mitigate their consequences.

These mitigations generally involve use of confinement boundaries and barriers in process areas, to confine spills or releases and protect workers from liquid sprays, other active and passive engineering controls, and administrative controls (TRISO-X, 2025).

The analysis presented by TRISO-X in the ISA indicates that sufficient mitigation and prevention controls are designed for the FFF to reduce the consequences and likelihoods of potential high- and intermediate-category accidents sufficiently to satisfy 10 CFR 70.61 requirements. The NRC staff conducted an independent review of the consequences of hazardous chemical accidents at the proposed FFF and of the engineered and administrative controls (e.g., IROFS) proposed by TRISO-X. The NRC staff determined that the controls will be designed, implemented, and maintained to ensure they are available and reliable to perform their preventative and mitigative functions when needed. The NRC staff also determined that the controls are sufficient to ensure that the likelihood and/or consequences of any credible hazardous chemical accidents at the proposed FFF would be reduced such that the proposed facility would be in compliance with the performance requirements in 10 CFR 70.61 and concluded that the impacts from potential hazardous chemical accidents at the proposed facility would be SMALL.

3.13.2.3 Transportation Accidents

The NRC has previously evaluated potential environmental impacts of the transportation of radioactive materials on public roads and by air.

Radioactive materials that may present a hazard in transportation must be shipped in packages that satisfy DOT standards in 49 CFR parts 100 to 177. DOT's standards for Type A packages address hazards encountered in normal transportation. Radioactive materials that exceed the limits for Type A packages must be shipped in Type B packages. Type B packaging provides a high degree of assurance that the package integrity will be maintained even during severe accidents, with essentially no loss of the radioactive contents or serious impairment of the shielding capability. Type B packaging must satisfy stringent testing criteria (as specified in 10 CFR Part 71) that were developed to simulate conditions of severe hypothetical accidents, including impact, puncture, fire, and immersion in water. The most widely recognized Type B packaging are the massive casks used to transport highly radioactive spent nuclear fuel from nuclear power stations (Leidos, 2023).

The NRC examined the transportation of radioactive material in NUREG–0170 (NRC, 1977b). The NRC determined that the environmental impacts, radiological and nonradiological, of normal (incident-free) transportation of radioactive materials and the risks and consequences of accidents involving radioactive material shipments in packages that comply with U.S. Department of Transportation (DOT) regulations (49 CFR 173) and for which the NRC has issued design approvals meeting the performance standards of 10 CFR Part 71, are SMALL (49 FR 9375). Federal transportation regulations, shipping practices, and basic package designs for transporting radioactive material have remained essentially unchanged since 1977. In the case of HALEU fuel, package content limits have been reduced to compensate for higher enrichment levels. For example, the DN30-20 package is qualified to hold about half the mass of HALEU that could be transported in a cylinder designed for low enriched uranium (Leidos 2023). Recent NRC assessments of the safety of radioactive materials transportation focused on shipping HALEU materials and are published in NUREG–2125; these assessments show that the potential environmental impacts associated with transportation of HALEU fuel materials are smaller than projected in 1977 (NRC, 2014). The NRC staff concludes the potential impacts from transportation of inbound fuel feedstock material and outbound final fuel product (including transportation of associated radioactive materials during operation) would be SMALL. Leidos Inc. (2023) performed a similar assessment in a technical report that supports the DOE's programs to support commercial development of HALEU fuel. The Leidos report states in table 6-3, Summary of the Transportation impacts for the Various Steps in a HALEU Fuel Cycle, that, "the analysis of impact is based on the results presented in NUREG1938 (NRC, 2012b) and adjusted for the differences…in the form of UO_2 or metal in their respective transportation packages. Consistent with the NRC's conclusions in the cited enrichment facility NEPA document, the overall transportation impacts are SMALL."

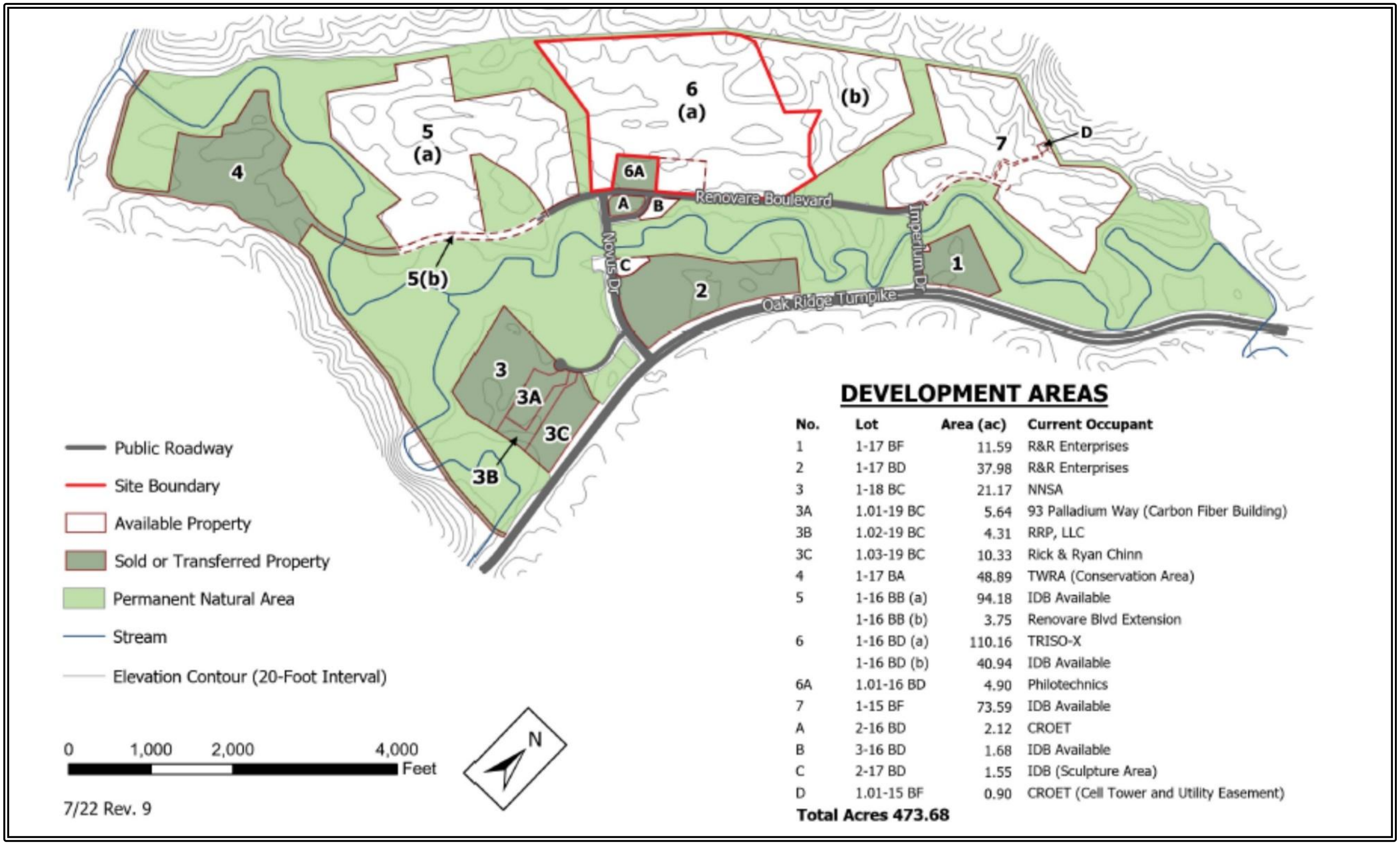
Although it is not a bounding radiological accident and it is technically a facility accident, not a transportation accident, it is worth noting that a liquid spill of the entire contents of one shipping package (230 gallons of uranyl nitrate) would result in a low radiological consequence to the public and the environment (TRISO-X, 2025).

3.14 Reasonably Foreseeable Cumulative Effects

The NRC staff has developed this EIS using the requirements described in the 10 CFR Part 51 regulations. This EIS considers reasonably foreseeable cumulative effects for each environmental resource. This section of the EIS is intended to describe the relevant reasonably foreseeable projects potentially impacting and impacted by the proposed action, leaving the resource-specific impacts analyzed and described in the respective resource sections of chapter 3. Relevant reasonably foreseeable future actions potentially impacting and impacted by the proposed action are described in appendix C. The projects listed were determined by information provided in TRISO-X, LLC's (TRISO-X's) environmental report (ER; TRISO-X, 2025b) and the NRC's own research. The geographic area of interest for reasonably foreseeable cumulative effects is generally defined as the area where effects from the construction, operation, and decommissioning of the proposed FFF could affect or overlap with resources also affected by other projects. The geographic area of interest for effects therefore varies by resource.

3.14.1 Reasonably Foreseeable Cumulative Activities

The proposed FFF would be within the Horizon Center Industrial Park (HCIP), which is owned by the Oak Ridge Industrial Development Board (IDB; Oak Ridge IDB, 2023). The purpose of the HCIP is to provide space to facilitate industrial development. The HCIP encompasses 1,000 acres containing existing facilities and with seven development sites. Approximately 500 acres are set aside for environmental preservation. The proposed FFF's preferred location is the HCS (Development Area 6). Figure 3.14-1 depicts the layout of the HCIP.



No.	Lot	Area (ac)	Current Occupant
1	1-17 BF	11.59	R&R Enterprises
2	1-17 BD	37.98	R&R Enterprises
3	1-18 BC	21.17	NNSA
3A	1.01-19 BC	5.64	93 Palladium Way (Carbon Fiber Building)
3B	1.02-19 BC	4.31	RRP, LLC
3C	1.03-19 BC	10.33	Rick & Ryan Chinn
4	1-17 BA	48.89	TWRA (Conservation Area)
5	1-16 BB (a)	94.18	IDB Available
	1-16 BB (b)	3.75	Renovare Blvd Extension
6	1-16 BD (a)	110.16	TRISO-X
	1-16 BD (b)	40.94	IDB Available
6A	1.01-16 BD	4.90	Philotechnics
7	1-15 BF	73.59	IDB Available
A	2-16 BD	2.12	CROET
B	3-16 BD	1.68	IDB Available
C	2-17 BD	1.55	IDB (Sculpture Area)
D	1.01-15 BF	0.90	CROET (Cell Tower and Utility Easement)

Total Acres 473.68

Figure 3.14-1 City of Oak Ridge Industrial Development Board development areas (Source: TRISO-X, 2025b)

3.14.1.1 Ongoing Activities at the HCIP

The existing facilities within the HCIP include multiple small businesses as well as the U.S. Department of Energy (DOE) Carbon Fiber Technology Facility (Development Area 3A) and Philotechnics (Development Area 6A). Philotechnics operates as a radiological services and mixed waste (including radioactive waste) brokerage provider and is located adjacent to the proposed FFF site.

In January 2026, BWX Technologies (BWXT) announced the opening of its centrifuge manufacturing development facility (CMDF), located on 97 acres of Development Area 5(a) of the HCIP. The manufacturing facility was constructed to produce centrifuges intended primarily to support uranium enrichment at a BWXT facility under construction in eastern Tennessee (BWXT, 2026).

X-energy proposes to construct and operate a helium test facility (HTF) within the HCIP in Development Area 7. The HTF is intended to replicate the environment of a small modular reactor, without the radioactive material, to test and verify the performance of the reactor components (DOE, 2024). The HTF would be constructed on 5 acres of the approximately 74-acre site constituting Development Area 7. Construction was anticipated to be completed in 2026–2027. The HTF is planned to operate for at least 6 years and up to as many as 26 years.

The Oak Ridge Electric Department (ORED) proposes to expand the infrastructure providing electrical service to the HCS through addition of two new 10-megawatt (MW) transmission circuits within the existing ORED right-of-way between the Blair Road substation, approximately 1.0 mile southwest of the HCS, and the southwest corner of the HCS. Additionally, ORED proposes to construct four 10 MW overhead transmission lines that would extend from a newly constructed substation south of Tennessee State Route 95 (TN 95) northward along Norvus Drive and enter the HCS at its southern point at the intersection of Norvus Drive and Renovare Boulevard (City of Oak Ridge, 2022d; TRISO-X, 2025b).

3.14.1.2 Activities on Undeveloped Portions of the HCIP

As noted above, approximately 500 acres of the HCIP have been set aside as permanent natural areas. In addition, the Tennessee Wildlife Resources Agency (TWRA) maintains approximately 49 acres as a conservation area within the HCIP (Development Area 4). Development Areas 6(b), 7, and B, totaling approximately 113 acres, are available to future industry.

Although the City of Oak Ridge anticipates additional development at the HCIP, particularly for carbon fiber manufacturing, specific plans for further development have not yet been determined.

3.14.1.3 Activities Outside of the HCIP

Projects and potential projects located outside the HCIP are listed and described in appendix C. These projects include the above-mentioned HTF, ORED electrical infrastructure upgrades, and the potential for as-yet-undefined new development within the available development areas.

Other projects include two recently opened facilities: the Oak Ridge Enhanced Technology and Training Center and Ultra Safe Nuclear Corporation’s Pilot Fuel Manufacturing Operation. Operational facilities include the Transuranic (TRU) Waste Processing Center. Ongoing project construction includes the Kairos Reactor Demonstration Project, a DOE Environmental Management Disposal Facility, the City of Oak Ridge's new water treatment plant, and ongoing remediation activities at East Tennessee Technology Park (ETTP), Oak Ridge National Laboratory, and Y-12 National Security Complex. The Oak Ridge Reservation (ORR), which includes the Oak Ridge National Laboratory (ORNL) and the Y-12 National Security Complex, is listed by the U.S. Environmental Protection Agency (EPA) as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/Superfund site. Projects in the planning phase include the Orano Uranium Enrichment Facility, the Kairos Hermes 2 Reactor at the ETTP, Coqui Pharma's Medical Isotope Production Facility, Tennessee Valley Authority's (TVA's) Advanced Nuclear Technology Park, and the City of Oak Ridge's Wilson Street Corridor.

3.14.1.4 Subsequent License Renewal and Decommissioning

It is possible that TRISO-X could request a license renewal beyond the initial 40-year license for the proposed FFF, thereby extending the operation of the FFF and delaying site decontamination and decommissioning. The NRC would review and approve any request for license renewal, which would include a new environmental review and assessment of the amount of funding needed for decommissioning.

Once operations have ceased, the proposed FFF would be decommissioned. TRISO-X would be required to decontaminate and decommission the site to levels that would allow for the release of the facility under the NRC's regulations in 10 CFR Part 20, "Standards for Protection Against Radiation." After completing decommissioning activities, TRISO-X must complete radiation surveys to verify that the site meets the release criteria. Although there are no specific plans for decommissioning at this time, activities associated with decommissioning could cause impacts on the environment. During decommissioning, there could be increased transportation impacts due to increased shipments offsite and additional workers; increases in waste generated for disposal associated with removal of buildings and equipment; and temporary increases in dust and particulate emissions from demolition and emissions from equipment. Availability at a licensed low-level radioactive waste disposal site for the waste from decommissioning activities requires long-term planning. Other potential impacts include effects on tax revenue and employment, changes in worker and public dose, and increased noise from demolition activities.

3.14.2 Reasonably Foreseeable Cumulative Resources Effects Methodology

The NRC's general approach for assessing reasonably foreseeable cumulative effects is based on the NRC's regulations in 10 CFR Part 51, and the NRC's guidance for developing EISs in NUREG-1748 (NRC, 2003). The NRC developed the following methodology for assessing reasonably foreseeable cumulative effects in this EIS:

1. Identify the potential environmental effects of the proposed action and evaluate the incremental impact of the action when added to other reasonably foreseeable future actions for each resource area. Potential environmental impacts of the proposed action are discussed and analyzed in chapter 3 of the EIS.
2. Identify the geographic scope for the analysis for each resource area. This scope will vary from resource area to resource area, depending on the geographic extent over which the potential impacts may occur.

3. Identify the timeframe for assessing reasonably foreseeable cumulative effects. The selected timeframe began with the NRC's acceptance of the application for an NRC license to possess and use special nuclear fuel at the proposed FFF on November 18, 2022 (Accession No. ML22320A110). The reasonably foreseeable cumulative effects analysis timeframe ends in approximately 2066; the date estimated for the expiration of the initial license.
4. Identify ongoing and prospective projects and activities that take place or may take place in the area surrounding the project site. These projects and activities are described in section 3.14.1 and in appendix C.
5. Assess the reasonably foreseeable cumulative effects for each resource area from the proposed FFF and other reasonably foreseeable future actions. This analysis would consider the environmental impacts identified in step 1 and the resource-area-specific geographic scope identified in step 2.

The following terms, as defined in NUREG-1748 (NRC, 2003), describe the level of reasonably foreseeable cumulative effects:

- SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.
- MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.
- LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

The NRC staff recognizes that many aspects of the activities associated with the proposed FFF would have SMALL impacts on the affected resources, as described in chapter 3. It is possible, however, that an impact that may be SMALL by itself, could result in a MODERATE or LARGE reasonably foreseeable cumulative effect when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be significant if it contributed to or accelerated the overall resource decline. The NRC staff determined the appropriate level of analysis merited for each resource area that the proposed FFF potentially affected. The level of analysis was determined by considering the impact level to the specific resource, as well as the likelihood that the quality, quantity, and stability of the given resource could be affected. Table 3.14-1 summarizes the potential reasonably foreseeable cumulative effects of the proposed FFF on environmental resources the NRC staff identified and analyzed for this EIS. The potential reasonably foreseeable effects consider the other reasonably foreseeable activities identified above in section 3.14.1. Resource-specific analyses and discussion of the impacts are included below.

Table 3.14-1 Resource impacts associated with the fuel fabrication facility

Resource	Impact assessment
Land Use	SMALL – The impacts upon land use of the FFF's construction, operation, and decommissioning on areas outside of the HCIP would be negligible, with the same conclusion for other potential development projects within the HCIP and outside projects affecting the HCIP, resulting in a SMALL cumulative effect.
Visual Resources	SMALL – The planned ORED electrical infrastructure upgrades would be underground or located along existing roads with only minor effects to visual resources. The FFF would entail long-term use of a new facility, but operation of the building would be consistent with the HCIP's purpose, zoning, and existing use. Construction of the HTF and the BWXT CMDF, both of which would also be consistent with the HCIP's purpose, zoning, and existing use, would be separated visually from the FFF by the forested permanent natural areas of the HCIP (refer to figure 3.14-1). Other construction projects listed in appendix C would be visually separated from the FFF by forested areas and TN 95 (e.g., the planned Orano Enrichment Facility) and outside the geographic area of interest. Given these factors, we conclude the reasonably foreseeable cumulative effects for visual resources would be SMALL.
Meteorology and Air Quality; Greenhouse Gas Emissions and Climate Change	SMALL – We anticipate that the construction and operation of the projects listed in appendix C would comply with all Tennessee Department of Environment and Conservation (TDEC) requirements, thereby minimizing air emissions. Given the nature of air quality impacts from the FFF in combination with the ORED electrical infrastructure upgrades, HTF, BWXT CMDF, Orano Enrichment Facility, and other projects listed in appendix C, we conclude the reasonably foreseeable cumulative effects to air quality would be SMALL. Climate change effects could overlap with impacts from the proposed FFF. Based on the list of climate change projections for the State of Tennessee in section 3.3, the NRC staff concludes there would be minimal overlap for impacts from both climate change and the proposed action. Climate change is expected to increase warming, cause increased winter and spring precipitation, and increase drought intensity in Tennessee. Climate change impacts are predicted to occur over prolonged periods of time, and the license term of the proposed facility is 40 years. Therefore, impacts from the proposed FFF that may overlap with the impacts of climate change are likely to be minor and SMALL.

Resource	Impact assessment
Geologic Environment – Geology and Soils	SMALL – Given the controlled and localized impacts on geology with the FFF and the expected localized impacts of the ORED electrical infrastructure upgrades, HTF, and BWXT CMDF, the reasonably foreseeable cumulative effects would be SMALL. SMALL – Given the controlled and localized impacts on soils with the FFF and the expected localized impacts of the ORED electrical infrastructure upgrades, HTF, and BWXT CMDF, the reasonably foreseeable cumulative effects would be SMALL.
Water Resources – Groundwater, Surface Water, Wetlands, Floodplains	MODERATE – Increased stormwater discharges to the existing karst features surrounding the HCS resulting from construction of the FFF, HTF, and BWXT CMDF, combined with the current drainage of the surrounding lands, could increase loadings of typical stormwater pollutants to groundwater in the bedrock and increased flow rates at nearby springs and discharge points, thereby impacting groundwater quality in the subsurface and the nearby springs and discharge points. The reasonably foreseeable cumulative effects on groundwater quality due to the increased stormwater flow into the offsite sinkhole would be MODERATE. MODERATE – Given the existing contamination of East Fork Poplar Creek (EFPC), the overall reasonably foreseeable cumulative effects on surface water would be MODERATE. However, because of the engineering controls that would be used to prevent sediment and erosion for the FFF, that would be expected to be used for the ORED electrical infrastructure upgrades, HTF, and BWXT CMDF, and the lack of connectivity to other projects listed in appendix C, the contributions of the FFF to reasonably foreseeable cumulative effects on surface water would be SMALL. There would be no impact upon floodplains or wetlands, as construction of the FFF would not affect any mapped 100-year floodplain or jurisdictional wetlands. However, given likely impacts on floodplains and wetlands resulting from other projects listed in appendix C, reasonably foreseeable effects on these resources would be SMALL. Potable water and water for industrial use would be obtained from and discharged to the City of Oak Ridge's municipal systems, resulting in no impacts for municipal water use and wastewater.

Resource	Impact assessment
Ecological Resources – Terrestrial Resources, Aquatic Resources, and Special Status Species and Habitats	SMALL – Construction of the ORED electrical infrastructure upgrades, HTF, and BWXT CMDF would occur along existing roads, existing transmission line rights of way, or within areas designated for future development and would be expected to have similarly minor potential impacts as the FFF. The other projects listed in appendix C would be expected to have similar impacts as the FFF and are separated from the FFF and each other with ample suitable terrestrial resources habitat between them. Therefore, reasonably foreseeable cumulative effects associated with the FFF in combination with the other projects listed in appendix C would be SMALL. SMALL – Construction of the ORED electrical infrastructure upgrades, HTF, and BWXT CMDF would occur along existing roads, existing transmission line rights of way, or within areas designated for future development. Impacts on aquatic resources would be minimized given the overhead transmission line would span waterbodies including EFPC, and the other projects would also avoid direct impacts to waterbodies. Impacts from the other projects listed in appendix C would be similar to impacts from the FFF. In combination, the reasonably foreseeable cumulative effects would be SMALL. SMALL – Given that no sensitive species were observed at the HCS, the generally low habitat value at the FFF, abundance of ample higher-value habitats among the HCIP permanent natural areas and the Black Oak Ridge Conservation Easement (BORCE) north of the FFF, and the requirement to comply with regulatory measures for listed species including section 7 of the Endangered Species Act for the FFF, ORED electrical infrastructure upgrades, HTF, BWXT CMDF, and other projects listed in appendix C, we conclude the reasonably foreseeable cumulative effects on listed and rare species would be SMALL.
Historic and Cultural Resources	NONE – None of the projects listed in appendix C would overlap with the Area of Potential Effects (APE) for the FFF. The FFF would not affect any eligible archaeological sites, and mitigation would be used to avoid impacts to an identified cemetery. Given these factors, there would be no reasonably foreseeable cumulative effects on historic and cultural resources.
Noise	SMALL – Noise from construction of the planned ORED electrical infrastructure upgrades, EFT, and BWXT CMDF could overlap with construction of the FFF, but the noise would be temporary, intermittent, and localized to within the forested buffer of the surrounding permanent natural areas of the HCIP. Construction of other projects listed in appendix C would be from the HCIP, outside of the geographic area of interest, with any noise generated attenuated by distance and intervening trees and topography. Given these factors, we conclude the

Resource	Impact assessment
	reasonably foreseeable cumulative effects of noise would be SMALL.
Waste Management	SMALL – Given the small amount of hazardous, nonhazardous/standard municipal, and radiological waste produced at the FFF and the amounts of similar waste produced by the other applicable projects listed in appendix C, we conclude the reasonably foreseeable cumulative effects of waste management on the national waste management infrastructure would be SMALL.
Public and Occupational Health	SMALL – The potential release of nonradiological materials is SMALL since released gases would readily disperse into the air near the source. Because the projects identified in appendix C with radiological or otherwise hazardous components are sufficiently far enough away from the FFF and from each other, and given the assumed compliance with all applicable federal, state, and local regulations including those pertaining to safe transportation, storage, and use of hazardous and radiological materials, the reasonably foreseeable cumulative effects of construction and operation of the projects would result in a SMALL risk of cross-project adverse health exposure on workers or the public.
Transportation	SMALL – Construction of the planned ORED electrical infrastructure upgrades, EFT, and BWXT CMDF at the HCIP would contribute to localized impacts on traffic and transportation. TRISO-X would add additional lanes to enhance traffic flow at the HCIP. Transportation impacts would be temporary for construction, but long term for operations. Cumulatively and on a regional basis, these effects would be SMALL. Similarly, potential exposure to the public from the transportation of radioactive or hazardous materials to or from the FFF in combination with other sources would be in accordance with NRC, U.S. Department of Transportation, and State of Tennessee requirements for shipping, resulting in SMALL reasonably foreseeable cumulative effects.
Socioeconomics	SMALL to MODERATE – Earnings and tax revenue for the FFF over decades would result in substantial positive socioeconomic effects, as discussed in section 3.12; however, considered in the context of the five-county region, the reasonably foreseeable cumulative effects would be SMALL. When these effects are combined with the benefits including increased jobs and tax revenue of the other projects listed in appendix C, the reasonably foreseeable cumulative positive socioeconomic effects would be MODERATE. The reasonably foreseeable cumulative effects on community services such as water, wastewater, and schools would be SMALL.

Resource	Impact assessment
Accidents	SMALL – Because the projects identified in appendix C with radiological or otherwise hazardous components are sufficiently far enough away from the FFF and from each other, and in light of assumed compliance with all applicable federal, state, and local regulations, including those pertaining to safe transportation, storage, production, and use of hazardous and radiological materials, construction and operation of the projects would result in a SMALL risk of cross-project risk of accidents adversely affecting employees or the public.

3.14.2.1 Land Use

SMALL – The geographic area of interest is the HCIP. As discussed in more detail in section 3.1, the FFF would convert the HCS (Development Area 6) of the HCIP from greenfield to industrial use. Industrial development is the purpose of the HCIP, and the site is zoned accordingly. The HTF and BWXT CMDF planned or constructed at the HCIP would also be constructed according to the current zoning regulations. The construction and operation of the planned ORED electrical infrastructure upgrades would occur in existing rights of way or roads and would not affect current land use within these areas. The other projects listed in appendix C would be developed and/or operated outside of the HCIP with localized impacts. The impacts upon land use of the FFF's construction, operation, and decommissioning on areas outside of the HCIP would be negligible, with the same conclusion for other potential development projects within the HCIP and outside projects affecting the HCIP, resulting in a SMALL reasonably foreseeable cumulative effect on land use.

3.14.2.2 Visual Resources

SMALL – The geographic area of interest is the maximum distance of visibility of the HCIP from outside areas, determined to be 0.6 mile as discussed in section 3.2. The HCIP is an industrial park, where periodic construction projects would not be unexpected, and visual observation of construction activity would be compatible with the site's zoning and intended purpose. Construction of the planned ORED electrical infrastructure upgrades could overlap with construction of the FFF, but visual observation of construction activity would be temporary, intermittent, and localized to existing rights of way and roads. The FFF would entail long-term use of a new facility, but operation of the building would be consistent with the HCIP's purpose, zoning, and existing use. The HTF would be constructed on 5 acres of the approximately 73-acre Development Area 7. The BWXT CMDF and the HCIP Development Areas are surrounded by permanent natural areas, which would buffer impacts to visual resources of the surrounding areas. Otherwise, the nearest construction projects listed in appendix C would be visually separated from the FFF by forested areas and TN 95 (e.g., the planned Orano Enrichment Facility) and outside the geographic area of interest. Given these factors, we conclude that reasonably foreseeable cumulative effects on visual resources would be SMALL.

3.14.2.3 Meteorology and Air Quality, Greenhouse Gas Emissions, and Climate Change

SMALL – The geographic area of interest for air quality is the HCIP and the surrounding area with other projects identified up to 7.3 miles away. Most of the other projects listed in appendix C are located more than 2 miles from the HCIP. All construction projects listed in appendix C, including the planned ORED electrical infrastructure upgrades, HTF, and BWXT CMDF, would result in air emissions from equipment and activity. However, air emissions from construction projects would be temporary, intermittent, and localized. We anticipate that all construction projects and their operation would comply with all Tennessee Department of Environment and Conservation (TDEC) requirements, thereby minimizing air emissions. Given the nature of air quality impacts from the FFF in combination with the other projects listed in appendix C, we conclude that reasonably foreseeable cumulative effects to air quality would be SMALL.

The impact magnitude resulting from a single source or a combination of greenhouse gas emission sources over a larger region must be placed in geographic context for the following reasons:

- The environmental impact is global rather than local or regional,
- The effect is not particularly sensitive to the location of the release point,
- The magnitude of individual greenhouse gas sources related to human activity, no matter how large compared to other sources, are small when compared to the total mass of greenhouse gases resident in the atmosphere, and
- The total number and variety of greenhouse gas emission sources is extremely large, and the sources are ubiquitous.

Based primarily on the scientific assessments of the GCRP and National Research Council, the EPA Administrator issued a determination in 2009 (74 *Federal Register* 66496) that greenhouse gases in the atmosphere may reasonably be anticipated to endanger public health and welfare, based on observed and projected effects of greenhouse gases, their effect on climate change, and the public health and welfare risks and effects associated with such climate change. Therefore, the NRC staff concludes that the national reasonably foreseeable cumulative effects of greenhouse gas emissions are noticeable but not destabilizing.

Greenhouse gas emissions would be generated by activities at the proposed FFF as well as during the transportation of materials to and from the proposed FFF. The peak year activities at the proposed FFF would generate an estimated 8,900 metric tons (9,811 short tons) of carbon dioxide equivalents (CO_2e) during site preparation and construction, 7,236 metric tons (7,976 short tons) of CO_2e during operations, and 1,300 metric tons (1,433 short tons) of CO_2e during transportation of both radiological and nonradiological materials. Peak annual greenhouse gas emissions for decommissioning would not be expected to exceed the estimate provided above for site preparation/construction. The EPA has established thresholds for greenhouse gas emissions in the Tailoring Rule that define whether sources are subject to EPA air permitting. For new sources, the threshold is 90,718 metric tons (100,000 short tons) of CO_2e per year, and for modified existing sources, the threshold is 68,039 metric tons (75,000 short tons) of CO_2e per year.

As described below, the EIS compares estimated emission levels to such thresholds to provide context for understanding the magnitude of these emissions, which are mostly from mobile and fugitive dust rather than stationary sources. This comparison in the EIS does not document or represent a formal determination for air permitting or regulatory compliance. Emission estimates for the proposed FFF are below the EPA thresholds in the Tailoring Rule. The NRC staff concludes that the activities at the proposed FFF would generate minor levels of greenhouse gases relative to other sources and would have a minor impact on air quality in terms of greenhouse gas emissions. For context, the proposed FFF maximum estimated peak year CO_2e

emissions (i.e., site preparation and construction, 8,900 metric tons [9,811 short tons]) would generate about 0.008 percent of the total projected greenhouse gas emissions in Tennessee of 111.4 million metric tons (122.8 million short tons) of CO_2e in 2021 (EPA, 2023d). This also equates to about 0.0001 percent of the total U.S. annual emission rate of 6.3 billion metric tons (6.9 billion short tons) of CO_2e in 2021 (EPA, 2023e).

The NRC staff estimated the greenhouse gases emissions resulting from transportation of radiological and nonradiological material. Transportation effects are discussed in section 3.11. Transportation activities during construction would include material deliveries, waste or excess material (such as excess soil) removals, and commuting of construction personnel. Transportation during operation would include deliveries of equipment and supplies, removal of produced wastes, and commuting of facility staff. The purpose of this basic estimate was to provide a value for comparison to the EPA thresholds specified in the previous paragraph. Because proposed FFF emission estimates for transporting materials are below the thresholds in the Tailoring Rule, the NRC staff expects that transporting materials for the proposed FFF would have a minor impact on air quality in terms of greenhouse gas emissions.

To provide additional context, transporting materials to and from the FFF would generate about 0.00002 percent of the total U.S. annual emission rate of 6.3 billion metric tons (6.9 billion short tons) of CO_2e in 2021 (EPA, 2023b).

Peak year CO_2e emissions would also be below the reporting threshold of 22,680 metric tons CO_2e and the 68,000-metric-ton-CO_2e threshold for Prevention of Significant Deterioration and Title V permits as established in the greenhouse gas Tailoring Rule.

In summary, the activities from the proposed FFF would generate greenhouse gas levels below the EPA thresholds. Therefore, the NRC staff expects that the proposed action would generate low levels of greenhouse gas emissions relative to other sources and would have a SMALL incremental effect to air quality in terms of greenhouse gas emissions when added to the SMALL impact to air quality from other reasonably foreseeable future actions in the geographic scope of the analysis, resulting in an overall SMALL reasonably foreseeable effect to air quality greenhouse gas emissions in the geographic scope.

Greenhouse gas generation is considered in a nation-wide context; thus, the NRC staff considers it appropriate for the reasonably foreseeable cumulative effects analysis to include carbon footprint as a relevant factor in evaluating distinctions between alternatives, including the no action alternative. The proposed FFF would add another site that generates emissions, but those emissions would be minor. For activities related to transporting radiological and nonradiological materials, the no action alternative would generate fewer emissions than the proposed FFF because no transportation of materials would occur.

Climate change effects could overlap with impacts from the proposed FFF. Based on the list of climate change projections for the State of Tennessee in section 3.3, the NRC staff concludes that there would be minimal overlap for impacts from both climate change and the proposed action. Climate change is expected to increase warming, cause increased winter and spring precipitation, and increase drought intensity in Tennessee. Climate change impacts are predicted to occur over prolonged periods of time, and the license term of the proposed facility is 40 years. Therefore, impacts from the proposed FFF that may overlap with the effects of climate change are likely to be minor.

3.14.2.4 Geologic Environment—Geology and Soils

SMALL (Geology) – The geographic area of interest for geology is the HCIP. As discussed in more detail in section 3.4, the FFF's impact upon geology would be limited to the HCIP. The construction and operation of the ORED electrical infrastructure upgrades, HTF, and BWXT CMDF would require ground disturbance, but reasonably foreseeable cumulative effects would be minor due to relatively shallow disturbance, engineering controls, and construction practices. The other projects listed in appendix C would be constructed outside of the HCIP. Given the controlled and localized impacts on geology from the FFF and the transmission line, reasonably foreseeable effects would be SMALL.

SMALL (Soils) – The geographic area of interest for soils is the HCIP. As discussed in more detail in section 3.4, the FFF's impacts upon soils would be limited to the HCIP (primarily limited to the HCS) through use of engineering practices and sediment and erosion controls. The construction and operation of the ORED electrical infrastructure upgrades, HTF, and BWXT CMDF would disrupt soils at the respective individual locations, but reasonably foreseeable cumulative effects impacts would be minor, in part due to engineering practices and sediment and erosion controls. The other projects listed in appendix C would be constructed outside of the HCIP. Given the controlled and localized impacts on soils from the FFF and the transmission line, reasonably foreseeable cumulative effects would be SMALL.

3.14.2.5 Water Resources—Groundwater, Surface Water, Wetlands, and Floodplains

MODERATE (Groundwater) – The geographic area of interest for groundwater is the HCIP and the surrounding area, with other projects identified up to 7.3 miles away. As described further in section 3.5, groundwater quality has been affected by historical operations of other facilities in the vicinity of the FFF including contaminated groundwater in the ORR and sewage overflows from the City of Oak Ridge's water treatment plant. The construction and operation of the ORED electrical infrastructure upgrades, HTF, and BWXT CMDF, would affect the HCIP, but reasonably foreseeable cumulative effects on groundwater would be minor due to relatively shallow disturbance, engineering controls, and construction practices.

Construction of the FFF would increase impervious surfaces at the HCS and increase the volume of stormwater runoff from the site. Increased stormwater discharges to the existing karst features surrounding the HCS, combined with stormwater discharges from the HTF, BWXT CMDF, and the current drainage of the surrounding lands, could increase loadings of typical stormwater pollutants to groundwater in the bedrock and increased flow rates at nearby springs and discharge points, thereby impacting groundwater quality in the subsurface and the nearby springs and discharge points. The potential impacts on groundwater quality due to the increased stormwater flow into the offsite sinkhole would be MODERATE.

MODERATE (Surface Water) – The geographic area of interest for surface water is the HCIP and the surrounding area with surface drainage connections to the HCIP. As discussed in more detail in section 3.5, the FFF's impacts upon surface water quality and hydrology would be limited to the HCIP (primarily limited to the HCS) using engineering practices and sediment and erosion controls. East Fork Poplar Creek (EFPC), which has been documented to contain elevated levels of polychlorinated biphenyls (PCBs), mercury, and *E. coli*, would be the receiving stream if sediment-laden runoff from the FFF construction site did occur. No regulatory jurisdictional ponds, streams, wetlands, or floodplains would be directly modified or affected by construction of the FFF within the HCS. The construction and operation of the HTF and BWXT CMDF would increase impervious surfaces at the HCIP, but reasonably foreseeable cumulative impacts would be minor due to the expectation that these facilities would also implement robust stormwater engineering practices and sediment and erosion controls. None of the other projects identified in appendix C have surface water connections to the HCIP. Given the existing contamination of EFPC, the reasonably foreseeable cumulative effects on surface water would be MODERATE. However, the engineering controls that would be used to prevent sediment and erosion for the FFF, HTF, and BWXT CMDF, and given the lack of connectivity to other projects, the contributions of the FFF to reasonably foreseeable effects upon surface water would be SMALL.

SMALL (Floodplains and Wetlands) – There would be no impact upon floodplains or wetlands, as construction of the FFF would not affect any mapped 100-year floodplain or jurisdictional wetlands. However, given the likely impacts on floodplains and wetlands resulting from other projects listed in appendix C, reasonably foreseeable cumulative effects to these resources would be SMALL. Potable water and water for industrial use would be obtained from and discharged to the City of Oak Ridge's municipal systems, resulting in no impacts on municipal water use and wastewater.

3.14.2.6 Ecological Resources—Terrestrial Resources, Aquatic Resources, and Special-Status Species and Habitats

SMALL (Terrestrial Resources) – The geographic area of interest for plant and terrestrial resources is the HCIP and the surrounding area, with other projects identified up to 7.3 miles away. As discussed in section 3.6, the FFF would be located on previously disturbed, maintained, largely herbaceous habitats with some invasive plant species present. Approximately 5 acres of forest land could be affected by construction of the FFF, but the amount of habitat is negligible compared to the ample forested and/or higher quality habitats available both within the HCIP permanent natural areas and the adjacent BORCE habitat. Although some common wildlife species using these lower-quality habitats could be killed or displaced by construction, the associated mortality and effects would be minor and would not rise to population-level impacts. Potential impacts on terrestrial resources and habitats resulting from the planned ORED electrical infrastructure upgrades, EFT, and BWXT CMDF, which would be constructed along existing roads and rights of way and in the designated Development Areas of the HCIP, as well as the other projects listed in appendix C, could have similar impacts as the FFF. Reasonably foreseeable cumulative effects associated with the FFF in combination with the other projects listed in appendix C would be SMALL.

SMALL (Aquatic Resources) – The geographic area of interest for aquatic resources is the HCIP and the surrounding area with surface drainage connections to the HCIP. As noted above for surface water and in section 3.6, construction of the FFF would not directly affect aquatic habitats in ponds, streams, wetlands, or floodplains. Runoff from the site could potentially affect the EFPC, but engineering controls would be used to prevent sediment and erosion for the FFF, planned ORED electrical infrastructure upgrades, EFT, and BWXT CMDF. Potential impacts on aquatic resources and habitats resulting from the planned ORED electrical infrastructure upgrades, EFT, and BWXT CMDF, which would be constructed along existing roads and rights of way and in the designated Development Areas of the HCIP, as well as the other projects listed in appendix C would be similar to the FFF impacts. In combination, the reasonably foreseeable cumulative effects of these projects on aquatic resources would be SMALL.

SMALL (Special-Status Species) – The geographic area of interest for special-status species and associated habitats is the HCIP and the surrounding area, with other projects identified up to 7.3 miles away. Although no endangered, threatened, or rare species were observed during field studies as described in section 3.6, and habitat quality is generally limited, potentially suitable habitat for some listed species could be located within the HCIP. TRISO-X would comply with all agency regulations to avoid, minimize, or mitigate potential impacts on special-status species, such as timing of tree felling, to avoid impacts on roosting bats and nesting birds. Given that no sensitive species were observed at the HCS, the generally low habitat value, the abundance of ample higher-value habitats within the HCIP permanent natural areas and the adjacent BORCE, and the requirement to comply with regulatory measures for listed species including section 7 of the ESA for the FFF, and other projects listed in appendix C, we conclude that the reasonably foreseeable cumulative effects of the FFF on special-status species and their habitat would be SMALL.

3.14.2.7 Historic and Cultural Resources

NONE – The geographic area of interest for historic and cultural resources is the direct and indirect Area of Potential Effect (APE) as described in section 3.7. None of the projects listed in appendix C would overlap with the APE for the FFF. The FFF would not affect any eligible archaeological sites, and mitigation would be used to avoid impacts to an identified cemetery. Given these factors, there would be no reasonably foreseeable cumulative effects on historic and cultural resources.

3.14.2.8 Noise

SMALL – The geographic area of interest for noise is 0.6 mile from the HCIP, based on the closest sensitive noise receptor (i.e., residences) being located 0.6 mile to the northwest of the HCIP. Extensive forested areas provide an extensive buffer between the FFF and the nearest residences, thereby attenuating potential noise impacts as described in section 3.8. Further, the HCIP is an industrial park, where periodic construction projects and operation of industry would not be unexpected, and noise levels generated would be compatible with the site's zoning and intended purpose. Noise from construction of the planned ORED electrical infrastructure upgrades, EFT, and BWXT CMDF could overlap with construction of the FFF, but the noise would be temporary, intermittent, and localized. Otherwise, the nearest construction project listed in appendix C would be separated from the HCIP by forested areas and TN 95 (e.g., the planned Orano Enrichment Facility), with any noise generated attenuated by distance and intervening trees and topography. Given these factors, we conclude the reasonably foreseeable cumulative effects of noise would be SMALL.

3.14.2.9 Waste Management

SMALL – The geographic area of interest is the HCIP and the surrounding area, with other projects identified up to 7.3 miles away. The proper minimization, handling, transportation, and disposal of generated waste including radiological, nonradiological, and standard municipal waste would be conducted in accordance with the applicable federal, state, and local regulations as discussed in section 3.9. These processes would apply to the FFF, as well as the other projects listed in appendix C. Hazardous and radiological waste generated by the FFF would be shipped to licensed facilities for disposal, outside of the region. The majority of hazardous and radiological waste generated in the ORR is processed onsite at treatment and disposal facilities. Standard, nonhazardous municipal waste would be disposed of or recycled at a local facility. Given the small amount of hazardous and radiological waste produced at the FFF and in combination with the similar waste produced by the other applicable projects listed in appendix C, we conclude that the reasonably foreseeable effects on the national waste management infrastructure would be SMALL.

3.14.2.10 Public and Occupational Health

SMALL – The geographic area of interest is the HCIP and the surrounding area, with other projects identified up to 7.3 miles away. The nearest residence to the FFF would be 0.6 mile away as discussed in section 3.10. There are presently no nuclear fuel cycle facilities in the immediate area; however, the HCS is near two nuclear reactor facilities: ORNL operates the 85-megawatt thermal (MWt) High Flux Isotope Reactor and the TVA Watts Bar Nuclear Plant (WBNP) operates a two-reactor site with a total power generation of 6,870 MWt (DOE, 2020b; NRC, 2021c, d; ORNL, 2021). The ORNL reactor is approximately 3.5 miles southeast of the HCS, and the WBNP is approximately 35 miles southwest of the HCS. Based on the distance between ORNL/WBNP and the HCS, the dose to the public near the HCS is less than 1 millirems per year (mrem/yr) from these facilities (TRISO-X, 2025b). The NRC has issued construction permits for a new low-power nuclear test reactor (Hermes) and two 35-MWt reactors (Hermes 2) to be built at the ETTP in Oak Ridge (TRISO-X, 2025b). Kairos Power started construction of the Hermes demonstration reactor in 2024 (Kairos Power, 2024). The TVA plans to build a next-generation small nuclear power reactor at the Clinch River site in Oak Ridge (TVA, 2024) and the Orano uranium enrichment facility is proposed for construction south of TN 95 from the HCIP (TRISO-X, 2025b).

In accordance with 10 CFR 20.1301, “Dose limits for individual members of the public,” the NRC requires its licensees to limit the maximum radiation exposure to individual members of the public to 1 millisievert per year (mSv/yr; 100 mrem/yr). The dose to the general public from nuclear fuel cycle facilities, such as fuel-processing plants, nuclear power plants, and transportation routes, has been estimated at less than 1 mrem/yr (0.01 mSv/yr) (DOE, 2022).

Philotechnics, a radiological services and mixed radioactive waste brokerage provider, is located adjacent to the HCS. According to the company website (Philotechnics, 2023), Philotechnics performs waste characterizations, consulting, decontamination and decommissioning, license terminations, and disposals for its clients. Workers employed at Philotechnics may receive a higher radiation dose than the general public due to exposures associated with working at Philotechnics, and the equivalent of the general public dosage of radiation that would be emitted by the FFF. However, the additional exposure still would not exceed the occupational limit set in 10 CFR 20.1201, “Occupational dose limits for adults,” which is 0.05 Sv/yr (5 rem/yr). Philotechnics is licensed by the State of Tennessee (TRISO-X, 2025b).

TRISO-X would implement a radiological effluent monitoring program to ensure that dose limits are met. The results of the monitoring program would be reported to the NRC.

The FFF would be considered a minor source of nonradiological air emissions. Workers at the FFF would be subject to chemical and occupational safety programs to prevent and minimize staff health impacts from radiological and nonradiological hazards in accordance with NRC and Occupational Safety and Health Administration (OSHA) regulations. Because the projects identified in appendix C are sufficiently far enough from the proposed FFF and from each other, and in light of assumed compliance with all applicable federal, state, and local regulations including those pertaining to safe transportation, storage, and use of nonhazardous, hazardous, and radiological materials, construction and operation of the projects would result in a SMALL risk of cross-project adverse health exposure reasonably foreseeable cumulative impacts on workers or the public.

3.14.2.11 Transportation

SMALL – The geographic area of interest is the HCIP and the surrounding area, with other projects identified up to 7.3 miles away. Transportation at the FFF is discussed in section 3.11. The construction, operation, and decommissioning of the FFF would result in increased traffic, particularly on TN 95, State Route (SR) 58, and other local and nearby roads. TRISO-X would install a left turn lane at the facility entrance at Renovare Boulevard along with acceleration and deceleration lanes for right-hand turns, as recommended by its traffic study. Construction of the planned ORED electrical infrastructure upgrades, EFT, and BWXT CMDF would affect traffic within the HCIP, particularly along Norvus Drive and Renovare Boulevard, but the reasonably foreseeable cumulative effects would be minor and temporary. The other projects listed in appendix C, particularly related to the ETTP, would be constructed and/or operated outside of the HCIP, with localized impacts on traffic and transportation. These impacts would be temporary for construction, but long term for operations. Cumulatively and on a regional basis, these impacts would be SMALL. Similarly, potential exposure to the public from the transportation of radioactive materials to or from the FFF in combination with other sources would be in accordance with NRC, U.S. Department of Transportation, and State of Tennessee requirements for shipping containers as detailed in section 3.11.2.3.2, resulting in SMALL reasonably foreseeable cumulative effects.

3.14.2.12 Socioeconomics

SMALL to MODERATE – The geographic area of interest is the five-county region of influence (ROI) consisting of Roane, Anderson, Knox, Loudon, and Morgan Counties, Tennessee. Construction and operation of the FFF, ORED electrical infrastructure upgrades, EFT, BWXT CMDF, other applicable projects listed in appendix C, and unrelated economic development in the five-county region, would increase employment and could contribute to population increases, increase the local economy and tax revenue, and affect local facilities and services. Earnings and tax revenue for the FFF over decades would result in substantial positive socioeconomic effects as discussed in section 3.12, although considered in the context of the five-county region these effects would be SMALL. When these effects are combined with the benefits, including increased jobs and tax revenue of the other projects listed in appendix C, the positive socioeconomic effects would be MODERATE. The impacts on community services such as water, wastewater, and schools would be SMALL.

3.14.2.13 Accidents

SMALL – The geographic area of interest is the HCIP and the surrounding area, with other projects identified up to 7.3 miles away. The nearest residence to the FFF would be 0.6 mile away. The potential for nonradiological and radiological accidents including fires, explosions, and releases, is assessed via an integrated safety analysis (ISA) in accordance with 10 CFR 70(H), “Additional requirements for certain licensees authorized to possess a critical mass of special nuclear material” as discussed in section 3.14. Because the projects identified in appendix C are sufficiently far enough away from the FFF and from each other, and in light of assumed compliance with all applicable federal, state, and local regulations including those pertaining to safe transportation, storage, production, and use of hazardous and radiological materials, construction and operation of the projects would result in a SMALL risk of cross-project risk of accidents adversely affecting employees or the public.

4.0 CONCLUSIONS

This environmental impact statement (EIS) describes the environmental review conducted by U.S. Nuclear Regulatory Commission (NRC) staff of a TRISO-X, LLC (TRISO-X) application for a license pursuant to Title 10 of the Code of Federal Regulations (10 CFR) Part 70 “Domestic Licensing of Special Nuclear Material” and Part 51, “Environmental Protection Regulations For Domestic Licensing And Related Regulatory Functions” If approved the license would allow TRISO-X to possess and use special nuclear material at a fuel fabrication facility (FFF) to be constructed on a 110-acre greenfield site in Oak Ridge, Roane County, Tennessee (TRISO-X, 2024c, 2025b). This EIS follows the requirements in 10 CFR Part 51, which are the NRC’s regulations that implement the National Environmental Policy Act of 1969 (NEPA). This chapter presents conclusions and recommendations based on the NRC staff’s environmental review of the TRISO-X application. Section 4.1 summarizes the environmental impacts from construction, operation, and decommissioning of the TRISO-X FFF. Section 4.2 discusses the unavoidable impacts of the proposed action and identifies resource commitments. Section 4.3 compares the environmental impacts of the proposed action against alternatives identified by the NRC staff. Section 4.6 presents the NRC staff’s conclusions and recommendations.

4.1 Environmental Impacts of the Proposed Action

The NRC staff concludes that issuing a license to TRISO-X to possess and use special nuclear material at the FFF would have generally SMALL but in some cases MODERATE environmental impacts. Table 4.1-1 summarizes the environmental impacts from construction, operations, and decommissioning of the proposed FFF at the Horizon Center site (HCS).

The NRC staff also considered the reasonably foreseeable cumulative effects of reasonably foreseeable actions regardless of which agency (federal or non-federal) or person undertakes them. In section 3.14, the NRC staff concluded that the reasonably foreseeable cumulative effects would be SMALL for all resource areas with the exception of groundwater, surface water, and socioeconomics. For socioeconomics, the NRC staff concluded that the reasonably foreseeable cumulative effects would be SMALL to MODERATE. For groundwater and surface water resources, the NRC staff concluded that the reasonably foreseeable cumulative effects would be MODERATE.

Table 4.1-1 Summary of environmental consequences

Resource	Summary of impact	Impact level
Land use	The entire 110-acre HCS parcel would be cleared of existing trees, excavated, graded, and/or covered with fill during construction in accordance with the City of Oak Ridge zoning classification as a heavy industrial area; operation activities of the FFF would be confined to the bounds of the HCS; and decommissioning of the FFF would consist of potential deconstruction of some parts of the facility while other portions would be decontaminated but remain onsite. The impacts of construction, operation, and decommissioning of the FFF on the land use study area surrounding the HCS are expected to be limited.	SMALL
Visual resources	The HCS location, as it currently exists, is classified as having the lowest visual and scenic value classification under the visual resource management classification system employed by NRC staff. This lowest classification allows for major modifications of the existing landscape. Additionally, built structures and associated lighting that would constitute the FFF would be consistent with the parameters and ordinances of the City of Oak Ridge zoning designations for the HCS.	SMALL
Air quality	Air emissions from the FFF could include nitrogen oxides, carbon monoxide, sulfur oxides, hydrocarbons in the form of volatile organic compounds, hazardous air pollutants, particulate matter having an aerodynamic diameter less than 2.5 microns ($PM_{2.5}$), and particulate matter having an aerodynamic diameter less than 10 microns (PM_{10}). Air emission sources would be managed in accordance with federal, state, and local air quality control laws and regulations. The FFF would comply with all applicable regulatory requirements of the Clean Air Act and Tennessee	SMALL

Resource	Summary of impact	Impact level
	Department of Environment and Conservation (TDEC) requirements to minimize impacts on state and regional air quality. Because the FFF would be a minor source, impacts on ambient air quality would be expected to be minor.	
Geology and soils	Karst features have been identified on the HCS and its vicinity. Subsurface voids in the limestone could cause difficulties with the placement of foundational materials and stormwater detention basins during construction. During operation, increased stormwater runoff has the potential to accelerate dissolution of carbonate features and impact karst features and could increase loading of typical stormwater pollutants, among other impacts. However, TRISO-X would be required to abide by TDEC stormwater regulations and the City of Oak Ridge's Stormwater Management Ordinance (City of Oak Ridge, 2016; TDEC, 2014). TRISO-X has obtained a TDEC National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit (TNR136931) and will comply with the permit conditions and requirements during construction of the FFF. Any changes in karst topography would likely occur relatively slowly over time. Impacts on soils resulting from the proposed action would be minor. TRISO-X would implement best management practices (BMPs) during the construction and decommissioning periods and would plant non-invasive herbaceous vegetation to restore all temporarily affected soils post-construction.	SMALL
Groundwater resources	Buildings associated with the FFF would have foundations of less than 2.5 feet and would not affect groundwater levels, availability, or flow patterns. Water infiltrating into the ground at the detention basin areas could cause mounding of groundwater under the detention basins and subsequently affect surficial groundwater flow surrounding	SMALL

Resource	Summary of impact	Impact level
	the HCS. The effect of the mounding would be to potentially slow infiltration at the basins, and it is unlikely to have a significant effect on groundwater supply or flow at the HCS. Changes to surface water and surficial groundwater flow could result from operation of the FFF due to increased infiltration and changes to flow volumes and discharge locations. Changes to surficial groundwater and surface water flow could affect and exacerbate existing karst features such as voids and sinkholes located both onsite and offsite of the FFF. Changes in flow could cause increased development of existing features, activation of dormant features, and development of new features. Changes to karst topography would occur relatively slowly over time. TRISO-X would inspect the stormwater basins and facility during maintenance for sinkhole development.	
Surface water resources	There are no waterbodies present on the HCS. TRISO-X would implement mitigation measures to control erosion and sedimentation; has developed a stormwater pollution prevention plan (SWPPP) and spill prevention, control, and countermeasures (SPCC) plan; would implement and update the prescribed BMPs during construction to address potential impacts from discharge of sediment or contaminants to surface waters in the vicinity of the HCS; and would obtain all necessary permits such as the National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit and Industrial Storm Water Discharge Permit. TRISO-X would use the City of Oak Ridge municipal water and sanitary sewer systems for all onsite water uses and sewage removal	SMALL
Wetland resources	There are no wetlands documented on the HCS. However, there are wetlands in the adjacent lands. TRISO-X would implement mitigation measures to control erosion and sedimentation; has developed a SWPPP and SPCC plan;	SMALL

Resource	Summary of impact	Impact level
	would implement and update the prescribed BMPs during construction to address potential impacts from discharge of sediment or contaminants to wetlands in the vicinity of the HCS; and would obtain all necessary permits such as the NPDES Construction Stormwater General Permit prior to starting construction.	
Ecological resources—terrestrial resources	The vegetative community in the majority of the HCS is regularly mowed and maintained; herbaceous vegetation with prevalent nonnative species is present. A small percentage of the site consists of mixed and deciduous forest, consistent with the abundant forested land surrounding the site. Wildlife documented to use the site are primarily common, mobile species prevalent in the region that can readily access the undeveloped natural and conservation areas surrounding the HCS.	SMALL
Ecological resources—aquatic resources	There are no aquatic species present at the HCS. To avoid or minimize impacts on aquatic resources in offsite waterbodies, TRISO-X would implement mitigation measures to control erosion and sedimentation and would update prescribed BMPs during construction to address potential impacts from discharge of sediment or contaminants to waterbodies in the vicinity of the HCS. Additionally, TRISO-X would obtain all necessary permits such as the NPDES Construction Stormwater General Permit prior to starting construction.	SMALL
Ecological resources—special-status species	Endangered Species Act (ESA) section 7 consultation with the U.S. Fish and Wildlife Service (FWS) has concluded. The NRC staff received concurrence from the FWS that the project would have *no effect,* is *not likely to adversely affect*, or is *not likely to jeopardize the continued existence* of federally listed or proposed threatened and endangered species and other special-status species potentially present at or in the vicinity of the HCS.	SMALL

Resource	Summary of impact	Impact level
Historic/cultural resources	No resources over 50 years of age were identified in the architectural survey of the 0.5-mile Area of Potential Effects (APE). The rugged topography of the region, distance of the historic resources beyond 0.5 mile from the APE, and extensive vegetation predominantly obscure the visibility of the HCS. National Historic Preservation Act section 106 consultation with the Tennessee State Historic Preservation Office confirms there are no historic or cultural resources present at the HCS that could be affected by the proposed FFF. TRISO-X would implement appropriate BMPs to ensure the McKamey and Carmichael Cemetery northeast of the HCS would not be adversely affected by construction, operation, or decommissioning of the FFF.	SMALL
Noise	Noise levels during construction, operation, and decommissioning of the FFF would primarily adhere to City of Oak Ridge noise ordinances and would be consistent with the industrial zoning designation of the Horizon Center Industrial Park (HCIP). Noise levels during construction and decommissioning could exceed noise ordinance maximums but these exceedances would be intermittent, temporary, and only perceptible in the immediate vicinity of the HCS. Noise levels would dissipate rapidly with distance due to the extensive tree cover surrounding the site. Noise during normal and power outage emergency operation would comply with City of Oak Ridge noise ordinances at all times. Noise levels would generally surpass the U.S. Environmental Protection Agency's (EPA's) conservative recommended maximum noise levels in the immediate vicinity of the HCS but would also be consistent with the industrial zoning designation of the HCIP and would dissipate rapidly with distance from the site.	SMALL
Waste management	TRISO-X has proposed a comprehensive pollution prevention and waste minimization plan to ensure that	SMALL

Resource	Summary of impact	Impact level
	activities are conducted in a manner intended to reduce the potential for waste generation. No high-level radioactive waste would be produced at the FFF. Radioactive waste would include gaseous effluents, which would be released to the facility environs; low-level solid waste, which would be packaged and transported offsite for disposal; and small quantities of liquid radioactive waste, which would be treated onsite or transported offsite for treatment and disposal. TRISO-X's waste management systems, engineering design features and contamination control and radiological safety procedures would help ensure that radiological doses to facility personnel and members of the public from the production, processing, handling, and packaging of radioactive waste are reduced to levels that are safe. The FFF process systems, effluent controls, maintenance and repairs, and administrative functions are expected to generate nonradioactive waste too. No solid waste would be buried at the FFF. Nonhazardous waste would be temporarily stored onsite before being transported to a local disposal or recycling facility. Hazardous nonradioactive waste would be temporarily stored onsite and then transported to a hazardous waste treatment and disposal company for separation, processing, and disposal. This nonradioactive waste is expected to be a small fraction of the total pickups of nonradioactive waste in the region.	
Public and occupational health	The operation of the proposed FFF would result in radiological and nonradiological (i.e., chemical) exposures to members of the public and workers. The potential impacts are bounded by NRC regulations that limit environmental releases and exposure of workers because the FFF would be required to operate within the regulatory limits. The expected annual level of workers' radiation exposure during operation (90 millirems [mrem]) is about 10 percent of the	SMALL

Resource	Summary of impact	Impact level
	radiation dose that the average citizen of Tennessee receives in a year (i.e., 910 mrem).	
Transportation	Traffic would increase on local roads during construction and decommissioning because of the overall increase in average daily traffic flow and because of construction- and decommissioning-related truck traffic. TRISO-X would construct a turning lane and acceleration and deceleration lanes on Renovare Boulevard for left and right turns at the entrance to the FFF. During all phases of development, the minor increase in local and regional car traffic would not significantly increase traffic safety problems or road degradation relative to existing conditions.	SMALL
Socioeconomics	Total construction expenditures associated with the FFF are expected to be approximately $767.9 million. This is anticipated to support a total of 1,593 jobs in the region of influence (ROI). The additional demands on community services resulting from operation of the FFF are anticipated to be generally proportional to the number of workers and their families moving into the ROI. However, these additional demands would be generally offset by the increased revenues collected as taxes by local governments from these workers as well as from TRISO-X operations. Incoming workers during the operation phase would pay property and sales taxes on local purchases. In addition, the FFF would drive incremental property tax revenue at the HCS of approximately $14.7 million annually, due to higher assessed property value. Increases in government revenues associated with sales tax, corporate income taxes, and other tax revenue that otherwise would not have been collected but for TRISO-X operations would also occur. The NRC staff determines that this represents between a 1 percent and a 5 percent increase in revenues over the ROI.	SMALL to MODERATE

Resource	Summary of impact	Impact level
Accident impacts	The analysis presented by TRISO-X in the Integrated Safety Analysis indicates that sufficient mitigation and prevention controls are designed for the FFF to reduce the consequences and likelihoods of potential high- and intermediate-category accidents sufficiently to satisfy 10 CFR 70.61 requirements. TRISO-X has proposed various controls (including engineering design features and administrative controls) that would prevent the initiation of nuclear or radioactive material accidents, or mitigate their consequences, in compliance with 10 CFR 70.61 and other NRC regulations applicable to radiological accident consequences. TRISO-X would transport materials to and from the FFF in compliance with U.S. Department of Transportation and NRC regulations. Therefore, impacts from transportation of TRISO-X fuel feedstock material and final fuel form product to and from the FFF site (including transportation of any radioactive materials during operation) would be minor.	SMALL

4.2 Resource Commitments Associated with the Proposed Action

The following sections address issues related to resource commitments contributing to the cost benefit analysis presented in section 4.5 of this EIS.

4.2.1 Unavoidable Adverse Environmental Impacts and Irreversible Commitments of Resources

Section 102(2)(C)(ii) of NEPA requires that an EIS include information on any adverse environmental effects that cannot be avoided should the proposal be implemented. Adverse environmental impacts that cannot be avoided are considered in this EIS.

As described in this EIS and summarized above, the impacts on most resource areas from the proposed action would be SMALL; that is, the environmental effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. However, though SMALL, there may be unavoidable adverse impacts from construction, operation, and decommissioning of the proposed FFF at the HCS. Table 4.2-1 presents the unavoidable adverse impacts from construction, operations, and decommissioning of the FFF. Section 4.4 presents mitigation and control measures intended to lessen the adverse impacts of the project, where applicable.

Resources are irreversible when primary or secondary impacts limit future options for a resource.

Table 4.2-1 Unavoidable adverse impacts from the proposed action

Resource area	Unavoidable adverse environmental impacts	Irreversible commitment of resources
Land use	The impacts on land use from the proposed action would be SMALL. The HCIP was created for the lots within to be developed. The HCS lot is currently zoned by the City of Oak Ridge as a heavy industrial district, which is established to provide sites for activities that, in part, involve manufacturing facilities that pose significant risks due to the involvement of radioactive materials.	No impact. There would be no irreversible and irretrievable commitment of land resources due to implementing the proposed action. The HCS parcel currently consists primarily of open herbaceous vegetation intended for development (i.e., there are no agricultural or other land uses that would otherwise occur at this site in the absence of the FFF). After the proposed license period, the land would be decontaminated, as necessary, and made available for other uses.
Visual resources	The impact on visual resources resulting from the proposed action would be SMALL. Visibility of the site to surrounding areas is limited by the forested hills and ridges in the immediate vicinity of the HCS. Visibility of the site would generally be limited to visitors and staff of the HCS or other surrounding developed areas within the HCIP and members of the public using the North Boundary Greenway trail when directly adjacent to the HCS.	No impact. There would be no irreversible and irretrievable commitment of visual resources. The FFF would be decommissioned after its 40-year license period. Although TRISO-X anticipates some buildings would be left in place after the decontamination process, all buildings and developed portions of the parcel could be removed and the currently existing open, herbaceous landscape could be restored.
Meteorology and air quality	The impact on meteorology, climatology, and air quality resulting from the proposed action would be SMALL. The FFF would comply with all applicable regulatory requirements of the Clean Air Act and TDEC requirements to minimize impacts on state and regional air quality. Because the FFF would be a minor source, impacts on ambient air quality are expected to be SMALL.	No impact. There would be no irreversible and irretrievable commitment of air resources and local climate from implementing the proposed action.

Resource area	Unavoidable adverse environmental impacts	Irreversible commitment of resources
	The NRC staff concludes there would be minimal overlap for impacts from both climate change and the proposed action. Climate change impacts are predicted to occur over long periods of time, and the license term of the proposed facility is 40 years. Therefore, impacts from the proposed FFF that may overlap with the impacts of climate change are likely to be SMALL.	
Geology	Impacts on geology resulting from the proposed action would be SMALL. TRISO-X would abide by local, state, and federal stormwater regulations and permit requirements, which would minimize the potential for stormwater to enter and adversely affect karst features at the HCS and surrounding lands.	SMALL. Increased stormwater flow could enter karst features at the HCS and potentially lead to irreversible carbonate rock dissolution and changes in groundwater flow paths. However, TRISO-X would implement BMPs to minimize these effects and changes in karst topography would occur relatively slowly over time
Soils	Impacts on soils resulting from the proposed action would be SMALL. TRISO-X would implement BMPs during the construction and decommissioning periods and would plant non-invasive herbaceous vegetation to restore all temporarily affected soils post-construction.	SMALL. A small volume of soils and sediments would be lost to wind and water erosion during implementation of the proposed action; however, no large-scale irreversible and irretrievable commitment of soil resources would be expected. TRISO-X would excavate, remove, and replace or otherwise appropriately mitigate any decontaminated soils during the decommissioning process according to its site decommissioning plan. TRISO-X would also decompact and restore onsite drainage patterns at the HCS to the extent practical.
Surface water	Impacts on surface waters resulting from the proposed action would be SMALL. There are no waterbodies present on the HCS. TRISO-X would implement mitigation measures to control erosion and sedimentation; has developed a SWPPP and SPCC plan; would implement	SMALL. TRISO-X would source water used at the FFF during construction, operation, and decommissioning from the City of Oak Ridge municipal water district, which uses Melton Hill Lake south of Oak Ridge as its

Resource area	Unavoidable adverse environmental impacts	Irreversible commitment of resources
	and update the prescribed BMPs during construction to address potential impacts from discharge of sediment or contaminants to surface waters in the vicinity of the HCS; and would obtain all necessary permits such as the NPDES Construction Stormwater General Permit prior to starting construction. TRISO-X would use the City of Oak Ridge municipal water and sanitary sewer systems for all onsite water uses and sewage removal.	water source. There would otherwise be no irreversible and irretrievable commitment resources surface waterbodies in the vicinity of the HCS during implementation of the proposed action.
Wetlands	Impacts on wetlands resulting from the proposed action would be SMALL. There are no wetlands documented on the HCS. However, there are wetlands in the adjacent lands. TRISO-X would implement mitigation measures to control erosion and sedimentation; has developed a SWPPP and SPCC plan; would implement and update the prescribed BMPs during construction to address potential impacts from discharge of sediment or contaminants to wetlands in the vicinity of the HCS; and would obtain all necessary permits such as the NPDES Construction Stormwater General Permit prior to starting construction.	No impact. There would be no irreversible and irretrievable commitment of wetland resources from implementing the proposed action.
Groundwater resources	Unavoidable impacts on groundwater resources would be SMALL. Changes to surficial groundwater flow could occur due to increased infiltration and changes to flow volumes and discharge locations associated with FFF stormwater detention basins. However, TRISO-X would abide by local, state and federal stormwater guidelines and permit requirements and routinely inspect the stormwater detention basins	No impact. There would be no irreversible and irretrievable commitment of ground water resources from implementing the proposed action
Terrestrial resources	Impacts on terrestrial resources would be SMALL. The vegetative community of the majority of the HCS is regularly mowed and maintained; herbaceous vegetation with prevalent nonnative species is present. A small percentage of the site consists of mixed and deciduous forest consistent with the abundant forested land	SMALL. Construction of the FFF would remove the approximately 5 acres of mixed deciduous forest that can serve as terrestrial wildlife habitat. There would be no other irreversible and irretrievable commitment of terrestrial resources. The

Resource area	Unavoidable adverse environmental impacts	Irreversible commitment of resources
	surrounding the site. Wildlife documented to use the site are primarily common, mobile species prevalent in the region that can readily access the undeveloped natural and conservation areas surrounding the HCS.	FFF would be decommissioned after its 40-year license period. Although TRISO-X anticipates some buildings would be left in place after the decontamination process, all buildings and developed portions of the parcel could be removed, and the currently existing open, herbaceous landscape could be restored and readily occupied by terrestrial wildlife from the surrounding areas.
Aquatic resources	Impacts on aquatic resources resulting from the proposed action would be SMALL. There are no aquatic species present at the HCS. To avoid or minimize impacts on aquatic resources in offsite waterbodies, TRISO-X would implement mitigation measures to control erosion and sedimentation; has developed a SWPPP and SPCC plan; would implement and update the prescribed BMPs during construction to address potential impacts from discharge of sediment or contaminants to waterbodies in the vicinity of the HCS; and would obtain all necessary permits such as the NPDES Construction Stormwater General Permit prior to starting construction.	No impact. There would be no irreversible and irretrievable commitment of aquatic resources from implementing the proposed action.
Special-status species	Impacts on special-status species would be SMALL. The action area encompassing the HCS contains suitable habitat for the federally endangered gray bat (*Myotis grisescens*), and Indiana bat (*Myotis sodalis*), the proposed endangered tricolored bat (*Perimyotis subflavus*), and the proposed threatened monarch butterfly (*Danaus plexippus*). Construction of the FFF would require clearing of seven potential roost trees for bats and milkweed (*Asclepias* spp.) plants for monarch butterflies. However, TRISO-X would conduct tree clearing during the winter season when bats would be hibernating and therefore not present at the HCS and surveys of the	SMALL. Construction of the FFF would permanently remove seven trees determined during bat habitat surveys to be potential summer roosting habitat. Based on the locations of the trees and general probability, the likelihood is very low that the potential roost trees at the HCS are maternity roost trees; thus, their loss would not adversely affect bat species in the action area. Milkweed at the HCS would be

Resource area	Unavoidable adverse environmental impacts	Irreversible commitment of resources
	HCS indicated milkweed is only sparsely present. The FWS concurred with the determinations of the NRC staff that construction, operation, and decommissioning of the FFF may affect but would be not likely to adversely affect the federally listed bat species. The NRC staff concluded construction, operation, and decommissioning of the FFF would not jeopardize the existence of monarch butterflies.	removed but could be replanted after decommissioning.
Historic and cultural resources	Impacts on historic or cultural resources resulting from the proposed action would be SMALL. National Historic Preservation Act section 106 consultation with the Tennessee State Historic Preservation Office confirms there are no known historic or cultural resources present at the HCS that could be affected by the proposed action. TRISO-X would implement appropriate BMPs to ensure the McKamey and Carmichael Cemetery northeast of the HCS would not be adversely affected by construction, operation, or decommissioning of the FFF.	No impact. There would be no irreversible and irretrievable commitment of historic or cultural resources from implementing the proposed action.
Noise	Impacts due to noise resulting from the proposed action would be SMALL. Noise levels during construction, operation, and decommissioning of the FFF would primarily adhere to City of Oak Ridge noise ordinances and would be consistent with the industrial zoning designation of the HCIP. Noise levels during construction and decommissioning could exceed noise ordinance maximums but would be intermittent, temporary, and only perceptible in the immediate vicinity of the HCS. Noise would dissipate rapidly with distance due to the extensive tree cover surrounding the site. Noise during normal and power outage emergency operation would comply with City of Oak Ridge noise ordinances at all times. Noise levels would generally surpass the EPA's conservative recommended maximum noise levels in the immediate vicinity of the HCS but would also be consistent with the	No impact. There would be no irreversible and irretrievable noise impacts from implementing the proposed action.

Resource area	Unavoidable adverse environmental impacts	Irreversible commitment of resources
	industrial zoning designation of the HCIP and would dissipate rapidly with distance from the site.	
Waste management	Impacts from producing, processing, and handling of radioactive and nonradioactive waste at the proposed FFF during operation and decommissioning would be SMALL. TRISO-X has proposed a comprehensive pollution prevention and waste minimization plan to ensure that activities are conducted in a manner intended to reduce the potential for waste generation. No high-level radioactive waste would be produced at the FFF. TRISO-X's systems, engineering, and safety procedures would help ensure that exposure to the radioactive components of the FFF by facility personnel and members of the public are safe. TRISO-X would implement waste management systems to control, handle, process, store, and transport nonradioactive waste generated during construction, operation, and decommissioning. Based on TRISO-X's proposed waste management systems, processes to minimize chemical contamination, and because TRISO-X would comply with applicable federal and State of Tennessee regulations, the NRC staff concludes that impacts from nonradioactive waste would be SMALL during construction, operation, and decommissioning.	No impact. There would be no irreversible and irretrievable waste management impacts at the HCS from implementing the proposed action.
Public and occupational health	The degree of public exposure to radiation associated with the proposed action would be minor, and therefore the potential health impacts on members of the public associated with the proposed action would be SMALL. TRISO-X would comply with NRC and Occupational Safety and Health Administration (OSHA) regulations pertaining to exposure of occupational workers to radiological and nonradiological hazardous materials.	Irreversible and irretrievable impacts on the public and occupational workers related to exposure to radiological and nonradiological hazardous materials would be SMALL.

Resource area	Unavoidable adverse environmental impacts	Irreversible commitment of resources
	Therefore, the NRC staff considers direct and indirect impacts on workers resulting from the proposed action to be SMALL.	
Transportation	Impacts on transportation associated with construction, operation, and decommissioning of the FFF would be SMALL. Each of the three phases of the proposed FFF would lead to minor increases in local and regional car traffic; however, these increases would not significantly increase traffic safety problems or road degradation relative to existing conditions. Risk to the public associated with transport of radiological materials is addressed in sections 3.9 and 3.10. Risk to the public and occupational workers would be SMALL.	No impact. There would be no irreversible and irretrievable transportation impacts associated with implementing the proposed action.
Socioeconomics	Impacts on the socioeconomics of the ROI associated with the proposed action would be SMALL to MODERATE. Impacts within the ROI on employment and economic activity, population and housing, and public services and finances during the construction and decommissioning periods would be SMALL. Impacts within the ROI on employment, the population, and public services and finances during the operation period would result in MODERATE beneficial impacts.	No impact. There would be no irreversible and irretrievable impacts on the socioeconomics of the ROI associated with implementing the proposed action.
Accident impacts	The impacts from potential nuclear, radioactive, or hazardous chemical material accidents at the proposed facility would be SMALL. TRISO-X has proposed various controls (including engineering design features and administrative controls) that would prevent the initiation of nuclear or radioactive material accidents, or mitigate their consequences, in compliance with 10 CFR 70.61 and other NRC regulations applicable to radiological accident consequences.	Given the controls (including engineering design features and administrative controls) that TRISO-X would implement to prevent or mitigate the consequences of radiological and hazardous chemical accidents, irreversible and irretrievable impacts due to accidents associated with the proposed action would be SMALL.

Resource area	Unavoidable adverse environmental impacts	Irreversible commitment of resources
	TRISO-X would transport materials to and from the FFF in compliance with U.S. Department of Transportation and NRC regulations. Therefore, impacts from transportation of TRISO-X fuel feedstock material and final fuel form product to and from the FFF site (including transportation of any radioactive materials during operation) would be SMALL.	

4.2.2 Irretrievable Commitments of Resources

This section describes the irretrievable commitment of resources that would be associated with construction, operation, and decommissioning of the FFF. An irretrievable commitment of resources refers to the use or consumption of resources that are neither renewable nor recoverable for future use. Irretrievable commitments of resources for construction, operation, and decommissioning of an FFF include the commitment of capital, labor, water, energy, raw materials, and other natural and manufactured resources.

The implementation of the FFF at the proposed site or alternative sites, or the use of alternative technologies discussed in this EIS, would entail irretrievable commitment of capital, labor, energy, water, chemicals, fossil fuels, and other natural and manufactured resources. These resources would be unrecoverable. For example, TRISO-X would consume materials during construction of the FFF, as described in chapter 2. These materials would be irretrievable unless TRISO-X recycled them during decommissioning (e.g., identified a different facility to use such materials). During operations, uranium used as the source for the high-assay low-enriched uranium (HALEU) fuel would be the main resource that would be irreversibly and irretrievably committed.

Mineral and other geologic resources, such as concrete, granular material, steel, and asphalt necessary for construction would be irreversibly committed for construction of the FFF. In addition, a small volume of soils and sediments would be lost to wind and water erosion during construction, operation, and decommissioning.

Irreversible commitments of nonradiological resources to protect occupational human health may occur. Such impacts would be similar to potential hazards that occur at any industrial construction site.

Energy expended would be in the form of fuel for equipment, vehicles, and facility operations and electricity for equipment and facility operations. Electricity and fuel would be acquired from offsite commercial sources. Water would be obtained from existing water supply systems. These resources are readily available, and the amounts required are not expected to deplete available supplies or exceed available system capacities.

4.2.3 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment

The construction, operation, and decommissioning of the FFF would result in short-term uses of the environment, as described in chapter 3. “Short-term” is the period during which construction, operation, and decommissioning activities would take place.

The construction, operation, and decommissioning of the FFF would require short-term use of the environment and commitment of resources and would commit certain resources (e.g., land and energy) indefinitely or permanently. The proposed action and the no action alternative would differ with regard to local short-term uses of the environment but would not differ with regard to maintenance and enhancement of long-term productivity.

Construction, operation, and decommissioning would transform approximately 110 acres of open land to industrial land use during the short term. This change would be in line with the intended use and current land use zoning. The facility would change the viewshed of the existing landscape for users of a very small portion of the North Boundary Greenway trail.

Construction, operation, and decommissioning could also displace wildlife through destruction of habitat or noise. Wildlife could return to the site once construction or decommissioning is completed if it is restored to suitable habitat. Mineral and other geological resources would be consumed for facility construction. Water would be required for various purposes during construction, operation, and decommissioning of the FFF as detailed in section 2.1.1.2.

Air emissions from construction, operation, and decommissioning would introduce small amounts of radiological and nonradiological constituents at the facility site. However, such emissions are not expected to affect air quality or radiation exposure to the extent that they would impair public health and long-term productivity of the environment. Noise emitted by construction, operation, and decommissioning activities would increase the ambient noise levels onsite and in adjacent offsite areas. However, increases in noise levels would adhere to City of Oak Ridge noise ordinances and would be consistent with the industrial zoning designation of the HCS. Noise levels would return to background levels once construction and decommissioning activities are complete.

The additional demands on community services resulting from construction, operation, and decommissioning of the FFF are anticipated to be generally proportional to the number of workers and their families moving into the region. These additional demands would be generally offset by the increased revenues collected as taxes by local governments from these workers as well as from TRISO-X operations. Worker and delivery vehicles-related traffic would be short term during peak construction and decommissioning activities and work shifts and, therefore, would not affect long-term productivity.

The management and disposal of low-level radioactive waste, hazardous waste, and nonhazardous waste would require an increase in energy and consume space at treatment, storage, and disposal facilities. The use of land to meet waste disposal needs would reduce the long-term productivity of the land.

Extension or installation of service lines (e.g., electric power, water) during construction of the FFF would connect the facility to utility providers. This additional infrastructure would be available and beneficial for any future use of the facility after its decommissioning.

4.3 Impacts of Alternatives

No alternative locations for the FFF were proposed for analysis beyond the initial site selection criteria screening. Therefore, the only identified alternative is the no action alternative. This section compares the environmental impacts for the no action alternative technology with the impacts from the proposed FFF. Table 4.3-1 provides a tabular comparison of the potential environmental impacts of constructing, operating, and decommissioning the proposed FFF with impacts from the no action alternative. The no action alternative would have SMALL impacts for every resource area, because there would be no change in current environmental conditions at the proposed site. Construction and operation of the proposed facility at any possible alternative site (as yet unconsidered) would likely not reduce or avoid adverse effects, compared with constructing and operating the FFF at the HCS. The adverse environmental impacts from the no action alternative would be SMALL. However, the no action alternative would not fulfill the purpose and need for the proposed action and would hinder future development of domestic advanced reactors.

Table 4.3-1 Comparison of proposed action and no action alternative

Area of consideration	Impacts from FFF at HCS	Impacts from no action alternative
Develops domestic supply chain for advanced reactor fuel?	YES	NO
Visual resources	SMALL	SMALL
Air quality	SMALL	SMALL
Noise	SMALL	SMALL
Geology	SMALL	SMALL
Water resources	SMALL	SMALL
Ecological resources	SMALL	SMALL
Historic and cultural resources	SMALL	SMALL
Socioeconomic	SMALL to MODERATE	SMALL
Human health	SMALL	SMALL
Waste management	SMALL	SMALL
Transportation	SMALL	SMALL
Land use	SMALL	SMALL

4.4 Summary of Mitigation Measures

This section summarizes mitigation measures that would reduce adverse impacts from the construction, operation, and decommissioning of the FFF. Under Title 40 CFR 1508.20, the Council on Environmental Quality (CEQ) defines mitigation to include activities that:

- Avoid the impact altogether by not taking a certain action or parts of a certain action;
- Minimize impacts by limiting the degree or magnitude of the action and its implementation;
- Rectify the impact by repairing, rehabilitating, or restoring the affected environment;
- Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action; and
- Compensate for the impact by replacing or providing substitute resources or environments.

Mitigation measures are those actions or processes that could be implemented to control and minimize potential adverse impacts from construction, operation, and decommissioning of the proposed FFF. Potential mitigation measures can include general best management practices (BMPs) and more site-specific management actions.

BMPs are processes, techniques, procedures, or considerations that can be used to effectively avoid or reduce potential environmental impacts. While BMPs are not regulatory requirements, they can overlap with and support such requirements. BMPs will not replace any NRC requirements or other federal, state, or local regulations.

Management actions are active measures that an applicant specifically implements to reduce potential adverse impacts to a specific resource area. These actions include compliance with applicable government agency stipulations or specific guidance, coordination with governmental agencies or interested parties, and monitoring of relevant ongoing and future activities. If appropriate, corrective actions could be implemented to limit the degree or magnitude of a specific action leading to an adverse impact (reducing or eliminating the impact over time by preservation and maintenance operations) and repairing, rehabilitating, or restoring the affected environment. The applicant may also minimize potential adverse impacts by implementing specific management actions, such as programs, procedures, and controls for monitoring, measuring, and documenting specific goals or targets and, if appropriate, instituting corrective actions. The management actions may be established through standard operating procedures that appropriate local, state, and federal agencies (including NRC) review and approve. The NRC may also establish requirements for management actions by identifying license conditions. These conditions are written specifically into the NRC license and then become commitments that are enforced through periodic NRC inspections.

The mitigation measures that TRISO-X proposes to reduce and minimize adverse environmental impacts at the FFF were provided in the TRISO-X environmental report (ER; TRISO-X, 2025b) and are summarized in Table 4.4-1. Given that TRISO-X committed to these, they were included as appropriate in the respective resource impact determinations in chapter 3. The proposed mitigation measures provided in this chapter do not include environmental monitoring activities. Environmental monitoring activities are described in chapter 6.0 of the TRISO-X ER (TRISO-X, 2025b).

Based on the potential impacts identified in chapter 3 of this EIS, the NRC staff have identified additional potential mitigation measures for the FFF. These mitigation measures are provided in section 4.4.1.

Table 4.4-1 Summary of mitigation measures proposed by TRISO-X

Resource	Activity	Proposed mitigation measures
Meteorology and air quality	Construction, decommissioning	TRISO-X would implement dust suppression and soil containment both onsite and during transport by trucks; TRISO-X would stabilize exposed soils to prevent migration to offsite areas and adjacent roads; TRISO-X would implement proper maintenance of vehicle and equipment engines to reduce vehicle emissions.
	Operation	TRISO-X would utilize specially designed ventilation systems and high-efficiency particulate-absorbing (HEPA) filters to limit air emissions to ensure compliance with all applicable laws and regulations.
Geology	Construction, operation, decommissioning	Proper stormwater management design for facilities located in karst terrain would be performed to mitigate stormwater management concerns. In addition, FFF operations would include a characterization of groundwater movement in the karst bedrock between the HCS and the associated springs and discharge points. To this end, the FFF stormwater management program would be designed as described in the *Tennessee Permanent Stormwater Manual*.
Soils	Construction	TRISO-X would dispose of excavated soils at an existing, approved offsite landfill. To minimize erosion, TRISO-X would stockpile excavated materials on level or gently sloped lands. Where slopes are steeper, TRISO-X would implement appropriate erosion control measures including berms, silt fences, straw bales, ditch check dams, geotextiles, riprap, and use of a sedimentation basin and storm drain inlet/outlet protection.
Water resources	Construction, operation, decommissioning	TRISO-X would abide by NPDES and Industrial Stormwater Discharge permit conditions and BMPs in the TRISO-X SWPPP and SPCC plan.
Ecological resources	Construction	TRISO-X would clear trees within the boundaries of the HCS during the winter months (November through March) to avoid potential impacts on roosting endangered or proposed endangered bats and nesting birds.

Resource	Activity	Proposed mitigation measures
Noise	Construction	Various mitigation options that may be considered for application by TRISO-X's contractor where possible and appropriate include: • Equipping and maintaining construction equipment with the manufacturer's noise-control devices in effective operating condition. • Utilizing quiet equipment or construction methods to minimize noise emissions. • Operating equipment with internal combustion engines at the lowest effective operating speed to minimize noise emissions. • Closing engine housing doors to minimize noise emissions. • Avoiding engine idling. • Utilizing back-up alarms on construction equipment that are less intrusive to offsite receptors while complying with all applicable safety restrictions.
Transportation	Construction	TRISO-X would construct a turning lane and acceleration and deceleration lanes on Renovare Boulevard for left and right turns, respectively, at the entrance to the FFF to improve traffic safety for vehicles entering and exiting the FFF during construction.
	Operation	All shipments of nuclear materials, chemicals, and wastes would be carried out in conformance with NRC, U.S. Department of Transportation, and State of Tennessee requirements, including using truck placarding to identify contents and manifests. Trucks used for transport would be of the design and size deemed appropriate by the applicable regulations and subject to the necessary inspections and maintenance to ensure safe transport

4.4.1 Potential Mitigation Measures Identified by the NRC

The NRC staff have reviewed the mitigation measures that TRISO-X has proposed and identified additional mitigation measures that could potentially reduce impacts. The NRC has the authority to address unique site-specific characteristics by identifying license conditions, based on conclusions reached in the safety and environmental reviews. These license conditions could include additional mitigation measures, such as modifications to required monitoring programs. While the NRC cannot impose mitigation outside its regulatory authority under the Atomic Energy Act, the NRC staff has identified mitigation measures that could potentially reduce the impacts of the FFF. These additional mitigation measures are not requirements being imposed upon TRISO-X. For the purposes of NEPA, and consistent with 10 CFR 51.71(d) and 51.80(a), the NRC is disclosing measures that could potentially reduce or avoid environmental impacts from the proposed project. Because TRISO-X has not committed to these, they are not credited in the resource area impact determinations in chapter 3.

4.4.1.1 Mitigation Measures Recommended for Groundwater Resources

The NRC staff recommend TRISO-X develop and implement a sinkhole mitigation plan that would detail the procedures TRISO-X would follow to minimize impacts on groundwater in the case of a sinkhole development associated with stormwater infiltration beneath the proposed stormwater detention basins at the HCS.

4.4.1.2 Mitigation Measures Recommended for Ecological Resources

The U.S. Fish and Wildlife Service provided recommendations for TRISO-X during the informal Endangered Species Act (ESA) section 7 consultation to minimize potential effects from temporary or permanent artificial lighting associated with construction, operation, and decommissioning of the FFF within 1,000 feet of suitable habitat for northern long-eared bat. These recommendations consisted of the following:

- Use downward-facing, full cut-off lights when installing new or replacing existing permanent lights (with the same intensity or less for replacement lighting); and
- If using the backlight, uplight, and glare (BUG) system developed by the Illuminating Engineering Society, all three ratings (backlight, uplight, and glare) should be as close to zero as possible, with priority given to an uplight rating of zero.

4.4.1.3 Mitigation Measures Recommended for Transportation

The NRC staff recommend TRISO-X schedule shift changes and material deliveries outside of weekday peak hours of 7:00 AM to 8:00 AM and 4:15 PM to 5:15 PM, as defined in the TRISO-X traffic study, to the maximum extent practical.

4.5 Cost and Benefits of Proposed Action and Alternatives

NEPA and the CEQ require that all agencies of the Federal Government prepare detailed environmental statements on proposed major federal actions significantly affecting the quality of the human environment. One of NEPA’s principal objectives is to require each federal agency to consider, in its decision-making process, the environmental impacts of each proposed major action. In particular, section 102 of NEPA requires all federal agencies to the fullest extent possible to:

> *(B) identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by Title II of this Act, which will ensure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations. (42 U.S. Code 4321)*

However, neither NEPA nor the CEQ requires the positive and negative impacts of a proposed action to be quantified in dollars or any other common metric. The intent of this section is not to identify and quantify all potential positive impacts of the proposed action and compare them to all potential negative impacts. Instead, it identifies the major positive and negative impacts, both socioeconomic and environmental in nature, in order to assist in the decision-making process.

This section identifies the expected impacts from operation of the proposed FFF and describes them as either generally positive or generally negative. Certain resource areas, such as socioeconomics, are composed of varying impacts of both positive and negative types and are discussed by sub-area as appropriate. See table 4.5-1 for an overview of major categories of positive and negative impacts.

Data relied upon for this analysis include fiscal and economic impacts of facility construction, operation, and decommissioning, both for the region of influence (ROI) and for Tennessee's state economy. While many of the potential negative impacts of the FFF would occur within the ROI, significant and positive economic, fiscal, air quality, and energy security benefits are likely to accrue to the nation as a whole. Therefore, this comparison of positive and negative impacts addresses a larger area than the ROI that was considered in the socioeconomic analysis. Societal impacts considered are those related to land use, historical and cultural resources, visual resources, air quality, geology and soils, water resources, ecological resources, socioeconomics, noise, transportation, public and occupational health, and waste management.

Table 4.5-1 Positive and negative impacts of constructing, operating, and decommissioning the proposed fuel fabrication facility at the Horizon Center Site

Resource	Description	Impact assessment
Domestic production of tri-structural isotropic fuel	The FFF would produce a proprietary version of tri-structural isotropic fuel, thereby satisfying the fuel needs of various advanced reactors, either planned or being considered. No other production site for this fuel currently exists at industrial scale. These advanced reactors offer potentially large positive impacts through the domestic generation of clean, stable, and low-cost electrical power. Also, the FFF would offer potentially positive impacts for national energy security, incentive for nuclear fuel innovation, and domestic nuclear supply chain.	Positive
Tax revenues	The estimated contribution to government revenues from increased property taxes at the HCS are $14.7 million annually during operation, evenly split between the City of Oak Ridge and Roane County. In addition, increases in sales tax collections (e.g., 7% Tennessee state and additional 2.5% Roane County) are also anticipated during all phases of development due to a large aggregate payroll associated with the FFF.	Positive
Local economic impacts	Total construction expenditures associated with the FFF are expected to be approximately $768 million. This is anticipated to support a total of 1,593 jobs per year in the ROI.	Positive
Land use	The entire 110-acre HCS parcel would be cleared of existing trees, excavated, graded, and/or covered with fill during construction; operation activities of the FFF would be confined to the bounds of the HCS; and	SMALL Negative

Resource	Description	Impact assessment
	decommissioning of the FFF would consist of potential deconstruction of some parts of the facility while other portions would be decontaminated but remain onsite. The impacts of construction, operation, and decommissioning of the FFF on the land use study area surrounding the HCS are expected to be limited.	
Visual resources	The HCS location, as it currently exists, is classified as having the lowest visual and scenic value classification under the visual resource management classification system employed by NRC staff. This lowest classification allows for major modifications of the existing landscape. Additionally, built structures and associated lighting that would constitute the FFF would be consistent with the parameters and ordinances of the City of Oak Ridge zoning designations for the HCS.	SMALL Negative
Air quality	Air emissions from the FFF could include nitrogen oxides, carbon monoxide, sulfur oxides, hydrocarbons in the form of volatile organic compounds, hazardous air pollutants, particulate matter having an aerodynamic diameter less than 2.5 microns ($PM_{2.5}$), and particulate matter having an aerodynamic diameter less than 10 microns (PM_{10}). Air emission sources would be managed in accordance with federal, state, and local air quality control laws and regulations. The FFF would comply with all applicable regulatory requirements of the Clean Air Act and TDEC requirements to minimize impacts on state and regional air quality. Because the FFF would be a minor source, impacts on ambient air quality would be expected to be SMALL.	SMALL Negative
Geologic environment	Karst features have been identified on the HCS and its vicinity. Subsurface voids in the limestone could cause difficulties with the placement of foundational materials	SMALL Negative

Resource	Description	Impact assessment
	during construction. During operation, increased stormwater runoff could accelerate dissolution of carbonate features and impact karst features and could increase loading of typical stormwater pollutants, among other impacts.	
Water resources	There are no wetlands, waterbodies, lakes, or ponds within the HCS or its vicinity, and therefore direct effects on these resources are unlikely. However, the removal of vegetation and movement of soil could increase sediment loads to waterbodies via stormwater and/or alter water runoff patterns. Nearby surface waters and wetlands could be impacted by fuel, lubricant, and construction material spills.	SMALL Negative
Ecological resources—terrestrial resources	The vegetative community in the majority of the HCS is regularly mowed and maintained; herbaceous vegetation with prevalent nonnative species is present. A small percentage of the site consists of mixed and deciduous forest, consistent with the abundant forested land surrounding the site. Wildlife documented to use the site are primarily common, mobile species prevalent in the region that can readily access the undeveloped natural and conservation areas surrounding the HCS. Therefore, impacts on terrestrial resources would be SMALL.	SMALL Negative
Ecological resources—aquatic resources	There are no aquatic species present at the HCS. To avoid or minimize impacts on aquatic resources in offsite waterbodies, TRISO-X would implement mitigation measures to control erosion and sedimentation and would update prescribed BMPs during construction to address potential impacts from discharge of sediment or contaminants to waterbodies in the vicinity of the HCS. Additionally, TRISO-X would obtain all necessary permits such as the NPDES	SMALL Negative

Resource	Description	Impact assessment
	Construction Stormwater General Permit prior to starting construction. Impacts on aquatic resources resulting from the proposed action would therefore be SMALL.	
Ecological resources—special-status species	ESA section 7 consultation with the FWS is completed. The FWS concurred with the findings of NRC staff that the project would have no effect or is not likely to adversely affect federally listed threatened and endangered bat, fish, and plant species potentially present at or in the vicinity of the HCS. The NRC staff concluded the project would not jeopardize the continued existence of the monarch butterfly, which has been proposed for listing as threatened under the ESA..	SMALL Negative
Historic/cultural resources	No resources over 50 years of age were identified in the architectural survey of the 0.5-mile APE. The rugged topography of the region, distance of the historic resources beyond 0.5 mile from the APE, and extensive vegetation predominantly obscure the visibility of the HCS. National Historic Preservation Act section 106 consultation with the Tennessee State Historic Preservation Office confirms there are no historic or cultural resources present at the HCS that could be affected by the proposed FFF. TRISO-X would implement appropriate BMPs to ensure the McKamey and Carmichael Cemetery northeast of the HCS would not be adversely affected by construction, operation, or decommissioning of the FFF.	SMALL Negative
Noise	Noise levels during construction, operation, and decommissioning of the FFF would primarily adhere to City of Oak Ridge noise ordinances and would be consistent with the industrial zoning designation of the HCIP. Noise levels during construction and	SMALL Negative

Resource	Description	Impact assessment
	decommissioning could exceed noise ordinance maximums but these exceedances would be intermittent, temporary, and only perceptible in the immediate vicinity of the HCS. Noise levels would dissipate rapidly with distance due to the extensive tree cover surrounding the site. Noise during normal and power outage emergency operation would comply with City of Oak Ridge noise ordinances at all times. Noise levels would generally surpass EPA's conservative recommended maximum noise levels in the immediate vicinity of the HCS but would be consistent with the industrial zoning designation of the HCIP and would dissipate rapidly with distance from the site.	
Public and occupational health	The operation of the proposed FFF would result in radiological and nonradiological (i.e., chemical) exposures to members of the public and workers. The potential impacts are bounded by NRC regulations that limit environmental releases and exposure of workers because the FFF would be required to operate within the regulatory limits. The anticipated level of radiation exposure during operation (90 mrem) is about 10 percent of the radiation dose that the average citizen of Tennessee receives in a year (910 mrem).	SMALL Negative
Waste management	TRISO-X has proposed a comprehensive pollution prevention and waste minimization plan to ensure that activities would be conducted in a manner intended to reduce the potential for waste generation. No high-level radioactive waste would be produced at the FFF. Radioactive waste would include gaseous effluents, which would be released to the facility environs; low-level solid waste, which would be packaged and transported offsite for disposal; and small quantities of	SMALL Negative

Resource	Description	Impact assessment
	liquid radioactive waste, which would be treated onsite or transported offsite for treatment and disposal. TRISO-X's waste management systems, engineering design features, and contamination control and radiological safety procedures would help ensure that doses to facility personnel and members of the public from the production, processing, handling, and packaging of radioactive waste are reduced to levels that are safe. TRISO-X would implement waste management systems to control, handle, process, store, and transport nonradioactive waste generated during construction, operation, and decommissioning. Based on TRISO-X's proposed waste management systems, processes to minimize chemical contamination, and compliance with applicable federal and State of Tennessee regulations, the NRC staff concludes that impacts from nonradioactive waste would be SMALL during construction, operation, and decommissioning.	
Transportation	Traffic would increase on local roads during construction and decommissioning because of the overall increase in average daily traffic flow and because of construction- and decommissioning-related truck traffic. During all phases of development, the minor increase in local and regional car traffic would not significantly increase traffic safety problems or road degradation relative to existing conditions.	SMALL Negative
Public services	The additional demands on community services resulting from operation of the FFF are anticipated to be generally proportional to the number of workers and their families moving into the ROI. However, these additional demands are generally offset by the increased revenues collected as taxes by local	SMALL to MODERATE Positive

Resource	Description	Impact assessment
	governments from these workers as well as from TRISO-X operations. Incoming workers during the operation phase would be anticipated to pay property and sales taxes on local purchases. In addition, the FFF would drive incremental property tax revenue at the HCS of approximately $14.7 million annually, due to estimated higher assessed property value. Increases in government revenues associated with sales tax, corporate income taxes, and other tax revenue that otherwise would not have been collected but for TRISO-X operations would also occur. The NRC staff determines that this represents between a 1 percent and a 5 percent increase in revenues over the ROI.	

The financial expenditures related to construction, operation, and decommissioning of the proposed FFF represent the opportunity cost of resources and are described below.

- Estimated construction cost: $767.9 million
- Estimated annual payroll during 40 years of operation: $115.5 million
- Estimated decommissioning cost: $182.2 million

Further, the applicant shall indicate the source(s) of funds to cover these costs. Financial qualifications and decommissioning financial assurance for the proposed FFF will be addressed in the safety review, which is conducted in parallel with the environmental review. The safety review includes an evaluation of the applicant's financial qualifications and decommissioning financial assurance under 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," Specifically the applicant must demonstrate its financial qualifications by meeting the requirements in 10 CFR 70.22(a)(8), 10 CFR 70.23(a)(5), and 10 CFR 70.25, "Financial assurance and recordkeeping for decommissioning."

4.5.1 Cost Benefit Conclusions

In section 2.2, chapter 3.0, and this section, the NRC staff describes anticipated negative and positive impacts of the proposed action as well as the no action alternative to the proposed action. In weighing these negative and positive impacts, the NRC staff concludes that the overall positive impacts of constructing, operating, and decommissioning the proposed FFF at the HCS outweigh the negative impacts based upon the following considerations:

- The mostly SMALL environmental impacts, which would be caused by constructing, operating, and decommissioning the proposed FFF at the HCS;
- The generally positive economic impacts of constructing, operating, and decommissioning the proposed FFF to communities located near the HCS; and
- The development of a domestic fuel supply chain supporting advanced reactors to power a new generation of safe, clean, and economical nuclear power.

4.5.1.1 Alternatives Summary

In this section, the NRC staff considered a no action alternative to construction, operation, and decommissioning of the FFF at the HCS.

The impacts from the proposed action are summarized in table 4.1-1. The impacts comparing the proposed action and the no action alternative are summarized in table 4.3-1.

In conclusion, the NRC staff notes that the no action alternative would result in SMALL or no impacts to all resource areas surrounding the HCS. The no action alternative, however, does not fulfill the purpose and need for the project. In the no action alternative, there would be additional economic and technological pressures increasing the proportion of electricity generation from non-nuclear sources. These non-nuclear sources include facilities that rely on fossil fuels. For example, the U.S. Energy Information Administration identifies over 40 gigawatts of natural gas nameplate capacity in the "planning" stage with estimated completion dates ranging from summer 2025 through the end of 2030 (U.S. Energy Information Agency, 2025). Greater activity in the areas of extracting, processing, transporting, and combusting these fossil fuels would result in increased negative economic impacts across the nation. Furthermore, the higher levels of combustion of fossil fuels would result in negative human health impacts.

The impacts associated with the proposed action and the alternative technology would be SMALL for all resource areas, except for positive economic impacts associated with FFF expenditures and tax revenue, which would represent MODERATE impacts during construction, operation, and decommissioning. No other alternatives capable of meeting the purpose and need of the project have been identified in this application or been evaluated in the present analysis.

4.6 Final Recommendation

After weighing the environmental, economic, technical, and other benefits against environmental and other costs, and considering the alternatives, the NRC staff's recommendation, unless safety issues mandate otherwise, is the issuance of a license to authorize TRISO-X to possess and use special nuclear material to manufacture HALEU fuel. The NRC staff based its recommendation on the following factors:

- The NRC staff's review of TRISO-X's ER and responses to requests for additional information;
- The NRC staff's consultation with federal and state agencies, as well as tribal officials;
- The NRC staff's independent environmental review; and
- The NRC staff's consideration of public comments.

5.0 REFERENCES

10 CFR Part 70. *Code of Federal Regulations*, Title 10, Energy, Part 70, "Domestic Licensing of Special Nuclear Material."

10 CFR Part 20. *Code of Federal Regulations*, Title 10, Energy, Part 20, "Standards for Protection Against Radiation."

10 CFR Part 51. *Code of Federal Regulations*, Title 10, Energy, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

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APPENDIX A
LAND USE TABLE AND FIGURES

Table A-1 National Landcover Database land cover classifications within the land use study area

NLCD land cover class	Area (acres)	Area (percent)
Deciduous Forest	30,827	53.0
Hay/Pasture	7,347	12.6
Mixed Forest	5,041	8.7
Developed, Open Space	3,899	6.7
Developed, Low Intensity	3,187	5.5
Developed, Medium Intensity	1,769	3.0
Woody Wetlands	1,621	2.8
Evergreen Forest	1,373	2.4
Open Water	1,013	1.7
Developed, High Intensity	913	1.6
Shrub/Scrub	635	1.1
Herbaceous	465	0.8
Barren Land	66	0.1
Emergent Herbaceous Wetlands	40	0.1
Total	**58,196**	**100.0**

Source: TRISO-X, 2025b

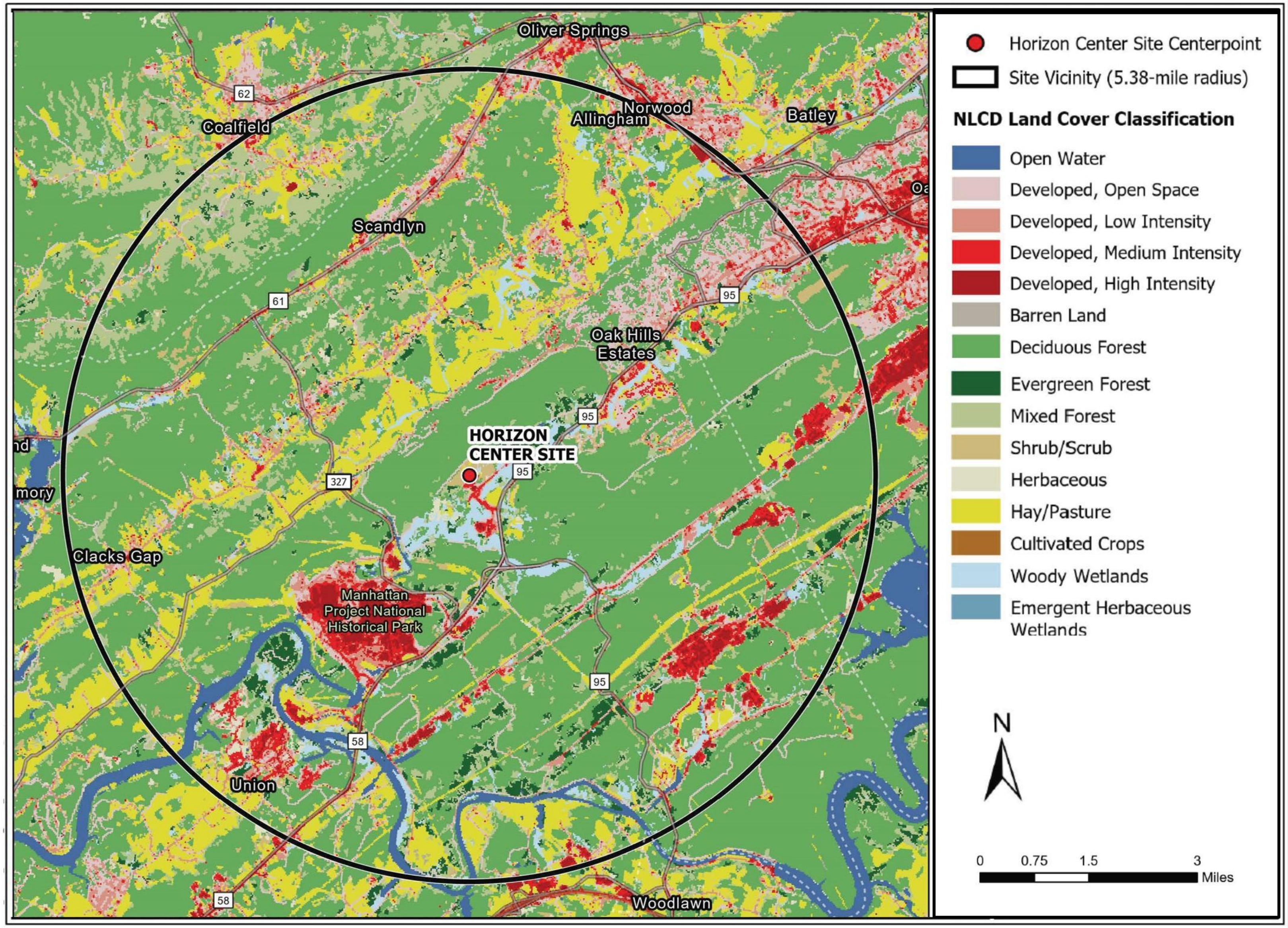

Figure A-1 **National Landcover Database land cover classifications within the land use study area (Source: TRISO-X, 2025b)**

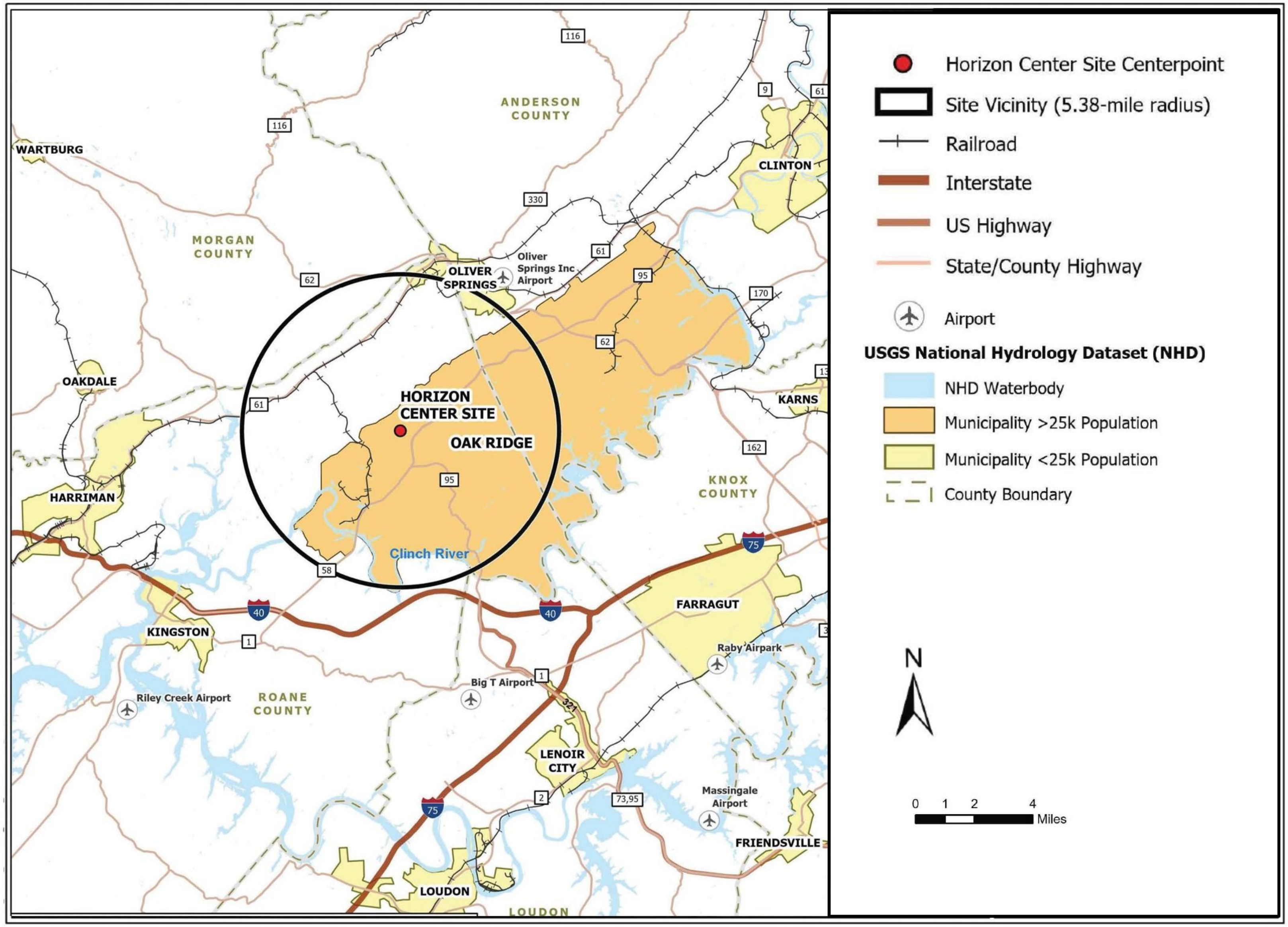

Figure A-2 **Population centers and transportation infrastructure near the land use study area (Source: TRISO-X, 2025b)**

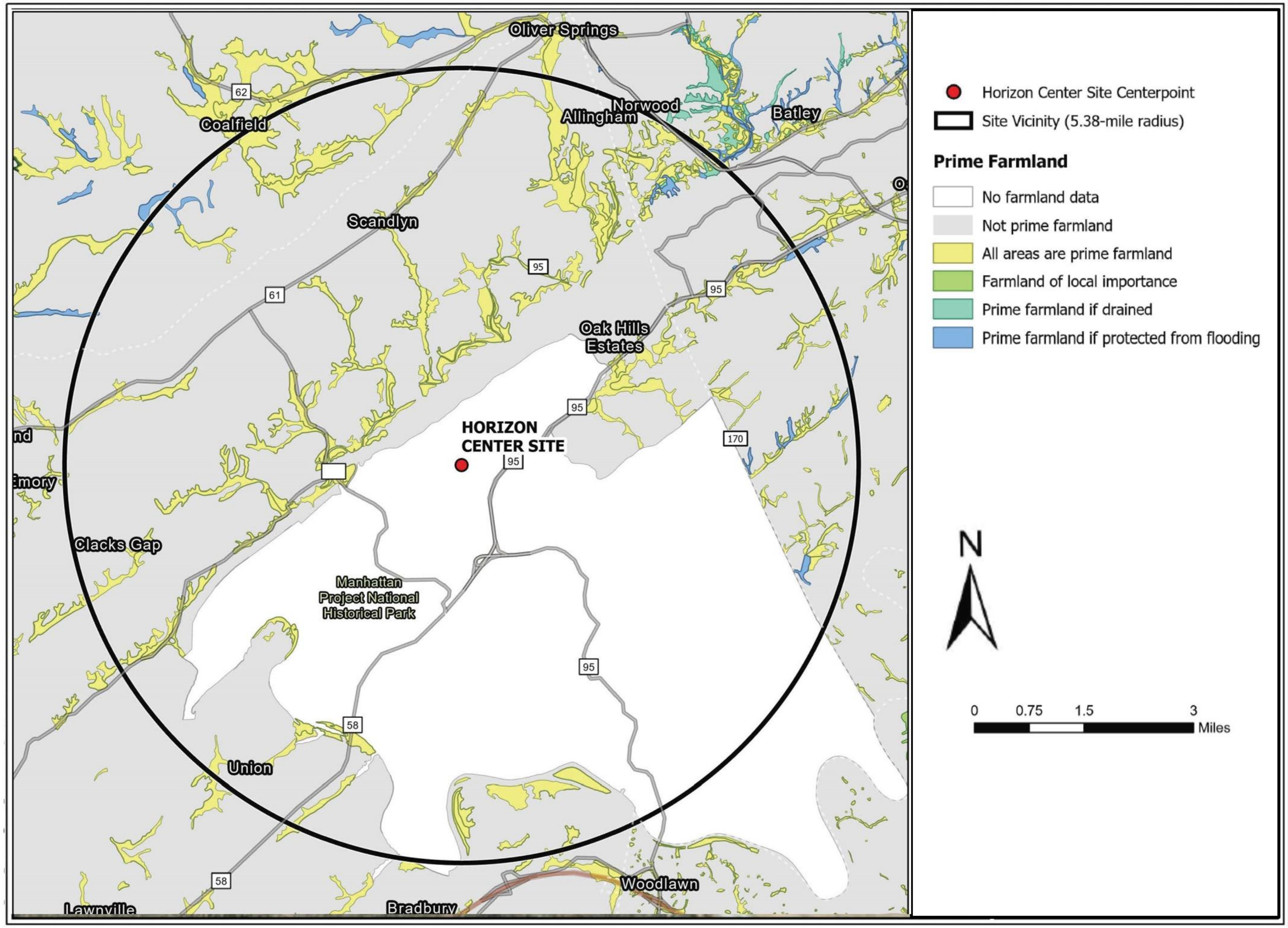

Figure A-3 **Prime farmland near the land use study area (Source: TRISO-X, 2025b)**

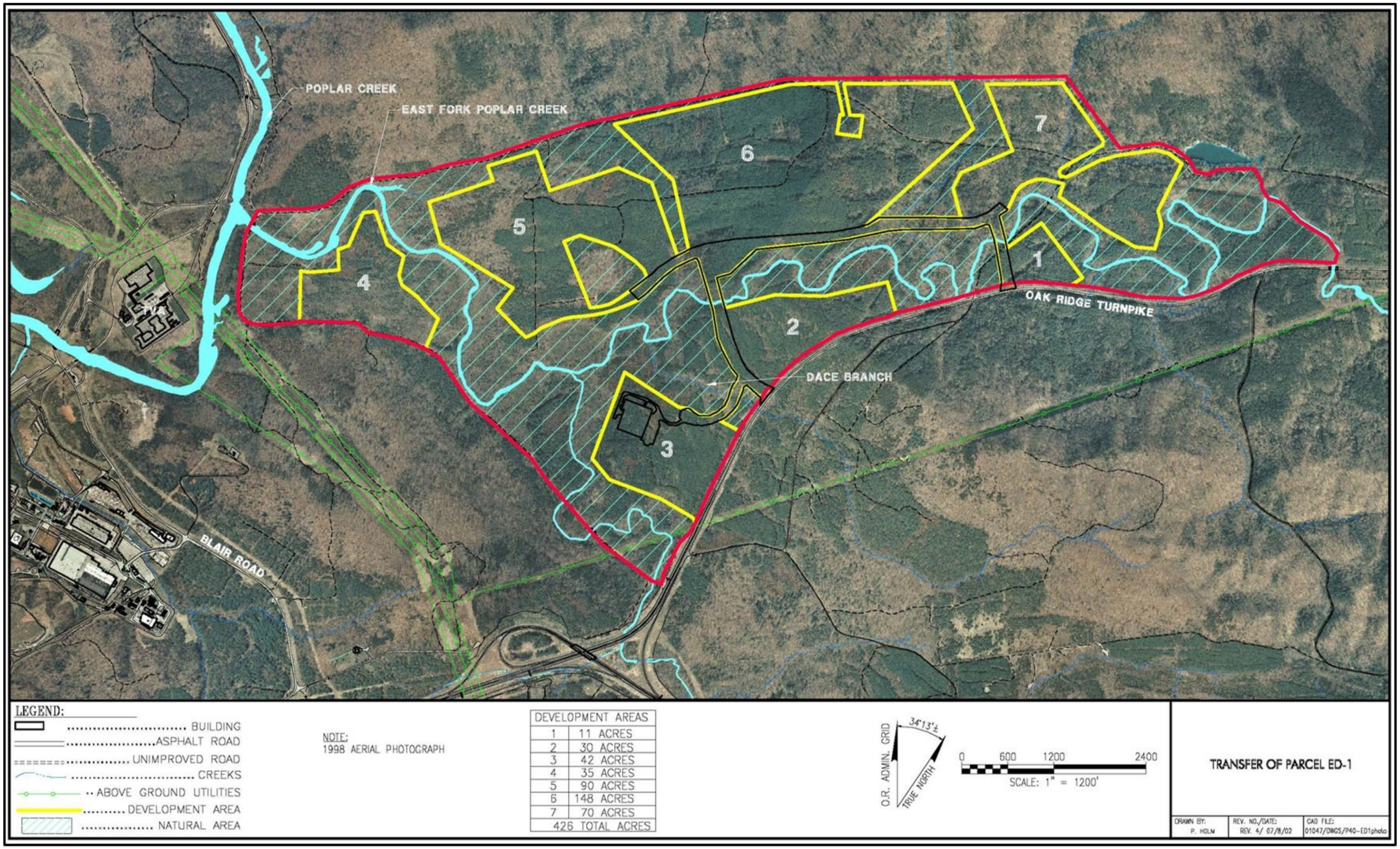

Figure A-4 **Schematic of the Development Area parcels and surrounding natural areas at the Horizon Center Industrial Park; the western two-thirds of Development Area 6 is what is now designated as the Horizon Center Site (Source: DOE, 2003)**

APPENDIX B
TRISO-X VISUAL RENDERINGS OF THE FUEL FABRICATION FACILITY

Figure B-1 Fuel fabrication facility visual rendering: aerial view from the southwest (Source: TRISO-X, 2025b)

Figure B-2 Fuel fabrication facility visual rendering: aerial view from the east (Source: TRISO-X, 2025b)

Figure B-3 Fuel fabrication facility visual rendering: elevation view from the east toward the administration building entry (Source: TRISO-X, 2025b)

Figure B-4 **Fuel fabrication facility visual rendering: elevation view from the south toward the administration building entry (Source: TRISO-X, 2025b)**

APPENDIX C
PROJECTS CONSIDERED IN CUMULATIVE EFFECTS

In determining the reasonably foreseeable cumulative effects associated with activities related to the construction, operation, and decommissioning of the TRISO-X fuel fabrication facility (FFF), the U.S. Nuclear Regulatory Commission (NRC or Commission) staff evaluated the reasonably foreseeable actions or projects in the geographic area of interest of the proposed location of the FFF. The NRC staff's analyses of the potential incremental effects of the proposed federal actions when added to the environmental effects of other reasonably foreseeable actions are presented in section 3.14 of this environmental impact statement. Table C-1 provides a list of projects and actions the NRC staff considered for its analysis of the reasonably foreseeable cumulative effects associated with constructing, operating, and decommissioning the FFF. However, because of the uniqueness of each environmental resource area evaluated and its associated geographic area of analysis, section 3.14 does not consider or explicitly evaluate every project and action listed in table C-1.

Table C-1. Projects and actions considered for the analysis of reasonably foreseeable cumulative effects associated with licensing, construction, operation, and decommissioning of the TRISO-X FFF

Name	Summary	Location	Status
Federal, State, County, and Local Projects			
Additional Development, Horizon Center Industrial Park, Oak Ridge Industrial Development Board (IDB)	Development of lots within the Horizon Center Industrial Park.	Horizon Center Industrial Park Development	Potential future undefined projects. Timeframe uncertain, development schedule is not definitive.
X-Energy Helium Test Facility	Test facility to support small modular reactor design validation. Proposed on 15 acre site adjacent to the Horizon Center Site (HCS).	Horizon Center Industrial Park Development Area 7 (northeast of the FFF)	Construction, expected to last 12 months, was expected to begin in 2025. Facility expected to operate for a minimum of 6 years up to an additional 20 years. Reasonably foreseeable.
BWX Technologies Advanced Centrifuge	BWX Technologies announced the opening of its centrifuge manufacturing facility on a 97-acre parcel at Horizon Center Industrial	Horizon Center Industrial Park Development	The facility began operations on January 26, 2026.

Name	Summary	Location	Status
Manufacturing Facility	Park. The facility will manufacture advanced centrifuges to support domestic uranium enrichment.		
Oak Ridge Electric Department (ORED) Electrical Infrastructure Upgrades	ORED plans to add two new 10 megawatt (MW) circuits to the existing circuit that currently powers the Horizon Center Industrial Park. The new transmission circuits would follow the existing ORED right-of-way from the Blair Road electrical substation, approximately 1 mile southwest of the HCS, to the southwest corner of the HCS. ORED plans to install four 10 MW overhead transmission lines from a substation south of Tennessee State Route 95 (TN 95) northward along Norvus Drive and enter the HCS at its southern point at the intersection of Norvus Drive and Renovare Boulevard. Construction activities may overlap with the FFF.	Southwest, and southeast of the FFF	Reasonably foreseeable.
Orano Uranium Enrichment Facility	Construction of a centrifuge uranium enrichment facility.	Approximately 0.8 mile southeast of the FFF	Reasonably foreseeable.
Oak Ridge Enhanced Technology and Training Center (ORETTC), U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA)	Operation of the ORETTC by the DOE-NNSA to train first responders and other experts in nuclear operations, safeguards, and emergency response to support the National Security Enterprise.	0.9 mile east of the FFF	The facility opened in January 2023.

Name	Summary	Location	Status
East Tennessee Technology Park (ETTP)	Ongoing remediation and transfer of remediated facilities.	2.3 miles southwest of the FFF	Operation will overlap with construction and operation of the FFF.
DOE Environmental Management Disposal Facility (EMDF)	The DOE proposed a landfill for disposal of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) low-level hazardous waste.	3.4 miles east of the FFF	The project is in the planning phase with an uncertain timeframe. Reasonably foreseeable.
Oak Ridge National Laboratory (ORNL)	Continuing remediation of radiologically and chemically contaminated facilities. ORNL occupies approximately 4,470 acres and includes facilities in two areas: Bethel Valley (includes the central campus of ORNL, as well as reactor, isotope production, waste treatment, and research facilities) and Melton Valley (includes reactor, research, waste treatment, and waste management facilities).	4 miles southeast of the FFF	Operation will overlap with construction and operation of the FFF.
Tennessee Valley Authority (TVA) Clinch River Nuclear Site	Construction and operation by TVA of an advanced nuclear technology park. The park would contain one or more advanced nuclear reactors with a cumulative electrical output not to exceed 800 megawatts of electricity for the site.	5 miles southwest of the FFF	Early Site Permit issued by the NRC in 2019. Programmatic EIS issued by TVA in July 2022. Timing of construction / operation is unknown. May overlap with construction and operation of the FFF. Reasonably foreseeable.
DOE Y-12 National Security Complex	Continuing remediation of contaminated facilities and mercury contamination in soil and groundwater. The following projects are	6.6 miles east of the FFF	Planning and installation of the Calciner Project began in 2014 and is ongoing. The

Name	Summary	Location	Status
	proposed at Y-12: West End Protected Area Reduction Project, Lithium Processing Facility, Calciner Project, and Electrorefining Project.		DOE received startup authorization for the Electrorefining Project in September 2025. The West End Protected Area Reduction Project was approaching completion of construction in 2025. The Lithium Processing Facility is scheduled for construction in 2031 and operation in 2034.
City of Oak Ridge Water Treatment Plant	A new water treatment facility to be constructed at a location near the intake of the current water treatment plant.	7.3 miles east of the FFF	Construction began in October 2022 and is expected to be in operation in 2026. Operation would support the FFF.
City of Oak Ridge, Downtown Oak Ridge	Downtown Oak Ridge development project along the Wilson Street Corridor. The project would include a mix of residential and retail development.	7.3 miles northeast of the FFF	Planning phase with an uncertain timeline. Reasonably foreseeable.
Businesses, Homes, and Other Projects			
Kairos Reactor Demonstration at ETTP	Construction and operation of a low-power demonstration reactor to support development of a fluoride salt-cooled, high-temperature reactor technology.	2.3 miles southwest of the FFF	Operation may overlap with construction and operation of the FFF
Kairos Hermes 2 Reactor at ETTP	Construction and operation of Hermes 2, two 35-MW reactors adjacent to the Hermes Test Reactor at ETTP.	2.3 miles southwest of the FFF	Construction permit issued by the NRC in November 2024.

Name	Summary	Location	Status
			Reasonably foreseeable.
Ultra Safe Nuclear Corporation (USNC) Pilot Fuel Manufacturing Operation/ETTP	USNC sited a new pilot fuel manufacturing operation, located on the ETTP (see above), at the site of the Manhattan Project's K-25 Gaseous Diffusion Process Facility.	2.3 miles southwest of the FFF	The facility opened in August 2022. Operation will overlap with construction and operation of the FFF.
Coqui Pharma – Medical Isotope Production Facility	Plans to construct a medical isotope facility.	2.3 miles southwest of the FFF	Construction may overlap with operation of the FFF. Reasonably foreseeable.
North Wind Solutions, LLC Transuranic (TRU) Waste Processing Center (WPC)	Ongoing operation of the TRU WPC for the DOE Oak Ridge Office of Environmental Management to process and repackage ORNL TRU waste and to ship it offsite.	4.8 miles southeast of the FFF	Operation will overlap with construction and operation of the FFF.

CERCLA – Compensation, and Liability Act; DOE – Department of Energy; EMDF – Environmental Management Disposal Facility; ETTP – East Tennessee Technology Park; FFF – Fuel Fabrication Facility; HCS – Horizon Center Site; IDB – Oak Ridge Industrial Development Board; MW – megawatt; ORETTC – Oak Ridge Enhanced Technology and Training Center; ORNL – Oak Ridge National Laboratory; TRU – North Wind Solutions, LLC Transuranic; TVA – Tennessee Valley Authority; USNC – Ultra Safe Nuclear Corporation; WPC – Waste Processing Center

APPENDIX D
LIST OF PREPARERS

Table D-1 List of preparers

Name	Function or expertise
Jill Caverly, NRC	Senior Project Manager
Marla Morales, NRC	Project Manager
Arthur Desrosiers, NUMARK	Project Management, Public and Occupational Health
William Dornsife, NUMARK	Waste Management
Andrew Marchese, NUMARK	Accidents
Jason Sean Lancaster, Stantec	Project Management
John Brewer, Stantec	Deputy Project Management, Federally Protected Species, Alternatives, Land Use, Visual Resources
Doug Mooneyhan, Stantec	Cumulative Effects, Climate Change
Malini Roberts, Stantec	Technical Editing
Afton Tankersly, Stantec	Meteorology and Air Quality
Brenton Jenkins, Stantec	Transportation
Jonathan Hess, Stantec	Geological Resources
James Douglas, Stantec	Water Resources
Kelly Daniels, Stantec	Ecological Resources
Mary Martin, Stantec	Noise
Rachel Kennedy, Stantec	Historic and Cultural Resources
Yosef Shirazi, Stantec	Socioeconomics

NRC – U.S. Nuclear Regulatory Commission; NUMARK – NUMARK Associates, Inc.; Stantec – Stantec Consulting Services, Inc.

APPENDIX E
PUBLIC COMMENT SUMMARIES AND RESPONSES

E.1 TRISO-X Draft Environmental Impact Statement Public Comment Summaries and Responses

E.1.1 Introduction

The U.S. Nuclear Regulatory Commission (NRC) issued a Federal Register Notice (FRN) on October 23, 2025, notifying the public of the availability of the draft environmental impact statement (EIS) for the TRISO-X Fuel Fabrication Facility (FFF) Special Nuclear Material License Application and requesting public comment (90 *Federal Register* 48508). The NRC registered the draft EIS with the U.S. Environmental Protection Agency (EPA) in September 2025. However, due to the lapse of government appropriations, notice of the availability of the document was not published on October 3, 2025, by EPA as originally scheduled. The October 23, 2025, FRN notified the public of the original comment period end date of November 17. However, to be consistent with the requirement in Title 10 of the Code of Federal Regulations (CFR) Part 51, the staff issued a FRN on November 17, 2025, notifying the public that the comment period end date was being extended to December 8, 2025.

The NRC staff strives to conduct regulatory activities in an open and transparent manner and to make information as accessible as possible to optimize public participation. For this draft EIS public comment process, the NRC staff published the FRNs and posted information to the NRC website. The NRC staff also sent a copy of the draft EIS materials to the Oak Ridge Library.

The NRC accepted all comments on the draft EIS received on or before December 8, 2025. The NRC received 13 individual comment correspondences. From these, the NRC identified 50 unique comments. This appendix contains summaries of these comments by subject matter, the NRC staff's responses to the comments, and a table of the correspondence numbers.

Where applicable, the responses note which EIS sections the NRC staff edited in response to comments.

E.1.2 Comment Review Method

Draft EIS comment correspondence received by the NRC staff included comments submitted online at www.regulations.gov and one letter received through the U.S. mail. The NRC staff assigned a number to each commenter based on the order in which the correspondence was received. For extensive correspondence, the NRC staff sub-divided the correspondence and assigned the sub-comment to the primary resource the comment addressed. Section E.2 provides summaries of the comments organized by the primary resource addressed in each comment and the responses of the NRC staff to each comment grouping.

Table E–1 provides, in the order in which the comments were received, a list of all commenters; their affiliations, if stated; the manner in which their comment correspondence was submitted; the accession number to be used to find the correspondence in the NRC's Agencywide Documents Access and Management System (ADAMS); and the identification number assigned to the commenter and their comment correspondence.

Table E-1. Individuals providing comments during the scoping comment period

Commenter	Affiliation	Correspondence ID	Comment source	ADAMS accession number
Jiang, Yue “Joy”	The Breakthrough Institute	TF3-EIS-DR-00001	Regulations.gov	ML25322A137
Anonymous	None Provided	TF3-EIS-DR-00002	Regulations.gov	ML25322A131
Anonymous	None Provided	TF3-EIS-DR-00003	Regulations.gov	ML25322A139
Anonymous	None Provided	TF3-EIS-DR-00004	Regulations.gov	ML25322A124
Unknown	Amphibian Refuge	TF3-EIS-DR-00005	Regulations.gov	ML25322A123
Creswell, Wade	Roane County Executive	TF3-EIS-DR-00006	Regulations.gov	ML25322A134
ganMoryn, Croitiene	None Provided	TF3-EIS-DR-00007	Regulations.gov	ML25322A126
Metz, Steven	None Provided	TF3-EIS-DR-00008	Regulations.gov	ML25322A178
DeLis, Wilson	None Provided	TF3-EIS-DR-00009	Regulations.gov	ML25322A136
Melle, Steven	None Provided	TF3-EIS-DR-00010	Regulations.gov	ML25322A129
Porterfield, Donivan	None Provided	TF3-EIS-DR-00011	Regulations.gov	ML25343A241
Darby, Valincia	U.S. Department of the Interior	TF3-EIS-DR-00012	Regulations.gov	ML25343A242
Kajumba, Ntale	U.S. Environmental Protection Agency	TF3-EIS-DR-00013	Letter	ML25343A341

E.2 Public Comment Summaries and Responses

E.2.1 Comments Concerning Editorial Changes

E.2.1.1 Editorial—General

The NRC received comments highlighting typographical errors in the text, tables, and references and another comment requesting process flow diagrams and charts in the EIS to describe the operational and waste management processes of the proposed facility in more detail.

Response: *The NRC corrected typographical errors discovered in the draft EIS during production of the EIS. The NRC staff produces the EIS consistent with its regulations and guidance implementing the National Environmental Policy Act (NEPA) and other applicable laws and believes the level of detail provided in the draft EIS sufficiently describes the Applicant's proposed action as written.*

Comments: (TF3-EIS-DR-00006) (TF3-EIS-DR-00011)

E.2.2 Comments Concerning Alternatives

E.2.2.1 Alternatives—Comment on the Breadth of Alternatives Provided

The NRC received a comment stating the EIS should assess more alternatives in addition to the no action alternative.

Response: *The NRC staff produces the EIS consistent with its regulations and guidance implementing NEPA and other applicable laws and believes the level of detail regarding alternatives provided in the EIS is sufficient.*

No changes were made to the EIS as a result of this comment.

(TF3-EIS-DR-00009)

E.2.2.2 Alternatives—Comment on the No Action Alternative

The NRC received a comment requesting that the EIS include additional detail regarding the potential indirect negative impacts, including offsite downstream effects, of accepting the no action alternative and whether the no action alternative would fulfill the purpose and need statements of both the NRC and the U.S. Department of Energy (DOE).

Response: *Section 2.2 of the EIS discusses the potential indirect negative impacts of accepting the no action alternative to the extent feasible. As noted in the EIS, accepting the no action alternative could limit the domestic sources of high-assay low-enriched uranium (HALEU) fuel for use in advanced reactors, which in turn could reduce the number of advanced reactors that could be used to generate electricity. As a result, other sources of power generation such as fossil fuel–based power plants could be added to the electric grid or remain in operation longer. Fossil fuel use contributes to greenhouse gas emissions and other forms of air pollution that are not associated with nuclear power plants. However, a more quantitative prediction of the effects of not constructing and operating the FFF is not feasible, as choosing the no action alternative for this project would not preclude a different FFF being constructed at a different site to provide* *the fuel needed for advanced nuclear reactors. It is likely that if the market supports the use of advanced nuclear reactors as a source of electricity, a facility to fabricate the fuel for these reactors could still be constructed elsewhere. Additional language has been added to section 2.2 of the EIS that addresses whether the no action alternative would fulfill the purpose and need statements of both the NRC and the DOE.*

Comments: (TF3-EIS-DR-00001)

E.2.3 Comments Concerning Visual Resources

E.2.3.1 Visual Resources—Visibility of Facility Buildings

The NRC received a comment requesting information regarding whether the six ventilation stacks proposed for the FFF, which would rise approximately 100 feet above ground level, would require flashing warning lights.

Response: *The Federal Aviation Administration's (FAA's) Advisory Circular AC 70/7460-1M - Obstruction Marking and Lighting, which describes the FAA's standards for marking and lighting structures to promote aviation safety (FAA, 2020), states that any temporary or permanent structure, including all appurtenances, that exceeds an overall height of 200 feet (61 meters) above ground level, or exceeds any obstruction standard contained in 14 CFR Part 77 [associated with objects in proximity to airports], should normally be marked and/or lighted. Given that the ventilation stacks at the FFF would rise approximately 100 feet above ground level, they will not require flashing warning lights.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.4 Comments Concerning Air Quality and Climatology

E.2.4.1 Air Quality and Climatology—Comments of the EPA

The NRC received comments from the EPA requesting that the EIS include revised National Ambient Air Quality Standards (NAAQS) for primary particulate matter (PM2.5) and secondary sulfur dioxide (SO_2); an air pollutant emissions estimate for construction of the FFF; and clarification regarding whether the FFF would be subject to permitting as a minor air pollutant source or a major air pollutant source according to 40 CFR Part 70.2 requirements.

Response: *Table 3.3-2 of the EIS has been updated to reflect the revised NAAQS. Section 3.3.3 of the EIS has been revised to include an air pollutant emissions estimate for construction of the FFF and to clarify the FFF would be subject to permitting as a minor air pollutant source.*

Comment: (TF3-EIS-DR-00013)

E.2.4.2 Air Quality and Climatology—Climatological Normals and Means

The NRC received a comment requesting that the EIS include meteorological data for the area surrounding the Horizon Center Site (HCS) that is more recent than the 1981–2010 period presented in table 3.3-1 of the draft EIS.

Response: *Table 3.3-1 of the EIS has been updated to present the most recent 30-year period of meteorological data available for the area surrounding the HCS (1991–2020). The staff evaluated the updated meteorological data and concluded the impacts of the FFF on air quality remain small.*

Comment: (TF3-EIS-DR-00006)

E.2.5 Comments Concerning Surface and Ground Water

E.2.5.1 Surface and Ground Water—Facility Water Usage

The NRC received a comment requesting that the EIS include the daily volume of water that would be necessary to support the FFF and to update the withdrawal rates of the Kingston and Rockwood, Tennessee Water Systems to a date more recent than 2010.

Response: *Section 2.1.1 of the EIS has been revised to include the estimated volume of water necessary to support daily operation of the FFF. Section 3.5.1 of the EIS has been revised to include more recent data regarding the withdrawal rates of the Kingston and Rockwood, Tennessee Water Systems as provided by each of the municipalities. The staff evaluated the updated withdrawal volumes and concluded the impacts of the FFF on surface water remain small.*

Comment: (TF3-EIS-DR-00006)

E.2.5.2 Surface and Ground Water—Sinkhole Mitigation Plan

The NRC received a comment asking when the Applicant would be required to have a sinkhole mitigation plan.

Response: *Changes to surficial groundwater and surface water flow could affect and exacerbate existing karst features such as voids and sinkholes located both onsite and offsite of the FFF. Changes in groundwater flow could cause increased development of existing features, activation of dormant features, and development of new features. Increased development of karst features over time at the HCS could allow stormwater to bypass permanent stormwater best management practices (BMPs) and directly enter subsurface voids and related karst features. To mitigate the potential for sinkhole development at the HCS, TRISO-X would line the stormwater detention basins with high-density polyethylene liners and clay backfill below the liners to prevent infiltration within the basins. TRISO-X would also periodically inspect the basins for indications of subsidence or potential sinkhole formation. To further reduce impacts, the NRC staff recommends an additional mitigation action that TRISO-X develop a sinkhole mitigation plan that would detail the procedures TRISO-X would follow to minimize impacts on groundwater in the case of a sinkhole collapse. However, this is a recommended action and TRISO-X is not required to implement this action.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.5.3 Surface and Ground Water—Stormwater Management System

The NRC received comments regarding whether recent heavy rains at the HCS would require the Applicant to update the stormwater management system at the FFF and perform new evaluations of karst features at the HCS.

Response: *Sections 3.4.2.1, 3.4.2.2, and 3.5 of the EIS note that TRISO-X would be required to follow Tennessee Department of Environment and Conservation (TDEC) stormwater management regulations; the City of Oak Ridge's Stormwater Management Ordinance, which includes specific requirements for stormwater management system design and operation in karst areas; and the permit conditions of the National Pollutant Discharge Elimination System (NPDES) Construction and Operation Stormwater General Permits, all of which would account for existing conditions at the HCS. As a component of permit compliance, TRISO-X has developed a stormwater pollution prevention plan (SWPPP). The SWPPP outlines temporary and permanent stormwater management BMPs and construction erosion and sediment control (ESC) practices. The practices outlined in these documents include BMPs and procedures intended to prevent or mitigate to the extent possible potential impacts from erosion. The SWPPP would be updated and modified as required during construction to ensure construction meets the regulatory standards enacted by the TDEC and City of Oak Ridge and requirements stated in the SWPPP. During operation of the FFF, the stormwater management system would be designed and operated in compliance with TDEC regulations and the City of Oak Ridge's Stormwater Management Ordinance, which includes specific requirements for stormwater management system design and operation in karst areas.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.5.4 Surface and Ground Water—Monitoring of Stormwater Runoff and Groundwater

The NRC received a comment requesting information regarding how runoff from the FFF would be monitored for hazardous and radioactive contaminants.

Response: *As noted in comment response E.2.5.3, TRISO-X would be required to follow the permit conditions of the NPDES Construction and Operation Stormwater Permits. These permits require a facility to sample its discharges to confirm compliance with the permitted level of a pollutant or pollutant parameter and notify the EPA and respective state regulatory agency of sampling results. EPA and state regulatory agencies also send inspectors to facilities to determine whether they are in compliance with the conditions imposed under their permits (EPA, 2025). Additionally, sections 3.4.4 and 3.5.2 of the EIS have been revised to describe sampling of soils, surface water at the stormwater detention basins, and groundwater that TRISO-X would conduct as part of its radiological environmental monitoring program (REMP) during operation. The monitoring program would be implemented with the purpose of ensuring radiological concentrations remain below regulatory limits at the HSC boundary and offsite.*

Comment: (TF3-EIS-DR-00006)

E.2.5.5 Surface and Ground Water—Groundwater Impacts

The NRC received a comment that expressed disbelief that effects on groundwater associated with the FFF would be moderate.

Response: *As noted in prior comment responses, TRISO-X would be required to follow TDEC stormwater management regulations, the City of Oak Ridge's Stormwater Management Ordinance, and the permit conditions of the NPDES Construction and Operation Stormwater General Permits and would implement an REMP that, in part, would regularly monitor groundwater. The NRC staff has concluded that this combination of adhering to state and local permit conditions and regularly monitoring groundwater would minimize the impacts of the FFF on groundwater.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00008)

E.2.6 Comment Concerning Floodplains

E.2.6.1 Floodplains—100-Year Floodplain Elevation

The NRC received a comment stating the maximum 100-year flood elevation in the vicinity of the HCS and the lowest ground elevation at the HCS are the same and requested information regarding how potential increased rain events in the region would affect the FFF.

Response: *The effects of environmental conditions, such as potential flooding, on the FFF are addressed in the NRC's safety evaluation report (SER) for the license application. However, as described in section 3.5.2.3 of the EIS, the FFF would be constructed outside of the 500-year floodplain and above the projected maximum 100-year flood elevation in the vicinity of the HCS. The FFF would not impact mapped flood zones or floodways. Additionally, the FFF would include a stormwater management system, in compliance with TDEC regulations and the City of Oak Ridge's Stormwater Management Ordinance, including a detention and retention basin that would be capable of managing 100-year precipitation events.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.7 Comment Concerning Ecological Resources

E.2.7.1 Ecological Resources—Threatened and Endangered Species

The NRC received a comment requesting clarification regarding how winter tree clearing at the HCS should be considered mitigation for protected species.

Response: *The approach to tree clearing described in section 3.6.8 of the EIS is considered by the U.S. Fish and Wildlife Service (USFWS) to be a mitigation measure protective of endangered or proposed endangered bats. The protected bats that may use trees at the HCS as roosting sites during summer months hibernate in caves and mines in other areas of the state during the winter months. Therefore, clearing potential roosting trees during the winter months mitigates the potential for bats to be injured when the trees are being cleared. Likewise, migratory birds are not known to nest in trees at the HCS during winter months; therefore, winter tree clearing would be considered protective for migratory birds as well.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00009)

E.2.8 Comment Concerning Noise

E.2.8.1 Noise—Multiple Noise Sources

The NRC received a comment requesting additional information regarding the noise levels of multiple pieces of heavy equipment operating simultaneously at the HCS during construction and how that might affect surrounding areas, including the North Boundary Greenway Trail.

Response: *Section 3.8.2 of the EIS has been revised to include discussion of simultaneous operation of construction equipment. Although multiple pieces of equipment operating simultaneously would increase the noise emanating from a construction site, construction noise is primarily governed by the loudest pieces of equipment operating at a given time, as the loudest pieces of equipment dictate the maximum noise levels at a site (Federal Highway Administration [FHWA], 2011). Decibels are measured on a logarithmic scale; therefore, the increase in noise resulting from multiple pieces of construction equipment operating simultaneously is not assessed by the standard addition of the individual decibel values. Based on logarithmic addition, two noises of equal level (plus or minus 1 decibel [dB]) would combine to raise the noise level by 3 dB higher than that of the loudest noise source; two pieces of equipment differing by 2 to 3 dB would increase the combined noise level by 2 dB higher than that of the loudest noise source; and two pieces of equipment differing by 4 to 9 dB would increase the combined noise level by 1 dB higher than that of the loudest noise source. Beyond 10 dB, the combined noise level of two pieces of equipment would be that of the louder of the two pieces of equipment (FHWA, 2011). Thus, even when operating several pieces of equipment simultaneously, noise levels from construction equipment at the HCS would be expected to attenuate to levels below the City of Oak Ridge zoning ordinance maximum noise level of 80 dBA at the boundary of the HCS.*

Comment: (TF3-EIS-DR-00006)

E.2.9 Comments Concerning Waste Management

E.2.9.1 Waste Management—Excavated Soils

The NRC received a comment expressing concern about the volume of soils that are proposed to be excavated from the HCS and trucked to offsite landfills.

Response: *As stated in section 2.1.1 of the EIS, TRISO-X has stated the material excavated from the HCS would be tested to determine its suitability as backfill, and it would use suitable materials as backfill where possible. The number of truckloads required to remove all excavated materials from the HCS prior to construction provided in the EIS is a conservative estimate to account for the possibility that none of the excavated materials would be suitable for reuse as backfill. The materials removed from the HCS would be transported to a licensed landfill, and TRISO-X would be required to obtain approval from the City of Oak Ridge for the use of any proposed borrow areas and landfills during the building permits process.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.9.2 Waste Management—Class A and Liquid Wastes

The NRC received a comment asking for clarification in section 2.1.3 of the EIS regarding the quantities of Class A or liquid wastes that would be trucked to offsite locations.

Response: *Section 3.9.2 of the EIS provides the anticipated volumes of radioactive waste that would be transported offsite and the locations of the licensed facilities the waste would be transported to.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.9.3 Waste Management—Effluent Monitoring Plan

The NRC received a comment asking for information regarding when TRISO-X would be required to implement an effluent monitoring plan.

Response: *The TRISO-X REMP, which includes effluent monitoring, will be required to be implemented prior to the facility receiving uranium feed material.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.10 Comments Concerning Public and Occupational Health

E.2.10.1 Public and Occupational Health—Contaminated Uranium Feedstock

The NRC received comments expressing concern that the feedstock uranium used by the FFF could be incidentally contaminated and thereby emit a different amount of radiation than was estimated in the draft EIS and cause potential impacts on worker dose, the environment, or the produced fuel that were not assessed in the draft EIS.

Response: *The uranium feedstock acquired by TRISO-X for use at the FFF would adhere to contamination limits that are below thresholds that would affect occupational or environmental dose limits (TRISO-X, 2024). Trace level alpha contaminants are limited to 0.1 parts per million (ppm) of transuranic contaminants (micrograms of transuranic contaminant per gram of uranium), and the fission product contaminants are limited to 600 becquerels of fission product activity per gram of uranium. TRISO-X would maintain approved procedures that prevent TRISO-X from receiving uranium feed material with contaminants in excess of these limits.*

No changes were made to the EIS as a result of this comment.

Comments: (TF3-EIS-DR-00006) (TF3-EIS-DR-00011)

E.2.10.2 Public and Occupational Health—Stored Chemicals

The NRC received a comment expressing concern that tables 2.1-1a through 2.1-1e of the TRISO-X environmental report (ER), referenced in section 2.1.2.2 of the draft EIS, did not clearly provide the information referred to in the draft EIS.

Response: *The reference to tables 2.1-1a through 2.1-1e in section 2.1.2.2 of the EIS (liquid and gaseous chemicals stored and consumed in the production of the fuel) has been revised to cite updated tables filed by TRISO-X in January 2026 (TRISO-X, 2026).*

Comment: (TF3-EIS-DR-00011)

E.2.10.3 Public and Occupational Health—Stored Chemical Emissions

The NRC received a comment expressing concern regarding the volume of pollutant emissions of stored chemicals as described in section 3.10.1 of the draft EIS.

Response: *Section 3.10.1 of the EIS has been revised to reduce confusion regarding air emissions associated with operation of the FFF. The text in section 3.10.1 of the draft EIS erroneously referred to total emissions associated with operation of the FFF, not stored chemicals.*

Comments: (TF3-EIS-DR-00006)

E.2.10.4 Public and Occupational Health—Trichloroethylene

The NRC received a comment requesting information regarding whether trichloroethylene would be used at the FFF.

Response: *TRISO-X has stated trichloroethylene would not be used at the FFF.*

No changes were made to the EIS as a result of this comment.

Comments: (TF3-EIS-DR-00011)

E.2.11 Comment Concerning Transportation

E.2.11.1 Transportation—Traffic

The NRC received a comment expressing concern that the draft EIS did not appropriately address project impacts on secondary and tertiary roads from transport of construction materials to the HCS and the removal of radiological waste materials. This comment also expressed concern regarding the effects of fuel feedstock deliveries to the FFF on the traffic of Knoxville, Tennessee, given that Interstates 75 and 40 would likely be used to transport the feedstock to the FFF and both interstates pass through Knoxville.

Response: *The HCS is immediately adjacent to primary roadways (e.g., Tennessee State Routes [TN] 95, 58, and 61 and Interstate 40); therefore, NRC staff expect these major roadways would be used to access the FFF and be used by vehicles departing from the FFF. NRC staff also expect that material deliveries during operation would travel on these primary roadways to reach the FFF. As described in section 3.11.2 of the EIS, all shipments of radiological materials and wastes would be conducted in conformance with NRC, 33 U.S. Department of Transportation, and State of Tennessee requirements. All the shipment containers and methods would adhere to the requirements of 10 CFR Part 71, “Packaging and Transportation of Radioactive Material” and 49 CFR Parts 100–180 of Chapter I, “Pipeline and Hazardous Materials Safety Administration, Department of Transportation” and approved by the NRC under docket number 71-9315. The Versa-Pac and LR-230s packages meet the surface* *dose rate limits of 10 CFR 71.47(a) and 49 CFR 173.441(a), and shipment batches of containers would meet the dose rate limits of 49 CFR 173.441(d). As stated in section 3.11.2 of the EIS, NRC staff anticipate a daily average of four nonradiological supply/waste deliveries and removals, and one radiological supply/waste delivery and removal would be required per day during operation of the FFF. NRC staff concluded that if these delivery vehicles pass through Knoxville on Interstates 75 and 40 to reach the FFF, the increase in associated daily traffic would be indiscernible from existing traffic.*

No changes were made to the EIS as a result of this comment.

Comments: (TF3-EIS-DR-00006)

E.2.12 Comment Concerning Socioeconomics

E.2.12.1 Socioeconomics—Impacts on the Region of Influence

The NRC received a comment noting that the small to moderate impacts on the socioeconomics within the region of influence of the FFF would be offset by beneficial impacts such as higher local government revenue. The comment also stated the draft EIS did not fully account for long-term socioeconomic growth driven by a permanent increase in population and sustained employment opportunities.

Response: *The small to moderate impacts described in section 3.12.2 of the EIS are characterized as beneficial impacts on the regional economy and employment. The NRC staff disagree with the contention that the EIS did not fully account for long-term socioeconomic growth. Section 3.12.2.2 of the EIS includes an assessment of the potential for long-term growth over the initial 40-year license period for the proposed FFF.*

No changes were made to the EIS as a result of this comment.

Comments: (TF3-EIS-DR-00001)

E.2.13 Comments Concerning Accidents

E.2.13.1 Accidents—Radiological Environmental Monitoring Plan

The NRC received a comment expressing concern that the TRISO-X REMP is more complex than indicated in the draft EIS and that it required oversight and independent monitoring by TDEC.

Response: *The NRC staff produces the EIS consistent with its regulations and guidance implementing NEPA and other applicable laws. NRC staff performed a detailed evaluation of the REMP program in its safety review where it has the statutory authority under Atomic Energy Act to regulate and inspect a licensee's effluents and REMP. Details of the environmental monitoring are found in the safety evaluation report. The NRC staff considers the level of detail regarding the REMP provided in the EIS appropriate for the environmental review. TDEC operates under Tennessee Code Title 68, Chapter 202, Section 203, and has legal authority to measure radiation and provide monitoring and surveillance of the environment for radioactive materials in areas under state jurisdiction.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.13.2 Accidents—Chemical Storage

The NRC received a comment expressing concern that section 3.10.1 of the draft EIS did not provide an exhaustive list of the hazardous chemicals and radionuclides that would be present onsite at the FFF and requesting a list identifying each hazardous chemical and radionuclide present at the facility, including specifications for trace impurities in the nuclear source material, and the maximum amount of radioactive material that would be at the facility during peak operation.

Response: *TRISO-X filed supplemental information to its ER in 2026, cited in section 3.10.1 of the EIS, that provides an inventory of the chemicals and compounds that would be stored onsite at the FFF with descriptions of the potential for public health impacts if the chemicals were to be released into the environment (TRISO-X, 2026). The quantity of uranium present at the FFF is not provided to the general public for security reasons. The types, maximum quantities, and forms of special nuclear materials (SNM) that are authorized under 10 CFR 70 are provided in the TRISO-X license application (TRISO-X, 2024). Trace level alpha contaminants are limited to 0.1 ppm of transuranic contaminants (micrograms of transuranic contaminant per gram of uranium), and the fission product contaminants are limited to 600 becquerels of fission product activity per gram of uranium.*

Comment: (TF3-EIS-DR-00006)

E.2.13.3 Accidents—Criticality Monitoring

The NRC received a comment expressing concern that the draft EIS did not clearly address whether the proposed FFF design would include a Criticality Accident Alarm System.

Response: *Criticality monitoring and the requirement for a licensee authorized to possess SNM to employ a Criticality Accident Alarm System is addressed in Section 1.3.1.1 of the TRISO-X license application (TRISO-X, 2024).*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.14 Comments Concerning Cumulative Effects

E.2.14.1 Cumulative Effects—Downstream Effects

The NRC received a comment requesting more research into the direct/indirect effects of the *use* of new special nuclear material.

Response: *The downstream effects of the use of fuel that would be fabricated at the FFF are beyond the scope of the EIS. However, the downstream use of the fuels would be in association with NRC-licensed activities or under the control of the DOE or other federal agencies and subject to limits established by the EPA.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00009)

E.2.14.2 Cumulative Effects—Integrated Safety Analysis

The NRC received a comment requesting details of the Integrated Safety Analysis in the context of the evaluation of reasonably foreseeable cumulative effects in section 3.14 of the draft EIS.

Response: *The technical basis for the evaluation of reasonably foreseeable cumulative effects is an assessment that the regulatory limits for impacts to the general public will not be exceeded. In the case of radiation dose impacts, the governing regulations are 10 CFR 20, which limits radiation dose to a member of the public at 100 mrem per year, and 40 CFR 190, which limits total radiation doses from fuel cycle facilities to actual persons. The location of the FFF relative to other proposed facilities and the current or potential locations of actual persons effectively limits potential cumulative effects because the impacts of radiological effluents diminish strongly with distance from the source and because each of the proposed facilities would be subject to federal regulations that limit radiological impacts at their site boundaries to fractions of the statutory limits to actual individuals.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00006)

E.2.15 Out of Scope Comments

E.2.15.1 Out of Scope—Support for Nuclear Power and the Nuclear Industry

The NRC staff received multiple comments expressing general support for the use of nuclear energy as an energy source and the expansion of the nuclear industry as a means to promote U.S. energy security.

Response: *Comments in support of nuclear power and the nuclear industry are beyond the scope of the EIS. This environmental review addresses the potential impacts that could result from the proposed project. Furthermore, the NRC is an independent regulatory agency that does not promote nuclear or other types of energy. These comments will not be addressed further in the EIS.*

Comments: (TF3-EIS-DR-00001) (TF3-EIS-DR-00002) (TF3-EIS-DR-00003) (TF3-EIS-DR-00010)

E.2.15.2 Out of Scope–Request for Charging Stations at the FFF

The NRC staff received a request that the Applicant consider adding renewable energy facilities as part of this project, such as solar panels, battery storage units, and electric vehicle charging stations.

Response: *Adding renewable energy facilities to the project is beyond the scope of the project's purpose and need.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00005)

E.2.16 General Opposition Comments

E.2.16.1 General Opposition—Need

The NRC staff received one comment of general opposition stating the FFF is not needed.

Response: *While the comments expressing opposition are useful for the NRC to understand public opinion about the licensing action, comments that do not provide new information regarding the scope of the potential impacts are not addressed in the EIS.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00007)

E.2.16.2 General Opposition—Radiological Waste

The NRC received a comment opposing the project on the basis that general disposal of radiological waste has not been resolved and stating “sustainable energy” projects should be pursued instead.

Response: *This environmental review addresses the potential impacts that could result from the proposed project. The management of radiological waste is addressed in section 3.9 of the EIS. The NRC is an independent regulatory agency that does not promote nuclear energy or other types of energy.*

No changes were made to the EIS as a result of this comment.

Comment: (TF3-EIS-DR-00004)

E.3 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, Energy, Part 20, “Standards for Protection Against Radiation.”

10 CFR Part 51. *Code of Federal Regulations*, Title 10, Energy, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.”

10 CFR Part 70. *Code of Federal Regulations*, Title 10, Energy, Part 70, “Domestic Licensing of Special Nuclear Material.”

40 CFR Part 190. *Code of Federal Regulations*, Title 40, Protection of Environment, Part 190, “Environmental Radiation Protection Standards for Nuclear Power Operations.”

EPA. 2025. “NPDES Permit Basics.” Last updated: June 3, 2025. Available at: https://www.epa.gov/npdes/npdes-permit-basics. Accessed February 2, 2026.

Federal Aviation Administration. 2020. “Advisory Circular 70/7460-1M - Obstruction Marking and Lighting.” AJV-P, Policy-Mission Support Services. 2020-11-16.

FHWA. 2011. “Highway Traffic Noise Analyses and Abatement: Policy and Guidance.” U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning, Noise and Air Quality Branch, Washington, D.C. FHWA-HEP-10-025.

TRISO-X. 2022. “TRISO-X Fuel Fabrication Facility Special Nuclear Material License 11 Application.” TRISO-X, LLC, Rockville, Maryland. April 5, 2022. ADAMS Accession No. ML22101A200.

TRISO-X. 2024. “Supplemental Information for the TRISO-X Fuel Fabrication Facility License Application Review (Part 1).” TX0-REG-LTR-0055. December 30, 2024. ML24365A256.

TRISO-X. 2026. “Supplemental Information for the TRISO-X Environmental Report. Enclosure 2.” TX0-REG-LTR-0105. January 29, 2026. ML26029A128.

APPENDIX F
APPLICABLE LAWS, REGULATIONS, AND OTHER REQUIREMENTS

Several federal laws and regulations affect environmental protection, health, safety, compliance, and consultation at every U.S. Nuclear Regulatory Commission (NRC or Commission)-licensed facility. Some of them require permits by, or consultation with, other federal agencies or state, tribal, or local governments. Certain federal environmental requirements have been delegated to state authorities for enforcement and implementation. Furthermore, states have also enacted laws to protect public health and safety and the environment. It is the NRC's policy to make sure that NRC-licensed facilities are operated in a manner that provides adequate protection of public health and safety and protection of the environment through compliance with applicable federal and state laws, regulations, and other requirements, as appropriate.

The Atomic Energy Act (AEA) of 1954, as amended (42 United States Code [U.S.C.] 2011 et seq.) gives the NRC the authority to license the possession and use of special nuclear material. The act allows the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under these statutes through regulations set forth in Title 10, "Energy," of the Code of Federal Regulations (CFR).

In addition to carrying out some federal programs, state legislatures develop their own laws. State statutes can supplement, as well as implement, federal laws for the protection of their air, surface water, and groundwater resources. State legislation may address solid waste management programs, locally rare or endangered species, and historic and cultural resources.

The U.S. Environmental Protection Agency (EPA) has the primary responsibility to administer the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251 et seq., herein referred to as the Clean Water Act [CWA]). The National Pollutant Discharge Elimination System Program addresses water pollution by regulating the discharge of potential pollutants to waters of the United States. The EPA allows for primary enforcement and administration through state agencies if the state program is at least as stringent as the federal program.

F.1 Federal and State Requirements

The TRISO-X fuel fabrication facility (FFF) is subject to various federal and state requirements. As a convenient source of references of environmental requirements, Table F-1 below lists principal federal and state approvals necessary for the licensing, construction, operation, and decommissioning of the TRISO-X FFF.

Table F-1 Federal and state requirements for licensing, construction, operation, and decommissioning of the TRISO-X fuel fabrication facility

Activity	Law/regulation	Requirements
Receipt, possession, use, and transfer of special nuclear material	Atomic Energy Act (42 U.S.C. 2011 et seq.)	The AEA (42 U.S.C. 2011 et seq.) gives the NRC the authority to license the possession and use of special nuclear material. The AEA allows the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under these statutes through regulations set forth in Title 10 CFR Part 70.
Licensing, construction, operation, and decommissioning of the FFF	National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.)	NEPA requires federal agencies to integrate environmental values into their process by considering the environmental impacts of proposed federal actions and reasonable alternatives to those actions. NEPA establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out the policy. NEPA Section 102(2) contains action-forcing provisions to ensure that federal agencies follow the letter and spirit of the act. For major federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of NEPA requires federal agencies to prepare a detailed statement that includes the environmental impacts of the proposed action and other specified information.
Operation of the FFF	10 CFR Part 20	Regulations in 10 CFR Part 20, “Standards for Protection Against Radiation,” establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC. These regulations are issued under the AEA and the Energy Reorganization Act of 1974, as amended. The purpose of these regulations is to control the receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual (including doses resulting from licensed and unlicensed radioactive material and from radiation sources other than background radiation) does not exceed the standards for protection against radiation prescribed in the regulations in this part.

Activity	Law/regulation	Requirements
Operation of the FFF	10 CFR Part 50	Regulations in 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” are NRC regulations issued under the AEA and Title II of the Energy Reorganization Act of 1974, as amended, to provide for the licensing of production and utilization facilities, including nuclear power reactors.
Licensing, construction, operation, and decommissioning of the FFF	10 CFR Part 51	Regulations in 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,” contain the NRC’s regulations that implement NEPA.
Air quality protection	Clean Air Act (42 U.S.C. 7401 et seq.)	The CAA is intended to protect and enhance the quality of the nation’s air resources to promote public health and welfare and the productive capacity of its population. The CAA establishes requirements to ensure maintenance of air quality standards and authorizes individual states to manage permits. Section 118 of the CAA requires each federal agency with jurisdiction over properties or facilities engaged in any activity that might result in the discharge of air pollutants to comply with all federal, state, interstate, and local requirements with regard to the control and abatement of air pollution. Section 109 of the CAA directs the EPA to set National Ambient Air Quality Standards for criteria pollutants. The EPA has identified and set National Ambient Air Quality Standards for the following criteria pollutants: particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. Section 111 of the CAA requires the establishment of national performance standards for new or modified stationary sources of atmospheric pollutants. Section 160 of the CAA requires that specific emission increases must be evaluated before permit approval to prevent significant deterioration of air quality. Section 112 requires specific standards for release of hazardous air pollutants (including radionuclides). These standards are implemented through plans developed by each state and approved by the EPA. The CAA requires sources to meet standards and obtain permits to satisfy those standards. The EPA regulates the emissions of air pollutants using 40 CFR Parts 50 to 99.

Activity	Law/regulation	Requirements
Air quality protection	Tennessee Air Pollution Control Rule 1200-03-09-.01	Construction of a new air contaminant source or the modification of an air contaminant source which may result in the discharge of air contaminants requires a construction permit received from the Tennessee Division of Air Pollution Control.
Air quality protection	Tennessee Air Pollution Control Rule 1200-03-09-.02	Facilities that have emit less than 100 tons per year (tpy) of an air pollutant, 10 tpy of a hazardous air pollutant, and/or 25 tpy of a combination of hazardous air pollutants require a non-Title V operating permit from the Tennessee Division of Air Pollution Control.
Nonradiological human health	Occupational Safety and Health Act of 1970 (29 U.S.C. 651 et seq.)	The Occupational Safety and Health Act establishes standards to enhance safe and healthy working conditions in places of employment throughout the United States. The act is administered and enforced by the Occupational Safety and Health Administration (OSHA), a U.S. Department of Labor agency. Employers who fail to comply with OSHA standards can be penalized by the federal government. The act allows states to develop and enforce OSHA standards if such programs have been approved by the U.S. Secretary of Labor.
Water-resources protection	Clean Water Act (33 U.S.C. 1251 et seq., and the NPDES [40 CFR Part 122])	The CWA was enacted to restore and maintain the chemical, physical, and biological integrity of the nation's water. The CWA requires all branches of the federal government with jurisdiction over properties or facilities engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with federal, state, inter-state, and local requirements. As authorized by the CWA, the National Pollution Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The NPDES program requires all facilities that discharge pollutants from any point source into waters of the United States to obtain an NPDES permit. The EPA is authorized under the CWA to directly implement the NPDES program; however, the EPA has authorized many states, including Tennessee, to implement all or parts of the national program. Section 401 of the CWA requires that an applicant for a federal license or permit to conduct any activity that may result in any discharge into navigable waters must provide the federal licensing or permitting agency with a certification (or waiver) from

Activity	Law/regulation	Requirements
		the state or appropriate water pollution control agency in which the discharge originates or will originate. This water quality certification implies that discharges from the activity or project to be licensed or permitted will comply with all limitations necessary to meet established state water quality requirements (40 CFR Part 121). The U.S. Army Corps of Engineers is the lead agency for enforcement of CWA wetland requirements (33 CFR Part 320). Under Section 401 of the CWA, the EPA or a delegated state agency has the authority to review and approve, condition, or deny all permits or licenses that might result in a discharge to waters of the state, including wetlands.
Water-resources protection	Tennessee Water Quality Control Act; Tennessee Code Annotated Title 69	Operators of construction sites involving clearing, grading, or excavation that result in an area of disturbance of 1 or more acres and activities that result in the disturbance of less than 1 acre if it is part of a larger common plan of development or sale require an NPDES General Permit for Discharges of Stormwater Associated with Construction Activities (CGP).
Water-resources protection	Tennessee Water Quality Control Act; Tennessee Code Annotated Title 69	All new and existing point source stormwater discharges associated with industrial activity require coverage under an NPDES Stormwater Permit from the Tennessee Division of Water Resources.
Water-resources protection	Safe Drinking Water Act of 1974 (42 U.S.C. 300(f) et seq.)	The SDWA was enacted to protect the quality of public water supplies and sources of drinking water and establishes minimum national standards for public water supply systems in the form of maximum contaminant levels for pollutants, including radionuclides. Other programs established by the SDWA include the Sole Source Aquifer Program, the Wellhead Protection Program, and the Underground Injection Control Program. In addition, the SDWA protects underground sources of drinking water from releases and spills of contaminants.

Activity	Law/regulation	Requirements
Waste management and pollution prevention	Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.)	The Resource Conservation and Recovery Act requires the EPA to define and identify hazardous waste; establish standards for its transportation, treatment, storage, and disposal; and require permits for persons engaged in hazardous waste activities. Section 3006, "Authorized State Hazardous Waste Programs" (42 U.S.C. 6926), allows states, including Tennessee, to establish and administer these permit programs with EPA approval. EPA regulations implementing the Resource Conservation and Recovery Act are found in 40 CFR Parts 260 through 283. Regulations imposed on a generator or on a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated, stored, and/or disposed. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements.
Waste management and pollution prevention	Pollution Prevention Act (42 U.S.C. 13101 et seq.)	The Pollution Prevention Act establishes a national policy for waste management and pollution control that focuses first on source reduction and then on environmental issues, safe recycling, treatment, and disposal.
Waste management and pollution prevention	Tennessee Comprehensive Rules and Regulations 0400-12-01 and 0400-12-02 40 CFR Chapter 1, Subchapter I, Solid Wastes Tennessee Code §68-212-101	Any person owning or operating a new or existing facility that treats, stores, or disposes of a hazardous waste must obtain a hazardous waste permit from the Tennessee Division of Solid Waste Management.
Waste management and pollution prevention	Hazardous Materials Transportation Act, as amended (49 U.S.C. 5101 et seq.)	The Hazardous Materials Transportation Act regulates the transportation of hazardous material (including radioactive material) in and between states. According to the act, states may regulate the transport of hazardous material as long as their regulation is consistent with provisions of the act or U.S. Department of Transportation regulations provided in 49 CFR Parts 171 through 177. Other regulations regarding packaging for transportation of radionuclides are contained in 49 CFR Part 173, Subpart I.

Activity	Law/regulation	Requirements
Operation of the FFF	Rules of the TDEC, Chapter 0400-20-10, Licensing and Registration	Persons who possess or use radioactive materials are required to obtain a Specific Radioactive Material License from the TDEC Division of Radiological Health.
Operation of the FFF	Rules of the TDEC, Chapter 0400-20-10, Licensing and Registration	Persons who transport radioactive waste or have radioactive waste transported into or within the State of Tennessee to a disposal/processing facility are required to obtain a License-for-Delivery from the TDEC Division of Radiological Health. Persons whose activities result in the generation of radioactive waste have the primary responsibility to ensure that a License-for-Delivery is obtained.
Protected species	Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d et seq.)	The Bald and Golden Eagle Protection Act prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald or golden eagles, including their parts (including feathers), nests, or eggs. The act defines “take” as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. Regulations further define “disturb” as to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.
Protected species	Endangered Species Act (16 U.S.C. 1531 et seq.)	The Endangered Species Act was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7, “Interagency Cooperation,” of the act requires federal agencies to consult with the FWS on federal actions that may affect listed species or designated critical habitats.
Protected species	Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901 et seq.)	The Fish and Wildlife Conservation Act provides federal technical and financial assistance to states for the development of conservation plans and programs for nongame fish and wildlife. The Fish and Wildlife Conservation Act conservation plans identify significant problems that may adversely affect nongame fish and wildlife species and their habitats and appropriate conservation actions to protect the identified species. The act also encourages federal agencies to conserve and promote the conservation of nongame fish and wildlife and their habitats.

Activity	Law/regulation	Requirements
Protected species	Migratory Bird Treaty Act, (16 U.S.C. 703-712 et seq.)	The MBTA implements four international conservation treaties that the U.S. entered with Canada (1916), Mexico (1936), Japan (1972), and Russia (1976). The MBTA has been amended with the signing of each treaty, as well as when any of the treaties were subsequently amended. To ensure that populations of all protected migratory birds are sustained, the MBTA prohibits the take of protected migratory bird species without prior authorization from FWS. Under the MBTA, "take" includes killing, capturing, selling, trading, and transport of protected migratory bird species.
Historic preservation and cultural resources	National Historic Preservation Act, 54 U.S.C. 300101 et seq.	The National Historic Preservation Act was enacted to create a national historic preservation program, including the National Register of Historic Places and the Advisory Council on Historic Preservation. Section 106 of the act requires federal agencies to consider the effects of their undertakings on historic properties. The Advisory Council on Historic Preservation regulations implementing Section 106 of the Act are found in 36 CFR Part 800, "Protection of Historic Properties." The regulations call for public involvement in the Section 106 consultation process, including involvement from Indian Tribes and other interested members of the public, as applicable.

AEA – Atomic Energy Act; CAA – Clean Air Act; CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act; CFR – Code of Federal Regulations; CWA – Clean Water Act; EPA – U.S. Environmental Protection Agency; FWS – U.S. Fish and Wildlife Service; FFF – fuel fabrication facility; MBTA – Migratory Bird Treaty Act; NEPA – National Environmental Policy Act; NPDES – National Pollutant Discharge Elimination System; NRC – U.S. Nuclear Regulatory Commission; OSHA – Occupational Safety and Health Administration; SDWA – Safe Drinking Water Act of 1974; TDEC – Tennessee Department of Environment and Conservation; U.S.C. – United States Code

F.2 Operating Permits and Other Requirements

Table F-2 below lists the permits and licenses issued by federal, state, and local authorities for activities at the TRISO-X FFF, as identified in the TRISO-X environmental report (ER; TRISO-X, 2025).

Table F-2 Operating permits and other requirements for licensing, construction, operation, and decommissioning of the TRISO-X FFF

Permit	Responsible agency	Number	Expiration date	Authorized activity
Special Nuclear Material License	U.S. Nuclear Regulatory Commission	Under review	--	Receipt, possession, use, and transfer of special nuclear material
Certificate of Registration	U.S. Department of Transportation	Application not yet submitted	--	Transportation of hazardous materials
Air Quality Construction Permit	Tennessee Air Pollution Control Board and TDEC	Permit application accepted for review December 31, 2025.	--	Construction of a new air contaminant source
Air Pollution Control Operating Permit	Tennessee Air Pollution Control Board and TDEC	Permit application not yet submitted	--	Operation of an air contaminant source
NPDES Permit for Stormwater Discharges Associated with Construction Activity	TDEC Division of Water Resources	TNR136931	Upon notice of termination	Clearing, grading, or excavation that disturbs 1 or more acres
Industrial Stormwater Discharge Permit	TDEC Division of Water Resources	Permit application not yet submitted	--	Discharge of stormwater runoff from the site during facility operation
Hazardous Waste Permit	TDEC's Division of Solid Waste Management	Pending determination of applicability	--	Owning or operating a new or existing facility that treats, stores, or disposes of a hazardous waste

Permit	Responsible agency	Number	Expiration date	Authorized activity
Specific Radioactive Material License	TDEC, Division of Radiological Health	License application not yet submitted	--	Required for source material and/or sealed sources above exempt quantities
Radioactive Waste License for Delivery	TDEC, Division of Radiological Health	License application not yet submitted	--	Transportation of radioactive waste into or within the State of Tennessee to a disposal/processing facility
By-Product Material License	TDEC, Division of Radiological Health	License application not yet submitted	--	Production, possession, and transfer of radioactive by-product material
Source Material License	TDEC, Division of Radiological Health	License application not yet submitted	--	Possession, use, and transfer of radioactive source material
Building Permit	City of Oak Ridge Community Development Department	Building Permit Issued September 8, 2025.	--	Required for construction of buildings
Land Disturbance Permit	City of Oak Ridge Community Development Department	PRLD202402171-LD1	3/31/2025	Required for land disturbing activity that disturbs more than 1 acre of land.
Plumbing Permit	City of Oak Ridge Community Development Department	Plumbing permit issued September 22, 2025.	--	Required for installation of plumbing systems
Electrical Permit	City of Oak Ridge Community Development Department	Electrical Permits issued September 22, 2025, November 6, 2025.	--	Required for installation of electrical systems

Permit	Responsible agency	Number	Expiration date	Authorized activity
Mechanical Permit	City of Oak Ridge Community Development Department	Permit application not yet submitted	--	Required for installation of mechanical systems

F.3 References

10 CFR Part 20. Code of Federal Regulations. Title 10, Energy, Part 20 "Standards for Protection Against Radiation." Nuclear Regulatory Commission, Washington, D.C.

10 CFR Part 50. Code of Federal Regulations. Title 10, Energy, Part 50 "Domestic Licensing of Production and Utilization Facilities." Nuclear Regulatory Commission, Washington, D.C.

10 CFR Part 51. Code of Federal Regulations. Title 10, Energy, Part 51 Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions. Nuclear Regulatory Commission, Washington, D.C.

Atomic Energy Act. 1954. 42 U.S.C. § 2011 *et seq.* Public Law 112-239, as amended.

Air Pollution Prevention and Control Act. 1955. 42 U.S.C. § 7401 *et seq.* Public Law 84-159, as amended (commonly referred to as the Clean Air Act).

Bald and Golden Eagle Protection Act. 1940. 16 U.S.C. 668 *et seq*.

Endangered Species Act. 1973. 16 U.S.C. §1531 *et seq*.

Federal Water Pollution Control Act. 1972.. 33 U.S.C. § 1251 *et seq.* (commonly referred to as the Clean Water Act).

Fish and Wildlife Conservation Act. 1980. 16 U.S.C. 2901-2911.

Hazardous Materials Transportation Act. 1975. 49 U.S.C. §§ 5101–5127.

Migratory Bird Treaty Act. 1918. 16 U.S.C. 703-712.

National Historic Preservation Act. 1966. 54 U.S.C. 300101 *et seq*.

Occupational Safety and Health Act. 1970. 29 U.S.C. 651 *et seq.* Law 91-596, as amended.

Pollution Prevention Act. 1990. 42 U.S.C. §13101 *et seq.*

Resource Conservation and Recovery Act. 1976. 42 U.S.C. §6901 *et seq.*

Safe Drinking Water Act. 1974. 42 U.S.C. §300f *et seq*.

Tennessee Air Quality Act. 1967. Tennessee Code Annotated. 68-201-101 *et seq*.

Tennessee Water Quality Control Act. 1977. Tennessee Code Annotated. 69-3-101 *et seq*.

TRISO-X. 2025. "Supplemental Information for the TRISO-X Fuel Fabrication Facility License Application Review (Part 3)." TX0-REG-LTR-0059. March 31, 2025. ML25087A161.

APPENDIX G
CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC or Commission), TRISO-X, LLC (TRISO-X or applicant), and other correspondence related to the NRC staff's environmental review. All documents, with the exception of those containing proprietary information, have been placed in the NRC's Public Document Reading Room at One White Flint North, 11555 Rockville Pike (First Floor), Rockville, Maryland, and are electronically available from the NRC's Agencywide Document Access and Management System (ADAMS). The ADAMS accession numbers for each document are listed below. The docket number for TRISO-X is 07007027. Table G-1 below lists the environmental review correspondence, by date.

Table G-1 Environmental review correspondence and consultation for licensing, construction, operation, and decommissioning of the TRISO-X FFF

Date	Originator	Correspondence	ADAMS accession number (ML)
2/2/2022	TRISO-X, LLC	Request for Concurrence – Hydrologic Determination Horizon, Lot 6 Oak Ridge, Roane County, Tennessee Wood Project No. 325221235 addressed to the Tennessee Department of Environment and Conservation	ML25087A164
2/2/2022	TRISO-X, LLC	Request for Jurisdictional Determination at TRISO-X Facility Project Area, Horizon Center-Lot 6 Oak Ridge, Roane County, Tennessee Wood Project No. 325221235 addressed to the Eastern Regulatory Field Office U.S. Army Corps of Engineers	ML25087A164
2/4/2022	TRISO-X, LLC	Request for an Exemption Pursuant to 10 CFR 70.17 and 10 CFR 51.6 from the Requirements of 10 CFR 51.60(a) and 70.21(1) for Timing of Submittal of the Environmental Report for the TRISO-X Fuel Fabrication Facility (FFF)	ML22039A050
3/9/2022	TRISO-X, LLC	Request for Information on Potential Site for a Proposed FFF in Eastern Tennessee (Horizon Center Site) addressed to Tennessee Wildlife Resources Agency	ML25087A164

Date	Originator	Correspondence	ADAMS accession number (ML)
3/9/2022	TRISO-X, LLC	Request for Information on Potential Site for a Proposed FFF in Eastern Tennessee (Horizon Center Site) addressed to U.S. Fish and Wildlife Service (FWS) Tennessee Field Office	ML25087A164
3/17/2022	U.S. Nuclear Regulatory Commission	Approval of TRISO-X Exemption Request to Support Submittal of the Safety and Safeguards Analysis Report in Advance of the Environmental Report	ML22055A559
4/13/2022	TRISO-X, LLC	Request for comments on Phase I Cultural Resource Survey for the TRISO-X FFF Horizon Center Site TRISO-X, LLC U.S. Nuclear Regulatory Commission Licensing Application Project, Roane County, Tennessee addressed to Tennessee Historical Commission State Historic Preservation Office	ML25087A164
4/14/2022	Tennessee Historical Commission State Historic Preservation Office (THC SHPO)	Response to TRISO-X request for comments on Phase I Cultural Resource Survey noting finding that no historic properties eligible for listing in the National Register of Historic Places will be affected by the TRISO-X FFF	ML25087A164
4/15/2022	U.S. Fish and Wildlife Service (FWS)	Response to TRISO-X Request for Information on Potential Site for a Proposed FFF in Eastern Tennessee (Horizon Center Site)	ML25087A164
5/24/2022	Tennessee Department of Environment and Conservation, Division of Water Resources	Letter to TRISO-X noting the hydrological determination submittal dated February 2, 2022 for Horizon Lot 6 is approved as submitted.	ML25087A164
9/29/2022	TRISO-X, LLC	FFF Environmental Report Submittal	ML22266A269
10/24/2022	City of Oak Ridge, Tennessee	TRISO-X preliminary site plan approval	ML25087A164

Date	Originator	Correspondence	ADAMS accession number (ML)
11/10/2022	Tennessee Department of Environment and Conservation, Division of Water Resources	NPDES Construction General Permit Tracking No. TNR136931 Master Tracking Number: TNR136931 TRISO-X FFF TRISO-X, LLC Oak Ridge, Roane County, Tennessee	ML25087A164
11/18/2022	U.S. Nuclear Regulatory Commission	Acceptance of the TRISO-X, LLC License Application for a FFF	ML22320A110
12/16/2022	U.S. Nuclear Regulatory Commission	TRISO-X Environmental Impact Statement Notice of Intent Federal Register Notice (FR87 Pg. 77146-77148)	NRC-2022-0201
12/27/2022	Tennessee Department of Environment and Conservation, Division of Water Resources	Comment noting a multi-sector stormwater permit with a surface water pollution prevention plan, stormwater construction permit, and a hydrologic determination would likely be required for the TRISO-X FFF.	ML23010A268
1/25/2023	U.S. Nuclear Regulatory Commission	Official Transcript of Environmental Scoping Meeting for an Application for a Special Nuclear Material License for the TRISO-X Proposed FFF at Oak Ridge, Pages 1-54	ML23037A021
2/2/2023	U.S. Nuclear Regulatory Commission	Request for information from the FWS to facilitate the identification of endangered or threatened species or critical habitat that may potentially be affected by the proposed TRISO-X FFF project.	ML23032A501
3/15/2023	U.S. Army Corps of Engineers	Response to request for Jurisdictional Determination, dated February 2, 2022; provision of Preliminary Jurisdictional Determination	ML25087A164
3/17/2023	U.S. Nuclear Regulatory Commission	Request for Additional Information for the Application from TRISO-X, LLC for a Special Nuclear Material license for a FFF in Oak Ridge, Tennessee	ML23072A456
4/14/2023	TRISO-X, LLC	Response to Requests for Additional Information on the Environmental Report for the Proposed FFF	ML23104A419
5/9/2023	TRISO-X, LLC	TRISO-X FFF, Traffic Impact Analysis	ML24057A039

Date	Originator	Correspondence	ADAMS accession number (ML)
5/19/2023	U.S. Nuclear Regulatory Commission	Request for FWS Information for Planning and Consultation resource list, an automatically generated list of species and other resources such as critical habitat under the jurisdiction of the FWS that are known or expected to be on or near the project area.	ML23234A124
8/18/2023	City of Oak Ridge, Tennessee	Review of TRISO-X Traffic Impact Study	ML25087A164
9/5/2023	U.S. Nuclear Regulatory Commission	Request for concurrence from THC SHPO on NRC's determination that no historic properties would be affected if the proposed license for TRISO-X to possess and use special nuclear material at the TRISO-X FFF with the enclosed cultural resource report, "Final Report - Phase I Cultural Resource Survey for the TRISO-X FFF Horizon Center Site TRISO-X, LLC U.S. Nuclear Regulatory Commission Licensing Application Project, Roane County, Tennessee."	ML23223A208
9/11/2023	Tennessee Historical Commission State Historic Preservation Office (THC SHPO)	Response to U.S. Nuclear Regulatory Commission request to review the cultural resources final report for the TRISO-X FFF per section 106 of the National Historic Preservation Act finding that the final report meets the Tennessee SHPO Reporting Standards and/or the Tennessee SHPO Standards and Guidelines for Archaeological Resource Management Studies.	ML23291A136; ML24036A269
9/20/2023	U.S. Nuclear Regulatory Commission	Request to initiate informal consultation with the FWS regarding the TRISO-X FFF in accordance with section 7 of the Endangered Species Act of 1973, as amended.	ML23214A265

Date	Originator	Correspondence	ADAMS accession number (ML)
10/12/2023	U.S. Fish and Wildlife Service (FWS)	Letter providing concurrence for the U.S. Department of Energy/Nuclear Regulatory Commission determination that the TRISO-X FFF is "not likely to adversely affect" the federally endangered and proposed endangered species and noting the requirements of section 7 of the Endangered Species Act of 1973, as amended, are fulfilled.	ML23293A035
11/20/2023	U.S. Nuclear Regulatory Commission	Request for Additional Information Part 2-1 for the Environmental Report for the Proposed FFF	ML23235A226
12/13/2023	U.S. Nuclear Regulatory Commission	Request for Additional Information Part 2-2 for the Environmental Report for the Proposed FFF	ML23342A214
12/20/2023	TRISO-X, LLC	Response to Request for Additional Information Part 2-1 for the TRISO-X Environmental Report and License Application	ML23354A28
1/8/2024	U.S. Nuclear Regulatory Commission	Scoping Summary Report	ML24010A167
1/18/24	U.S. Nuclear Regulatory Commission	Memorandum of Understanding between the U.S. Nuclear Regulatory Commission, Office of Nuclear Safety and Safeguards, and the Department of Energy, Office of Clean Energy Demonstrations, on the environmental review related to the issuance of a special nuclear material license to TRISO-X LLC for use at a FFF in Oak Ridge, Tennessee	ML24018A208
1/31/2024	TRISO-X, LLC	Supplement to License Application, ISA Summary and partial Environmental Report	ML25031A449
3/4/2024	TRISO-X, LLC	Response to Request for Additional Information Part 2-2 for the TRISO-X Environmental Report and License Application	ML24065A313

Date	Originator	Correspondence	ADAMS accession number (ML)
3/6/2024	U.S. Nuclear Regulatory Commission	Request for Additional Information Part 3 for the Application from TRISO-X, LLC for Special Nuclear Material License for Use at a FFF	ML24059A443
3/8/2024	City of Oak Ridge, Tennessee	Comments on updated TRISO-X site plan review package	ML25087A164
4/4/2024	TRISO-X, LLC	Response to Request for Additional Information Part 2 for the TRISO-X Environmental Report	ML24065A31
10/3/2024	City of Oak Ridge, Tennessee	Land Disturbance Permit No. PRLD202402171	ML25087A164
12/30/2024	TRISO-X, LLC	Supplement to License Application	ML24365A255
5/12/2025	U.S. Nuclear Regulatory Commission	TRISO-X ER Supplement Request for Additional Information May 2025	ML25122A176
5/23/2025	TRISO-X, LLC	Enclosure 1 - RAI Responses for the TRISO-X Environmental Report Supplement	ML25143A218
6/11/2025	TRISO-X, LLC	RAI Part 2 Responses for the TRISO-X Environmental Report Supplement	ML25162A267
9/25/2025	U.S. Nuclear Regulatory Commission	Notice to applicant of publication of draft environmental impact statement (EIS)	ML25267A208
11/17/2025	U.S. Nuclear Regulatory Commission	Extension of comment period for draft EIS	ML25316A020
12/2/2025	U.S. Department of the Interior	Comments from the Office of the Secretary on the draft EIS	ML25343A242
12/8/2025	U.S. Environmental Protection Agency	Comments on draft EIS	ML25343A341
1/29/2026	TRISO-X, LLC	TRISO-X Fuel Fabrication Facility ER Supplemental Information	ML26029A128

ADAMS – Agencywide Documents Access and Management System; CFR – Code of Federal Regulations; ER – Environmental Report; FFF – Fuel Fabrication Facility; FR – Federal Register; FWS – U.S. Fish and Wildlife Service; ISA – Integrated Safety Analysis; LLC – Limited

Liability Company; SHPO – State Historic Preservation Office; THC – Tennessee Historical Commission

APPENDIX H
AGENCIES, ORGANIZATIONS, AND PERSONS CONTACTED

The U.S. Nuclear Regulatory Commission (NRC or Commission) contacted federal, state, tribal, and local agencies listed in Table H-1 below during the NRC staff's environmental review of the TRISO-X fuel fabrication facility. This list excludes the U.S. Department of Energy since they are a cooperating agency.

Table H-1 List of agencies, organizations, and persons contacted by the NRC during the TRISO-X FFF environmental review

Name	Affiliation	Contact information
Brandon Wear	Tennessee Wildlife Resources Agency Region 3 Office	464 Industrial Blvd. Crossville, TN 38555
Brent Sewell	U.S. Army Corps of Engineers Nashville District	501 Adesa Blvd, Suite B250. Lenoir City, TN 37771
Chairman David Sickey	Coushatta Tribe of Louisiana	P.O. Box 818 Elton, LA 70532
Chairman Marcellus W. Osceola Jr.	Seminole Tribe of Florida	6300 Stirling Road Hollywood, FL 33024
Chairwoman Nita Battise	Alabama-Coushatta Tribe of Texas	571 State Park Rd 56 Livingston, TX 77351
Chief Glenna J. Wallace	Eastern Shawnee Tribe of Oklahoma	12705 South 705 Rd Wyandotte, OK 74370
Chief Joe Bunch	United Keetoowah Band of Cherokee Indians	P.O. Box 746 Tahlequah, OK 74465
Chief Ron Sparkman	Shawnee Tribe of Oklahoma	P.O. Box 189 Miami, OK 74354
Chief Wilson Yargee	Alabama-Quassarte Tribal Town	P.O. Box 187 Wetumka, OK 74883
Governor John Raymond Johnson	Absentee Shawnee Tribe	2025 S. Gordon Cooper Shawnee, OK 74801
Mekko Brian Givens (mekko means "chief")	Kialegee Tribal Town	P.O. Box 332 Wetumka, OK 74883
Michael Atchley	Tennessee Department of Environment and Conservation Knoxville Environmental Field Office	3711 Middlebrook Pike, Knoxville, TN 37921
Mr. Chuck Hoskin, Jr., Principal Chief	Cherokee Nation of Oklahoma	P.O. Box 948 Tahlequah, OK 74465
Patrick McIntyre	State Historic Preservation Officer Tennessee Historical Commission	2941 Lebanon Pike, Nashville, TN 37214

Name	Affiliation	Contact information
Principal Chief B. Cheryl Smith	Jena Band of the Choctaw Indians	P.O. Box 14 Jena, LA 71432
Principal Chief David Hill	Muscogee (Creek) Nation of Oklahoma	P.O. Box 580 Okmulgee, OK 74447
Principal Chief Gregory Chilcoat	Seminole Nation of Oklahoma	P.O. Box 1498 Wewoka, OK 74884
Principal Chief Richard Sneed	Eastern Band of Cherokee Indians of North Carolina	P.O. Box 455 Cherokee, NC 28719
Robbie Sykes	U.S. Fish and Wildlife Service Tennessee Field Office	446 Neal Street Cookeville, TN 38506
Senior Planner City of Oak Ridge	City of Oak Ridge Tennessee	PO Box 1. Oak Ridge, Tennessee 37831-0001
Steven R. Alexander	U.S. Fish and Wildlife Service South Atlantic-Gulf Interior Region Tennessee Ecological Services Field Office	446 Neal Street Cookeville, TN 38501
Town King Ryan Morrow	Thlopthlocco Tribal Town	P.O. Box 188 Okemah, OK 74859
Gretchen Applegate	Department of Energy	DOE James V. Forrestal Building, 1000 Independence Ave, SW, Washington, D.C, 20585