

Final Environmental Assessment

The X-energy Helium Test Facility
Oak Ridge, Tennessee



OCED
Office of Clean Energy Demonstrations

February 2024

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SUMMARY

Proposed Action: Under the Proposed Action, the U.S. Department of Energy would authorize X-energy, LLC to expend federal funding to design, construct, operate, and maintain a Helium Test Facility, within Roane County in the City of Oak Ridge, Tennessee.

Type of Document: Final Environmental Assessment (DOE/EA-2230)

Lead Agency: U.S. Department of Energy

Project Location: Roane County, Oak Ridge, Tennessee

For Further Information: U.S. Department of Energy
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Summary: This Environmental Assessment (EA) provides the U.S. Department of Energy (DOE) and other decision-makers with information needed to make an informed decision about the proposed Helium Test Facility (HTF) including an evaluation of the potential direct, indirect, and cumulative impacts of the HTF during construction and operation. This EA also evaluates the impacts that could occur if DOE did not provide funding (No-Action Alternative) under which DOE assumes the project would not proceed.

ACRONYMS AND ABBREVIATIONS

Name	Acronym
U.S. Department of Energy	DOE
Office of Clean Energy Demonstrations	OCED
Advanced Reactor Demonstration Program	ARDP
National Environmental Policy Act	NEPA
Helium Test Facility	HTF
Development Area	DA
Structures, Systems and Components	SSC
First-in-a-While	FIAW
Small Modular Reactor	SMR
Environmental Assessment	EA
Bipartisan Infrastructure Law	BIL
Funding Opportunity Announcement	FOA
Greenhouse gas	GHG
Council on Environmental Quality	CEQ
Finding of No Significant Impact	FONSI
U.S. Fish and Wildlife Service	USFWS
Nuclear Regulatory Commission	NRC
Information for Planning and Conservation	IPAC
Endangered Species Act	ESA
Horizon Center Industrial Park	ED-1
Fuel Handling System	FHS
Auxiliary Gas Service System	AGSS
Reactivity Control & Shutdown System	RCSS
Helium Circulator System	HCS
Helium Purification System	HPS
Test Setup	TSU
Distributed Control System	DCS
Control Rod Drive Mechanism	CRDM
Control Rod	CR
Control Rod Drive Line	CRDL
Test Loop	CIL
Conditioning Loop	CL
Helium Supply and Storage Loop	HSSL
Kilovolt Ampere	kVA
Feet	ft
Megawatt	MW
Square feet	Sq/ft
Best Management Practices	BMP
East Fork Poplar Creek	EFPC
Natural Area	NA
Oak Ridge Reservation	ORR
Oak Ridge National Lab	ORNL
Tennessee Department of Environment and Conservation	TDEC
Decibel A Scale	dBA
National Pollution Discharge Elimination System Permit	NPDES
Fuel Fabrication Facility	FFF
TRISO-X, LLC	TRISO-X
Carbon Fiber Technology Facility	CFTF
Tennessee Wildlife Resources Agency	TWRA

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SECTION 1 INTRODUCTION

1.1 Background

The U.S. Department of Energy (DOE) established the Office of Clean Energy Demonstrations (OCED) in December 2021 as part of the Infrastructure Investment and Jobs Act, otherwise known as the Bipartisan Infrastructure Law (BIL), to accelerate clean energy technologies from the lab to market and fill a critical innovation gap on the path to achieving our nation’s climate goals of net zero emissions by 2050. OCED’s mission is to deliver clean energy demonstration projects at scale in partnership with the private sector to accelerate deployment, market adoption, and the equitable transition to a decarbonized energy system.

The DOE’s Advanced Reactor Demonstration Program (ARDP) will expedite the demonstration of advanced reactors through cost-shared partnerships with U.S. industry. Advanced nuclear energy systems have the potential to lower emissions, create new jobs, and build an even stronger economy.

In February 2021, DOE entered into a cooperative agreement with X-energy, LLC (X-energy) for the development and demonstration of an advanced nuclear reactor. Prior to entering into the cooperative agreement with X-energy, DOE completed a National Environmental Policy Act (NEPA) review and issued a categorical exclusion for design, planning, and administrative activities. The scope of the cooperative agreement includes, among other elements, the construction and operation of a Helium Test Facility (HTF). This facility would not contain or process any radioactive material and is considered an industrial-type facility.

DOE is currently proposing to provide funding to X-energy, under the existing cooperative agreement, in support of the construction and operation of the HTF. X-energy is required to test critical Structures, Systems, and Components (SSC) that are First-in-a-While (FIAW) and would operate in a harsh, high temperature helium environment in the reactor. The purpose of the HTF is to replicate the reactor environment without the radioactive material and to be capable of providing the required test conditions for qualifying the components in support of the Xe-100, a high temperature gas cooled Small Modular Reactor (SMR). The HTF would be constructed and operated in the Horizon Center Industrial Park (also referred to as the Horizon Center or ED-1), Development Area (DA) 7 in Oak Ridge, Tennessee. The Project would consist of one building, access road, stepdown transformer, laydown areas, and a parking lot that would be connected to the adjacent roadway. The expected workforce is between 30-40 people during construction and 10-15 people during operations.

DOE has determined that an environmental assessment (EA) is required prior to authorizing the expenditure of project funds for construction and operation of the HTF. This determination was made because the HTF would be constructed on a greenfield site, would have the potential to impact recreational use and enjoyment of the Greenway, and would require clearing of 5 acres of land that may include potential habitat for threatened and endangered bat species, necessitating consultation pursuant to the Endangered Species Act (ESA) with U.S. Fish and Wildlife Service (USFWS) and Tennessee Ecological Services Field Office. This EA analyzes potential impacts to recreational areas and threatened and endangered species. The location of the HTF is an area that has been considered in multiple NEPA documents over the years, which provide a significant amount of information incorporated by reference into this analysis.

1.2 Purpose and Need for Action

In compliance with the statutory mandates of the Fiscal Year 2020 Further Consolidated Appropriations Act (H.R. 1685), the Energy Act of 2020 section 2001 (amending EPACT 2005, 42 U.S.C. 16281), and the Infrastructure Investment and Jobs Act (H.R. 3682) (BIL), DOE established and is implementing the ARDP to support the demonstration of advanced reactors through cost-shared partnerships (cooperative agreements) with U.S. industry. The BIL authorizes funding for the ARDP through 2027. The ARDP also supports the Administration’s goals of 50-52 percent reduction in greenhouse gas (GHG) emissions from 2005 levels by 2030, a carbon-pollution free power sector by 2035, and achieving a net-zero GHG emissions economy by 2050.

DOE’s purpose is to select ARDP projects that:

- advance the deployment at scale of the next generation of reactors;
- are consistent with the goals and timeline of BIL and DOE’s mission;
- are safe and affordable to design, construct and operate; and,
- support significant improvements in safety, security, economics, and environmental impacts through these first-of-their-kind designs over current nuclear power plant designs.

DOE issued a Funding Opportunity Announcement (FOA) (DE-FOA-0002271) for the ARDP on May 14, 2020. DOE competitively selected and has provided initial funding in support of two such projects that would design, license, construct, and operate first-of-their-kind advanced reactor designs, as well as design, license, construct, and operate fuel fabrication facilities. The X-energy demonstration project is one of the two advanced reactor demonstration projects selected by DOE. The cost-share partnership would cover the Xe-100 reactor and a proposed HTF. The HTF would be used to support the reactor industry at large.

The need for the DOE action is to respond to X-energy’s request for financial assistance through the cooperative agreement to design, construct, and operate an HTF in Oak Ridge, TN that would further the design of an X-energy Xe-100 reactor (and associated technologies). The HTF testing capabilities would also serve the reactor community at large as the technology continues to develop and is adopted around the world.

1.3 NEPA Documents

The following NEPA documents are incorporated by reference into this EA in accordance with 40 CFR § 1501.12. Table 1 below provides a brief description of the NEPA documents’ content. All NEPA documents are publicly available, and links can be found in the References Section.

Table 1. NEPA Documents

Title	Date Published	Relevance
Environmental Assessment – Lease of Parcel ED-1 of the Oak Ridge Reservation by the East Tennessee Economic Council (DOE/EA-1113)	April 1996	EA for original Parcel ED-1 lease agreement. Established baseline affected environment and provided analysis of activities associated with development as an industrial park within developable areas. Identified mitigations required for development activities to avoid and/or minimize potential environmental impacts. Resulted in a Finding of No Significant Impact (FONSI) and the following Mitigation Action Plan (MAP).
Mitigation Action Plan – Lease of Parcel ED-1 of the Oak Ridge	April 1996	Prescribed measures to be implemented to mitigate potentially significant adverse impacts from industrial development on Parcel

Title	Date Published	Relevance
Reservation by the East Tennessee Economic Council (MAP) (DOE/EA-1113)		ED-1. Specified that mitigation would be accomplished by: (1) excluding areas on Parcel ED-1 from disturbance and development, and (2) conducting surveys and monitoring of industrial DAs prior to disturbance (predevelopment) and during industrial operations (post-development).
Environmental Assessment Addendum for the Proposed Title Transfer of Parcel ED-1 (DOE/EA-1113-A)	April 2003	Addendum to 1996 EA – addressed transfer of lease title to Horizon Center LLC. As a continuation of analysis of activities conducted in the 1996 EA, the Addendum provided updated affected environment information and addressed potential impacts from continued buildout/development of Parcel ED-1 (consisting of seven major development areas). Resulted in a FONSI.
Mitigation Action Plan for the Protection of the Natural Area on Parcel ED-1	April 2003	The revised 2003 MAP covers the transfer of Parcel ED-1 to CROET and specifies monitoring of birds, benthic invertebrates, and fish to evaluate changes from the predevelopment conditions potentially associated with development of the site as an industrial park.
Environmental Assessment Conveyance of Parcel ED-6 to the City of Oak Ridge, Tennessee (DOE/EA -1514)	May 2007	EA for the conveyance of approximately 336 acres of excess property (i.e., property not needed to fulfill DOE current or foreseeable future requirements) known as Parcel ED-6 to the city of Oak Ridge, TN for economic development. Resulted in FONSI.
Summary Report – Monitoring and Ecological Data (1996 – 2011) for Parcel ED-1 at Horizon Center, Oak Ridge, Tennessee	2013	Provided summaries of the monitoring data for birds, benthic macroinvertebrates, fish, and stream habitat characteristics collected during sampling conducted from 1996 – 2011 at Parcel ED-1. Compared the monitoring data for the bird, benthic macroinvertebrate, and fish data from the pre- versus post-development years at different locations.
Implementation of Mitigation Action Plan for Parcel ED-1 on the Oak Ridge Reservation, Oak Ridge, Tennessee (DOE/OR/01-2585)	May 2013	Assessed the effectiveness of mitigations identified in the 1996 MAP and 2003 MAP; analyzed and summarized ecological data collected during the time frame between 1996 and 2012; determined if mitigation goals were being met based on the ecological data evaluation; reported and evaluated the results of ecological monitoring conducted in 2012; made recommendations regarding the appropriate path forward for stewardship of the NA and the need for future ecological monitoring at Parcel ED-1.
Environmental Assessment Addendum – Proposed Revitalization of Parcel ED-1 at the Horizon Center, Oak Ridge, Tennessee (DOE/EA-1113-A2)	August 2020	Addendum to 1996 and 2003 EAs. Proposed revitalization of Parcel ED-1 at the Horizon Center, Oak Ridge, TN to increase allowable land uses in the Horizon Center and create more connectivity between Development Areas 5, 6, and 7, which would require reducing the restrictions for the NAs that separate them. Resulted in FONSI.
NEPA Determination	November 2022	Categorical Exclusion issued for pre-construction activities required to prepare site for construction of planned TRISO-X Fuel Fabrication Facility (FFF).

1.4 Scope of the EA

This EA presents information on the potential impacts associated with the proposed construction and operation of the HTF, located in the Horizon Center, DA 7 in Oak Ridge, Tennessee. The project area would consist of one building, access road, stepdown transformer, laydown areas, and a parking lot that would be connected to the adjacent roadway. DOE has prepared this EA to assess the potential consequences of its activities on the human environment in accordance with the Council on

Environmental Quality (CEQ) regulations (40 CFR Parts 1500–1508) implementing NEPA and DOE NEPA Implementing Procedures (10 CFR Part 1021). If the impacts associated with the proposed action are not identified as potentially significant in this EA, DOE will issue a Finding of No Significant Impact (FONSI) and proceed with the action. If impacts are identified as potentially significant, an Environmental Impact Statement will be prepared.

This EA (1) describes the existing environment for DA 7 relevant to potential impacts of the proposed action and alternatives; (2) analyzes potential environmental impacts that could result from the proposed action; (3) identifies and characterizes cumulative impacts that could result from the proposed action in relation to other ongoing or proposed activities within the surrounding area; and (4) provides DOE with environmental information for use in prescribing restrictions to protect, preserve, and enhance the human environment and ecosystems.

1.5 Public Agency Coordination and Consultations

NEPA requirements help ensure that information is made available to the public during the decision-making process and prior to decisions and actions being taken. The premise of NEPA is that the quality of federal agency decisions will be enhanced if federal agencies provide information to the public, including stakeholders, and involve the public in the planning process. Stakeholders include federal, tribal, state, and local governments, interested organizations, and individuals within and near the Proposed Project.

As part of the NEPA process, DOE provided USFWS and the State of Tennessee opportunities for input on the EA. A scoping period and EA review period are not required by 40 CFR Parts 1500-1508 or 10 CFR Part 1021. Given the number of recent NEPA documents covering the same project area and similar proposed actions and the input received from USFWS and the State of Tennessee, Department of Environmental and Conservation (TDEC), DOE concluded that a scoping or draft EA review was not necessary for this EA. The EA will be made publicly available on DOE's Office of NEPA Policy and Compliance website.

1.5.1 Nuclear Regulatory Commission

The Nuclear Regulatory Commission (NRC) license authorizes an applicant to conduct any or all of the following activities:

- Construct, operate, and decommission commercial reactors and fuel cycle facilities;
- Possess, use, process, export, and import nuclear materials and waste, and handle certain aspects of their transportation; and
- Site, design, construct, operate, and close waste disposal sites.

As the HTF is considered an industrial-type facility and would not contain or process any radioactive material, consultation with NRC is unnecessary. NRC determined there is no radiological nexus and, thus it does not have a licensing or permitting role.

1.5.2 U.S. Fish and Wildlife

In July 2023, DOE sent a Notification of Preparation of an Environmental Assessment and Request for Information for the Helium Test Facility in Oak Ridge, TN to the USFWS. This letter contained a project description, a formal species list from the USFWS's Information for Planning and Conservation (IPAC), and a request for additional data. A request for informal consultation was submitted to the USFWS's Tennessee Ecological Office on November 15, 2023. DOE received concurrence from USFWS on

November 28, 2023, with a may affect, not likely to adversely affect determination for four endangered bat species and no effect determination for other species.

1.5.3 State of Tennessee

In July 2023, DOE sent a Notification of Preparation of an Environmental Assessment for the Helium Test Facility in Oak Ridge, TN to the host State of Tennessee explaining the Project and notifying the State of the upcoming EA and Section 7 consultation under the Endangered Species Act (ESA) with the USFWS. The State completed a 14-day review of the EA in October 2023. DOE has incorporated their comments into the Final EA.

1.5.4 State Historic Preservation Office and Tribal Consultations

Surveys have been conducted throughout Parcel ED-1 as part of previous NEPA analyses. There are three known cultural resources at Parcel ED-1: the McKamey-Carmichael cemetery located in DA 6 (which includes a protective 100-ft buffer) and two former grist mill sites (40RE195 and 40RE200) along East Fork Poplar Creek (EFPC). None of the cultural resources would be impacted by the proposed action.

Tribes have been consulted during previous EAs. In the 2003 EA, regarding the title transfer of Parcel ED-1, DOE sent notification to Eastern Band of Cherokee Indians Tribal Historic Preservation Office providing information about the proposed transfer. There were no resulting indications that locations have traditional or cultural importance or other concerns regarding the proposed project and for that reason the EA was not circulated for public review and did not undergo Section 106 consultation.

Should previously undiscovered artifacts or cultural resource features be unearthed during ground disturbance activities, work would be stopped in the immediate vicinity of the find and DOE would be notified. At that point, a determination of significance would be made and, if required, consultation with the Tennessee State Historic Preservation Officer or Eastern Band of Cherokee Indians Tribal Historic Preservation Officer would be initiated.

SECTION 2 PROPOSED ACTION, NO-ACTION ALTERNATIVE, AND CUMULATIVE ACTIVITIES

2.1 Proposed Action

The DOE's Proposed Action consists of authorizing the expenditure of federal funding by X-energy to support the construction, operation, and maintenance of the HTF. Kinectrics AES, Inc. (Kinectrics), a vendor for X-energy under the award, and X-energy will be working together in the development of the HTF on fifteen (15) acres in the Horizon Center Industrial Park (ED-1) in Oak Ridge, TN (see Figure 1). The HTF would be located within DA 7 or Lot 7 within ED-1 which is approximately 72 acres in size. Kinectrics has acquired one undeveloped parcel containing 15 acres within DA 7. The expected amount of the land disturbance within DA 7 is approximately 5 acres. Kinectrics is a nuclear engineering company selected by X-energy through a competitive bid process to design, build and operate the HTF as a subcontractor. Kinectrics would provide turn-key design-build services to construct and operate the HTF on land purchased and owned by Kinectrics in the City of Oak Ridge Horizon Industrial Center.

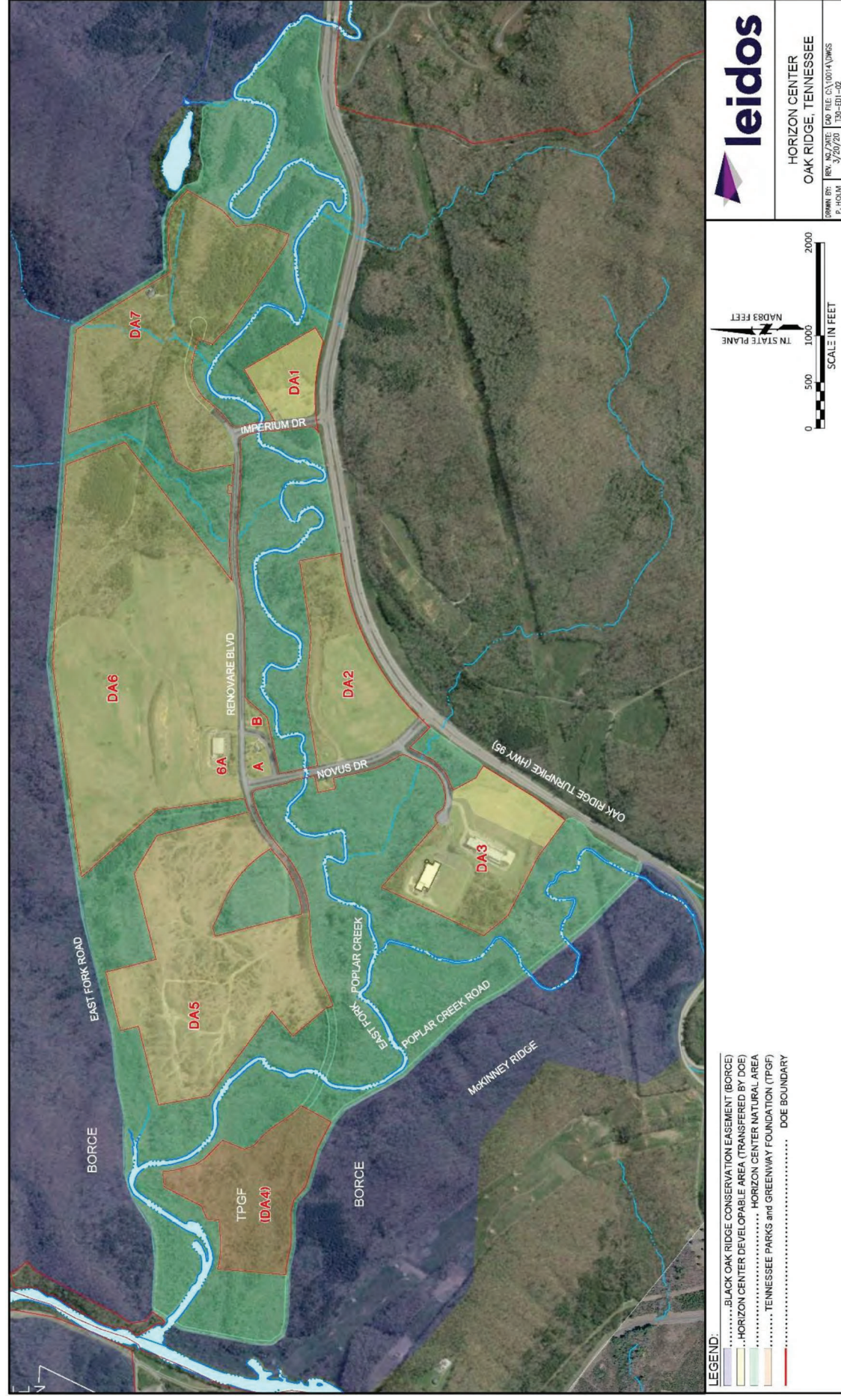
2.2 Description of Proposed Project

X-energy is developing the Xe-100, a high temperature gas cooled SMR. As part of this development, X-energy is required to test critical SSC that are FIAW and will operate in a harsh, high temperature helium environment in the reactor. A specialized test facility replicating the reactor environment, without the radioactive material, and capable of providing the required test conditions for verifying the performance of SSCs is needed (i.e., the proposed HTF).

The HTF will house the following components and systems for testing:

1. Fuel Handling System (FHS) with Auxiliary Gas Service System (AGSS)
2. Reactivity Control & Shutdown System (RCSS)
3. Helium Circulator System (HCS)
4. Helium Purification System (HPS)
5. Xe-100 Plant Control and Reactor Protection System (RPS) for the Equipment Under Test
6. Representative Reactor Pressure Vessel

Figure 1. Project Location



2.2.1 The Fuel Handling System Test Setup

The FHS Test Setup (TSU) will contain a scaled Xe-100 Fuel Handling System with an AGSS and sphere vessel that will represent the Xe-100 reactor. The purpose of the FHS TSU is to test the functions of the FHS in a high pressure, high temperature, helium environment. Billiard ball size spheres will simulate the reactor fuel. The main functions, their associated control sequences, and interfaces being tested include:

- Load New Spheres
- Unload Spent Spheres
- Recirculate Spheres
- Store Used/Spent/Damaged Spheres
- Maintain Operation
- All AGSS Functions, and
- Track the flow of spheres in the vessel.

2.2.2 The Reactivity Control System & Shutdown System Test Setup

The RCSS TSU will house a complete Control Rod Drive Mechanism (CRDM) containing a Control Rod (CR), CR chain, CR shock absorber, and graphite liners. The CRDM electrical drive and controller will also be present. The CRDM housing will be mounted on a Control Rod Drive Line (CRDL) Vessel that will be tall enough to contain a fully extended control rod.

2.2.3 Helium Circulator System Test Loop

The Helium Circulator System (HCS) Test Loop will test a full scale Xe-100 Helium Circulator and support components. The loop will make use of a check valve, flow meter, and heat exchangers to regulate flow resistance and temperatures during testing.

2.2.4 Helium Purification System

A scaled HPS will be both tested and used to regulate the purity of helium in the HTF. The function of the HPS is to remove contaminants from the helium and ensure a helium outlet purity of Grade 6 (99.9999).

2.2.5 Plant Control & Reactor Protection System

Representative portions of both the Xe-100 Distributed Control System (DCS) and RPS will be supplied to validate the control functions of the FHS, RCSS, HCS, and HPS. Signals from these systems will be integrated with the facility's control system for data collection and storage purposes.

2.2.6 Support Systems

Auxiliary systems of the HTF are systems required for the operation but do not contain any Xe-100 specific SSCs. These include the helium supply and storage loop and the cooling water system (i.e., conditioning loop) which are described below.

2.2.6.1 Conditioning Loop

The Conditioning Loop (CL) will be used to condition temperatures and provide the required helium mass flows at test pressure for the FHS, RCSS, and HCS TSUs. The CL will incorporate helium blowers, pulse

filters, and other components necessary to control the helium temperature used for conditioning and sphere transport.

2.2.6.2 Helium Supply and Storage Loop

The Helium Supply and Storage Loop (HSSL) will store and supply helium to the HTF loops to maintain the correct helium pressure. It will also recover helium when maintenance and/or repair is required. The HSSL is designed to store at least the capacity of the sphere vessel.

2.3 Construction

The construction phase of the proposed action will take approximately 12 months. The construction phase is expected to provide about 30-40 construction jobs. Construction would likely commence in early 2024.

Project facilities and components would include:

- One main building (approx. 11,500 square feet (sq/ft)). The lower portion of building would be approximately 126'-3" x 71'-2" with an approximate height of 18'6". The tower portion would be approximately 56'-9" x 47'-0" with an approximate height of 85'0"
- Stepdown transformer (2000 Kilovolt Ampere (kVA))
- Access road (approx. 75 feet (ft))
- Emergency diesel generator (250 kVA)
- External helium & nitrogen storage pads. Nitrogen pad is estimated at 14' x 14'. Helium storage pad is estimated at 52' x 62'. The helium storage pad is expected to use a combination of concrete and gravel/stone foundation, estimated at 30-40 percent concrete with the remainder in gravel/stone, and
- Parking lot (~184' x 43').

The facility electrical connections will include a dedicated 5MW line from an existing substation to a manhole located on DA 7. The utility will provide the 4-position switchgear and fiberglass sleeve needed for installation along with two (2) 1500 kVA transformers. X-energy has already secured right-of-way and a site access agreement with the Oak Ridge Industrial Development Board (Figures 2 and 3).

Construction activities are expected to occur in the following sequence:

- Heavy equipment would arrive on site and commence preparation of a laydown area, road construction, and building foundations;
- The main building would be erected and connected to local utilities including water, sewer, and electric; and
- X-energy would complete the construction with site reclamation and restoration.

Best Management Practices (BMPs) would be implemented to minimize impacts from proposed action construction. The BMPs are discussed in Environmental Conservation Measures and Best Management Practices Section.



2.4 Operation

The HTF would operate for approximately 6 years with the possibility of extensions up to an additional 20 years. The operational workforce would be between 10-15 permanent employees. Maintenance activities would occur as necessary throughout the life of the Project. Any earth-disturbing activities would be scheduled to occur primarily April to November or when weather conditions allow. Operation and maintenance BMPs are discussed in Section Environmental Conservation Measures and Best Management Practices. Figure 4 provides an overview of what the HTF would look like once completed.

Figure 42. Project Rendering



2.6 Alternatives Considered but Eliminated for Further Analysis

Several alternative locations were considered by X-energy as part of a competitive bid process for the HTF. The evaluation process considered financial costs to the ARDP program, the availability of existing utilities, and the technical expertise of the design partner and available local labor pool. The selected location provided the lowest-cost option while minimizing potential environmental impacts because of the availability of existing utility connections and readily available work force.

2.7 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by X-energy in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or

adverse effects to the physical, natural, or socioeconomic resources would not be realized.

2.8 Past, Present and Future Activities (hereinafter referred to as cumulative activities)

TRISO-X Fuel Fabrication Facility – TRISO-X, LLC (TRISO-X) submitted an application to the NRC on April 5, 2022, to possess and use special nuclear material in the TRISO-X Fuel Fabrication Facility (FFF). The facility would be located in Roane County, Tennessee, within the western limits of the City of Oak Ridge on DA 6 within the Horizon Center Industrial Park. This project proposes the construction and operation of the TRISO-X FFF, which includes possession and use of special nuclear material. The TRISO-X FFF produces TRISO-based coated particles and final fuel forms in various shapes and configurations to power the coming fleet of advanced reactors.

Existing operations within the Horizon Center Industrial Park, Oak Ridge National Laboratory and Y-12 National Security Complex – The Horizon Center Industrial Park contains a TVA Certified Data Center Site and a State of Tennessee Certified Industrial Site. Additionally, Horizon Center is home to the Carbon Fiber Technology Facility (CFTF), the Oak Ridge National Laboratory (ORNL) pilot demonstration facility for reducing the cost of carbon fiber, positioning the park for substantial additive manufacturing activity. It also has 500 acres set aside for environmental preservation and protection. The Oak Ridge National Laboratory (the nation's largest multi-program science and technology laboratory) conducts research and development related to climate change, clean energy, supercomputing, fusion, fission, and human health. The Y-12 National Security Complex is a manufacturing facility that retrieves and stores nuclear materials, fuels the nation's naval reactors, and performs complementary work for other government and private-sector entities.

Manhattan Project National Historic Park – The National Historic Park for the Manhattan Project at Oak Ridge includes historic sites, community centers and museums, and once highly secured nuclear research facilities operated by the US Department of Energy relating to uranium enrichment at Oak Ridge for the Manhattan Project.

Decommissioning of the HTF. The HTF is expected to operate for approximately 6 years with the possibility of extensions up to an additional 20 years. Decommissioning is an activity that would occur at a later date and is outside the period of performance of the cooperative agreement and therefore outside the scope of the Proposed Action. Decommissioning would require approximately 12 to 18 months. At the end of the HTF life cycle, the operating agreement and ground lease would terminate and the HTF would be decommissioned, and the remaining facility would be owned by Kinectrics. It is likely that the access road, parking lot, and lay down areas would remain in place after the main building is decommissioned. General steps for decommissioning may include but are not limited to:

- Establishing temporary storage areas for dismantled components and other materials for recycling
- Recycling and disposing of electric control devices
- Selling, refurbishing, or disposing of transformers and other control devices
- Removing and recycling on-site access roads, rock or gravel at the substation, and building foundations (access roads may remain in place if desired), and
- Restoring disturbed land areas covered in rock or gravel and building/tower footprints to original grade.

2.9 Permitting and Authorization Summary

The following permits, licenses, and authorizations are required for the Project.

- USFWS, Section 7 consultation for threatened and endangered species under the Endangered Species Act, and
- City of Oak Ridge or Tennessee Department of Environment and Conservation (TDEC) building permits, utility permits, site permits, and construction storm water permits.

2.10 Applicant Committed Measures

Previous NEPA determinations include FONSIIs with Mitigation Action Plans for the 1996 & 2003 DOE/EA-1113. Areas within ED-1 where development is restricted are called Natural Areas (NAs). NAs are the areas in ED-1 that contain sensitive cultural, environmental, and ecological attributes assessed during the NEPA review of ED-1. The protections for the NAs and limitations of the DAs are outlined in the 1996 MAP which is incorporated into the deed Covenants, Conditions, and Restrictions (CCRs). The 2003 MAP summarized the data collected based on the monitoring requirements in the 1996 MAP and clarified additional mitigation requirements for ED-1. In addition to complying with the MAPs and CCRs, the Project will enact additional conservation measures to limit tree clearing activities to November 1-March 15 in consideration of the Indiana bat and Northern long-eared bat (NLEB). According to the USFW website, this timeframe for Tennessee is the inactive season for the bats swarming and staging areas. In general, the Indiana bat and NLEBs are likely to be in hibernacula (caves, mines) and are not likely to occur in forested habitat.

2.11 Environmental Conservation Measures and Best Management Practices

X-energy will implement conservation measures and BMPs applicable to construction, operation, and maintenance activities to avoid and minimize potential environmental impacts or concerns. Below is a general review of the environmental conservation measures and BMPs that X-energy will implement during construction and operation of the Project.

2.11.1 General Planning and Land Use

General guidelines X-energy would follow for efficient land use include the following:

- The Project was designed and will be constructed to utilize existing roads and utility corridors to the maximum extent practicable, and to minimize the number and length/size of new roads, laydown areas, and borrow pit areas.
- “Good housekeeping” procedures will be implemented to ensure that during operation the site would be kept clean of debris, garbage, fugitive trash, or waste; to prohibit scrap heaps and dumps; and to minimize storage yards.
- An access road siting and management plan would be prepared incorporating applicable standards regarding road design, construction, and maintenance.
- Access roads will be designed to minimize total length, avoid wetlands, and avoid or minimize stream and drainage crossings.

2.11.2 Soil Resources

General steps X-energy would take for avoiding or minimizing impacts to soil resources include the following:

- The Project was designed to avoid steep slope areas as practicable and minimize construction cut and fill work.

- Permits will be obtained and complied with under the National Pollutant Discharge Elimination System Industrial Storm Water General Permit issued by the TDEC, and the Large Construction General Permit issued by the Tennessee Department of Construction (TDOT).
 - These permits require development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would be developed during civil engineering design of the Project and would include BMPs to control erosion and sedimentation.
- Minimize ground-disturbing activities, especially during the wet periods of the year.
- Surface new roads with aggregate materials, wherever appropriate.
- Restrict heavy vehicles and equipment to improved roads to the extent practicable.
- Control vehicle and equipment speed on unpaved surfaces.
- Stabilize disturbed areas that are not actively under construction using methods such as erosion matting or soil aggregation, as site conditions warrant.
- Regularly inspect access roads, utility and transmission line corridors, and tower site areas for damage from erosion, washouts, and rutting. Initiate corrective measures upon evidence of damage.
- Address drainage problems caused by construction to minimize damage to agricultural fields.
- Decompress soil to the extent practicable following completion of construction.
- Salvage topsoil from all excavation and construction activities to the extent practicable, to reapply to disturbed areas once construction is completed.
- Dispose of excess excavation materials in approved areas to minimize erosion.
- Isolate excavated areas and soil piles from surface water bodies using silt fencing, bales, or other accepted methods to limit sediment transport by surface runoff.
- Use earthen dikes, swales, and lined ditches to divert local runoff around the construction site where practicable.
- Re-establish the original grade and drainage pattern to the extent practicable after construction is complete.

2.11.3 Water Resources

General steps X-energy would take for avoiding or minimizing impacts to water resources include the following:

- A Spill Prevention, Control, and Countermeasures (SPCC) plan will be prepared for the Project to address accidental release of construction-related chemicals, fuels, or hydraulic fluid. Implementation of BMPs associated with the SPCC would minimize potential impacts on groundwater. BMPs for spill-related effects will include (as appropriate) storing fuels within secondary containment devices, checking vehicles and equipment for leaks, performing refueling and equipment maintenance away from water wells and surface water resources, maintaining a spill response kit on-site, and appropriate reporting protocols for any spills.
- Apply standard erosion control BMPs to all construction activities and disturbed areas (e.g., sediment traps, water barriers, erosion control matting), as applicable, to minimize erosion and protect water quality.
- Apply erosion controls where it is probable soil erosion from vehicular traffic would occur.
- Construct drainage ditches only where necessary; appropriate structures at culvert outlets to prevent erosion will be used.
- Avoid or minimize alteration of existing drainage systems, especially in sensitive areas such as erodible soils or steep slopes.

- Clean and maintain catch basins, drainage ditches, and culverts as needed.
- Limit herbicide and pesticide use to non-persistent, immobile compounds and apply the chemicals using a properly licensed applicator in accordance with label requirements.
- Dispose of excess excavation materials in approved areas to minimize erosion and leaching of hazardous materials.
- Reestablish the original grade and drainage pattern to the extent practicable after construction is complete.

2.11.4 Air Quality

General steps X-energy would take for avoiding or minimizing impacts to air quality include the following:

- Use access roads and parking lots surfaced with aggregates or that maintain compacted soil conditions to reduce dust generation where possible.
- Post and enforce speed limits on dirt and gravel access roads to minimize airborne fugitive dust.
- Minimize potential environmental impacts from the use of dust palliatives by taking measures to keep the chemicals out of sensitive terrestrial habitats and streams. The application of dust palliatives will comply with federal, state, and local laws and regulations.
- Heavy equipment will meet emission standards specified by State laws and regulations, and routine preventive maintenance will be conducted as required.
- Minimize idling of diesel equipment where practicable, unless necessary for proper operation.
- As practicable, stage construction activities efficiently to minimize the area of disturbed soils exposed at any particular time.
- Spray stockpiles of soils with water and/or treat the stockpiles with appropriate dust suppressants as reasonably necessary. Vegetative plantings may also be used to minimize dust generation for stockpiles that are expected to be inactive for relatively long periods.
- Train workers as necessary to comply with speed limits, use good engineering practices, minimize the drop height of excavated materials, and minimize disturbed areas where practicable.
- Cover vehicles transporting loose materials when traveling on public roads, and/or keep loads sufficiently wet and below the freeboard of the truck to minimize wind dispersal as practicable.
- Equipment will undergo routine inspection and preventative maintenance to minimize leaks.

2.11.5 Noise

General steps X-energy would take for avoiding or minimizing noise include the following:

- A process will be established for documenting, investigating, evaluating, and resolving project construction-related noise complaints.
- All construction equipment would be maintained in good working order in accordance with manufacturer specifications and operate within applicable noise limits.
- Operate vehicles traveling within and around the Project in accordance with posted speed limits.
- When practicable, noisy construction activities will be limited to times of the day when nearby sensitive receptors are less likely to be disturbed.
- Locate stationary construction equipment (e.g., compressors or generators) as far as practicable from nearby sensitive receptors.
- In the event that blasting or pile driving would be needed during the construction period, nearby residents in advance will be.

2.11.6 Vegetation

General steps X-energy would take for avoiding or minimizing impacts to vegetation include the following:

- Avoid siting infrastructure in wetlands and water bodies unless not practicable.
- Minimize habitat disturbance by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.
- Restore and regrade disturbed soils to the extent practicable after construction. The construction contractor would coordinate on native seed mixes, or other preferred species used for revegetation. The seed mixes and revegetation plan would be developed as part of the SWPPP for the Project.
- Develop a plan for control of noxious weeds and invasive plants that could occur as a result of new surface disturbance activities at the site. The plan will address monitoring, weed identification, the manner in which weeds spread, and methods for treating infestations as appropriate.

2.11.7 Wildlife

General steps X-energy would take for avoiding or minimizing impacts to wildlife include the following:

- Conduct pre-construction surveys in and around the building site to ensure that denning and nesting species are not present within seven days prior to construction activities being initiated.
- Instruct employees, contractors, and site visitors to avoid harassment and to minimize disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons.
- Employee, contractor, and site visitor's pets would not be allowed on the Project.
- Any incident (defined as injury or mortality) involving a state- or federally listed threatened or endangered species, golden or bald eagle, or species protected by the MBTA, will be reported to the USFWS, Tennessee Wildlife Resources Agency (TWRA), and the TDEC, as appropriate, within 24 hours of confirmed identification by a qualified biologist. This includes impacts to active nests defined by the presence of eggs or chicks in the nest.
- If needed during construction, only use explosives within specified times and at specified distances from sensitive wildlife or surface waters, as established by the appropriate federal and state agencies.
- Promptly dispose of all garbage and human waste generated onsite in order to avoid attracting nuisance wildlife.
- Train O&M staff to recognize mortalities that may be sensitive species as well as to observe injured individuals to determine if they are sensitive species.

2.11.8 Visual Resources

General steps X-energy Project would take for avoiding or minimizing impacts to visual resources include the following:

- For ancillary buildings and other structures, low-profile structures will be chosen whenever practicable to reduce their visibility.
- To the extent allowed by the FAA and by state and local permitting authorities, grouped structures will be painted the same color to reduce visual complexity and color contrast where practicable.
- Where possible for ancillary structures, materials and surface treatments may repeat and/or blend with the existing form, line, color, and texture of the landscape.

- Lighting for facilities would not exceed the minimum required for safety and security as established by the FAA, the Department of Defense, and state and local permitting authorities. If possible, where they are necessary, security lights will be extinguished except when activated by motion detectors (e.g., only around the substation) or down-shielded to prevent lighting into the night sky.
- A site restoration plan would be in place prior to construction, and restoration of the construction areas will occur at the end of construction.

2.11.9 Construction

General steps X-energy would take for minimizing construction impacts include the following:

- Disturbed surfaces would be restored to the greatest extent practicable to their original contours and revegetated after construction. X-energy will take reasonable action to limit erosion.
- Existing rocks, vegetation, and drainage patterns will be preserved to the extent practicable.
- Care will be taken to minimize color and texture contrasts from new roads and the surrounding landscape where possible.
- The geometry of road ditch design would consider visual objectives where feasible.
- Areas for planting pockets would be included in designs where feasible.
- To the extent practical, topsoil from cut/fill activities will be spread on freshly disturbed areas to minimize impacts and aid revegetation. Best efforts will be used to not locate topsoil piles in sensitive viewing areas.
- Reasonable efforts will be used to minimize the impacts of excess cut/fill material and to be disposed of or relocate appropriately.
- Where feasible, construction on wet soils will be avoided or limited in order to reduce erosion.
- Communication cables and low or medium voltage utility power lines will be buried, where practicable.
- Culvert ends will be designed to minimize color contrasts with existing landscape as necessary.
- Signage will only be used where necessary and designed to minimize impact.
- The burning of trash and vegetation will be prohibited during construction; trash will be stored in containers, hauled offsite or otherwise disposed of appropriately.
- Litter must be controlled and removed during construction.

2.11.10 Operations and Maintenance

General steps X-energy would take for minimizing impacts from O&M processes include the following:

- Repair inoperable systems as quickly as reasonably practicable with consideration.
- Clean facilities and offsite surrounding areas of debris and related trash or waste on a regular basis.

2.11.12 Paleontological, Cultural, and Historic Resources

General steps X-energy would take for avoiding or minimizing impacts to paleontological, cultural, and historic resources include the following:

- Cultural resources discovered during construction will immediately be brought to the attention of DOE and the State Historic Preservation Offices (SHPOs). Work will be halted for a reasonable time in the vicinity of the find to avoid further disturbance of the resources while the find is being evaluated and appropriate mitigation plans are being developed.

2.11.13 Transportation

General steps X-energy would take for minimizing transportation impacts include the following:

- A transportation plan for Project construction will be developed, if necessary, in coordination with local departments. In addition, the process to be used will comply with unique state requirements and U.S. Department of Transportation requirements, and all necessary permits will be clearly identified and obtained.
- A traffic management plan for Project construction will be prepared, if necessary, in coordination with local departments. This plan shall incorporate measures such as informational signs, flaggers when equipment may result in blocked throughways, and traffic cones to identify any temporary changes in lane configuration as necessary and other items identified in agency discussions.

SECTION 3 AFFECTED ENVIRONMENT AND IMPACTS ANALYSIS

3.1 Background

Section 3 describes the existing environmental resources associated with the Project based on best available data for the Project. The section also analyzes the potential environmental effects of the Project and the No-Action Alternative on the environmental resources using the best available data for the assessment. Potential environmental effects are analyzed for each of the following phases of the Project: (1) construction and (2) operations and maintenance. The evaluation of potential effects or impacts considers the size and scope of this technology demonstration project and describes the effects or impacts in terms of their type (adverse or beneficial); duration (short- or long-term); and intensity. The threshold definitions for the impact intensities used in this analysis are as follows:

- Negligible: Impacts on the resource, although anticipated, would be difficult to observe and are not measurable.
- Minor: Impacts on the resource would be detectable upon scrutiny or would result in small but measurable changes in the resource.
- Moderate: Impacts on the resource would be easily observed and measurable but would be localized or short-term (equal to or less than 2 years).
- Major: Impacts on the resource would be easily observed and measurable, widespread, and long-term (i.e., more than 2 years)¹.

In addition to these impact thresholds under NEPA, there are effects determinations definitions that are applicable to species protected under the Endangered Species Act (ESA). The ESA effects determination for federally listed species are as follows:

- No effect: Federally listed species or critical habitat will not be affected, directly or indirectly.
- May affect but is not likely to adversely affect: All effects on federally listed species or critical habitat are beneficial, insignificant, or discountable.
- May affect and is likely to adversely affect: An adverse effect to listed species or critical habitat may occur as a direct or indirect result of the proposed action and the effect is not: discountable, insignificant, or beneficial.

3.2 Identification of Resources Present, Not Present and Affected

Consistent with NEPA implementing regulations and guidance, DOE focused the analysis in this EA on topics with the greatest potential for environmental impacts (consistent with the sliding-scale approach [40 CFR 1502.2(b)]). The environmental resources on which the Project is expected to have no impact or a negligible impact are described below in Section 3.3 and are not carried forward for detailed analysis.

3.3 Resource on which the Proposed Project is expected to have no impact or a negligible impact

- Air Quality and Climate Change: Assessment of impacts to air quality are required under the Clean Air Act of 1970. Air quality impacts are assessed by comparing potential air emissions from proposed activities to National Ambient Air Quality Standards (NAAQS) [40 CFR part 50] for pollutants considered harmful to public health and the environment. The U.S. Environmental Protection Agency (EPA) has set NAAQS for six principal pollutants, which are called “criteria” air pollutants. The current standards are available at <https://www.epa.gov/criteria-air-pollutants/naaqs-table>. Currently, Roane County is in attainment for all criteria pollutants (EPA 2020). Impacts from development activities would be primarily associated with land disturbance

activities. This activity would result in intermittent, short-term impacts to air quality from particulate matter (i.e., dust), and to some extent emissions from equipment use. Effects from these types of emission sources would conclude once development activities cease, and typical dust control BMPs associated with NPDES construction permitting would serve to minimize particulate matter. Potential impacts from vehicle emissions associated with employees of businesses and visitors to the area would be intermittent and would not be associated with quantities that would result in non-attainment of NAAQS. Overall, potential impacts associated with development activities and operations are within the scope of analysis conducted in previous NEPA documentation and this resource area is not carried forward for detailed analysis in this EA. Emissions from GHGs would be negligible resulting in negligible impacts to climate change. Impacts of climate change on the HTF could include increased risk of wildfire or flooding. The HTF would be constructed to withstand impacts from a 500-year flood event.

- Noise: Assessment of impacts to this resource area is based on the length of activity and the levels of noise expected. Noise would be generated by construction equipment which would operate for short periods of time during designated hours and noise generated during operations is expected to be minimal. There are no nearby sensitive receptors including homes, schools, places of worship, or hospitals therefore this resource area would not be analyzed in detail. The closest residence is located over 1 mile away. Noise impacts have been analyzed in the 1996 and 2003 EAs, with development activities having occurred on Parcel ED-1 over the years. Noise impacts to recreational resources are analyzed under the recreational resources section of this EA.
- Visual (aesthetics): Assessment of impacts to this resource area is based on the surrounding landscape and expected structures. Aesthetic impacts from the HTF would be negligible due to the presence of other industrial facilities in the immediate area as well as other natural landscape features such as dense forests and mountains. Visual impacts to recreational resources are analyzed under the recreational resources section of the EA.
- Geology and soils (including prime and unique farmland): Assessment of impacts to this resource area is based on the amount/area of ground disturbance and the potential for erosion impacts or adverse impacts to soil productivity. Area geology and soils have not changed from baseline conditions presented in the 1996 and 2003 EAs, with development activities having occurred on Parcel ED-1 over the years as described in the 2013 MAP. Regulatory requirements such as compliance with National Pollution Discharge Elimination (NPDES) permitting for land disturbance of more than one acre and associated BMPs for erosion mitigation are still applicable for development activities throughout Parcel ED-1. Additionally, mitigations associated with ground disturbance activities within Parcel ED-1 identified in the previous FONSI are still applicable. Because the affected environment for this resource area and potential impacts associated with development activities (e.g., ground disturbance, erosion, etc.) are within the scope of analysis conducted in previous NEPA documentation, this resource area is not carried forward for more analysis in this EA.
- Hydrology (including floodplains and wetlands): Analysis of hydrology includes potential impacts to water quality or quantity and potential impacts to floodplains or wetlands. X-energy would have negligible impacts to water quality or quantity from wastewater and sanitary wastewater from facility occupation. X-energy would comply with all necessary permits for wastewater from the State of TN including a NPDES Stormwater Construction Permit. X-energy and Kinectrics completed a jurisdictional waters report in April 2023 for DA 7. The report

concluded that the Project was not located within a floodplain and that no potentially jurisdictional drainage features or wetlands were discovered (S&ME 2023).

- Socioeconomics: Analysis of socioeconomic impacts assesses potential beneficial or adverse impacts to the social and economic environment surrounding the action area. Overall, potential impacts associated with proposed development activities and operations are within the scope of analyses conducted in previous NEPA documentation. Socioeconomic impacts identified under previous NEPA documentation were beneficial and associated with job creation associated with development, as well as spending and job creation associated with new businesses entering the park. Since the parcel was originally intended for use as an industrial/business park, and there are no adjacent residential land areas, there are no impacts outside Parcel ED-1 that would negatively affect residential land areas or property values.
- Environmental Justice: Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, requires evaluation of potential impacts to minority and low-income populations from the proposed action. As discussed in the 1996 and 2003 NEPA documents, there would be no environmental justice impacts associated with industrial development and use of Parcel ED-1.
- Accidents (including destructive acts): The assessment of accident and potential destructive acts impacts is typically focused on unplanned event(s) that result in an undesirable outcome and may be caused by equipment malfunction, human error, or natural phenomena. Occupational Safety and Health Administration (OSHA) requirements would be implemented during construction activities to minimize job-site safety risks. No otherwise unique health and/or safety risks would be anticipated. As a result, this issue is not addressed further in this document. The risks from potential destructive acts would be negligible as there are no radiological components associated with the facility and the inclusion of blast zones and relief panels in the design of the HTF building.
- Affects Abroad: The Project is located within the continental United States in Oak Ridge, TN and most impacts would be located at the HTF site or in the surrounding communities. Air quality emissions would have the potential to travel outside of the State of Tennessee however the dispersion rate would be high and the rate of emissions from the construction and operation of the HTF would be minimal and therefore the HTF would not significantly affect the environment in the global commons or a foreign nation.
- Infrastructure: This includes utility system development and use (electricity, potable water, wastewater, natural gas, etc.) and transportation infrastructure development and use. Potential effects from land disturbance, traffic, and consumptive use were reviewed in 1996 and 2003 EA for Parcel ED-1 and resulted in a FONSI. Impact analysis assesses the potential for degradation or improvement of utility systems, increases or decreases in consumptive use, and whether there would be increased traffic that would negatively affect current transportation systems. Since 1996, there have been significant improvements in Parcel ED-1 infrastructure, as described in the 2013 MAP. Continued development and utilization of infrastructure at Parcel ED-1 under the proposed action and Alternative 1 would be similar in scope to that analyzed in previous NEPA documentation. Design and construction of stormwater systems would be conducted in accordance with state and local requirements for proper management of stormwater. Impacts and associated mitigations/management requirements would be similar to those analyzed previously, with potential benefits associated with minimization of large trucks associated with industrial

activities entering/leaving the area. It is also likely that there would be improved traffic management with implementation of traffic control mechanisms such as traffic lights and turn lanes.

- **Indigenous Ecological Knowledge:** In accordance with the November 2022 Memorandum from the Executive Office of the President's Council on Environmental Quality on *Implementation of Guidance for Federal Departments and Agencies on Indigenous Knowledge* DOE has evaluated whether Indigenous Knowledge (IK) should be a resource area evaluated in detail in this EA. This EA does not have any cooperating or participating agencies. Based on the current guidance for IK, "*Common circumstances in which Indigenous Knowledge may arise include environmental reviews of resource management plans, forest plans, energy resource lease sales, and other Federal authorizations regarding the use of public lands.*" DOE's proposed action includes the funding of the construction and operation of the HTF in Oak Ridge, TN. DOE is not preparing a land management or landscape level NEPA review of the project area. The HTF is located on private land and not located on a Tribal reservation or public lands. Therefore, this resource area is not carried forward for detailed analysis in this EA.
- **Cultural Resources:** The National Historic Preservation Act requires identification and assessment of potential impacts to archaeological resources and historic structures. Surveys have been conducted throughout Parcel ED-1 as part of previous NEPA analyses. There are three known cultural resources at Parcel ED-1: the McKamey-Carmichael cemetery located in DA 6 (which includes a protective 100-ft buffer) and two former grist mill sites (40RE195 and 40RE200) along East Fork Poplar Creek (EFPC). Because there are no archaeological sites or historic resources that would be affected by HTF activities, this resource has not been carried forward for further analysis in this EA. Should previously undiscovered artifacts or cultural resource features be unearthed during ground disturbance activities, work would be stopped in the immediate vicinity of the find and DOE would be notified. At that point, a determination of significance would be made and, if required, consultation with the Tennessee State Historic Preservation Officer would be initiated.
- **Waste Disposal:** Chemical waste, hazardous waste, industrial waste, and biological hazards would be generated during the construction and operation of the HTF. HTF would generate small volumes of various (non-radiological) waste forms including industrial waste typical to a construction site, non-hazardous waste (e.g., process filters), potential for small amounts of hazardous waste generation (e.g., chemicals, universal waste from facility maintenance), wastewater (e.g., non-contact cooling water), and sanitary wastewater from facility occupation. Disposal of all materials would comply with applicable federal, state, and local regulations and would fall in the small quantity generator category. X-energy would have appropriate personal protective equipment for safe handling and would follow spill prevention plans.
- **Human health and safety:** Air quality emissions are expected to be minimal from construction and operation of the HTF and hazardous materials would be handled in accordance with applicable regulations and spill prevention plans. The HTF would adhere to OSHA regulations for workers during construction and operation.
- **Vegetation:** This includes the removal of five acres of forested land within the 72 acres of DA 7. Vegetation within DA 7 consists of mixed pine-hardwood forests, second-growth loblolly pine forests, tall fescue, and beech-maple forests which would result in permanent habitat loss; however, within ED-1 there are established NAs that would not be affected by the Project and

DA 7 would continue to support 67 acres of forested habitat which would reduce impacts from habitat fragmentation. X-energy would prepare a plan to prevent the spread of invasive and noxious weeds on DA 7. Impacts to threatened and endangered species from habitat loss is discussed in the Threatened and Endangered Species Section of this EA.

3.4 Affected Environment and Impacts Analysis

3.4.1 Threatened and Endangered Species

This section describes the biological resources in the study area, which includes the proposed project site and the surrounding area within the Oak Ridge Reservation (ORR) and is intended to provide a baseline characterization of the ecology prior to any disturbances associated with construction or operation of the HTF.

The project area is situated in the Great Valley of East Tennessee between the Cumberland and Great Smoky Mountains (DOE 2020). At approximately 35,000 acres, the ORR is the largest contiguous and protected land ownership in the southern Valley and Ridge Physiographic Province of East Tennessee. The ORR contains approximately 25,000 acres of forestland. The ORR's natural resources are managed for DOE by the Oak Ridge National Lab (ORNL) Natural Resources Management Program.

More than 1,100 vascular plant species have been identified at the ORR. Of the 168 non-native plant species on the ORR, 54 are considered severe or significant threats to natural areas or the ORR mission. The Invasive Plant Management Plan for the ORR addresses the impacts of invasive plants on facility operations and natural areas. The overall goals of wildlife management on the ORR are directed toward preserving populations and habitat, maintaining, and enhancing biodiversity, integrating multiple use objectives, and minimizing wildlife damage to property and public safety (ORNL 2006).

The proposed project site would be located on 15 acres of land, with only 5 acres of land to be cleared, within DA 7 which is approximately 72 acres in size located within the 957-acre Horizon Center (Parcel ED-1), see Figures 5 and 6. Terrestrial resources at the Parcel ED-1 site are managed through various agencies including the USFWS, TDEC, and the Tennessee Wildlife Resources Agency.

Figure 5. Horizon Center Industrial Park

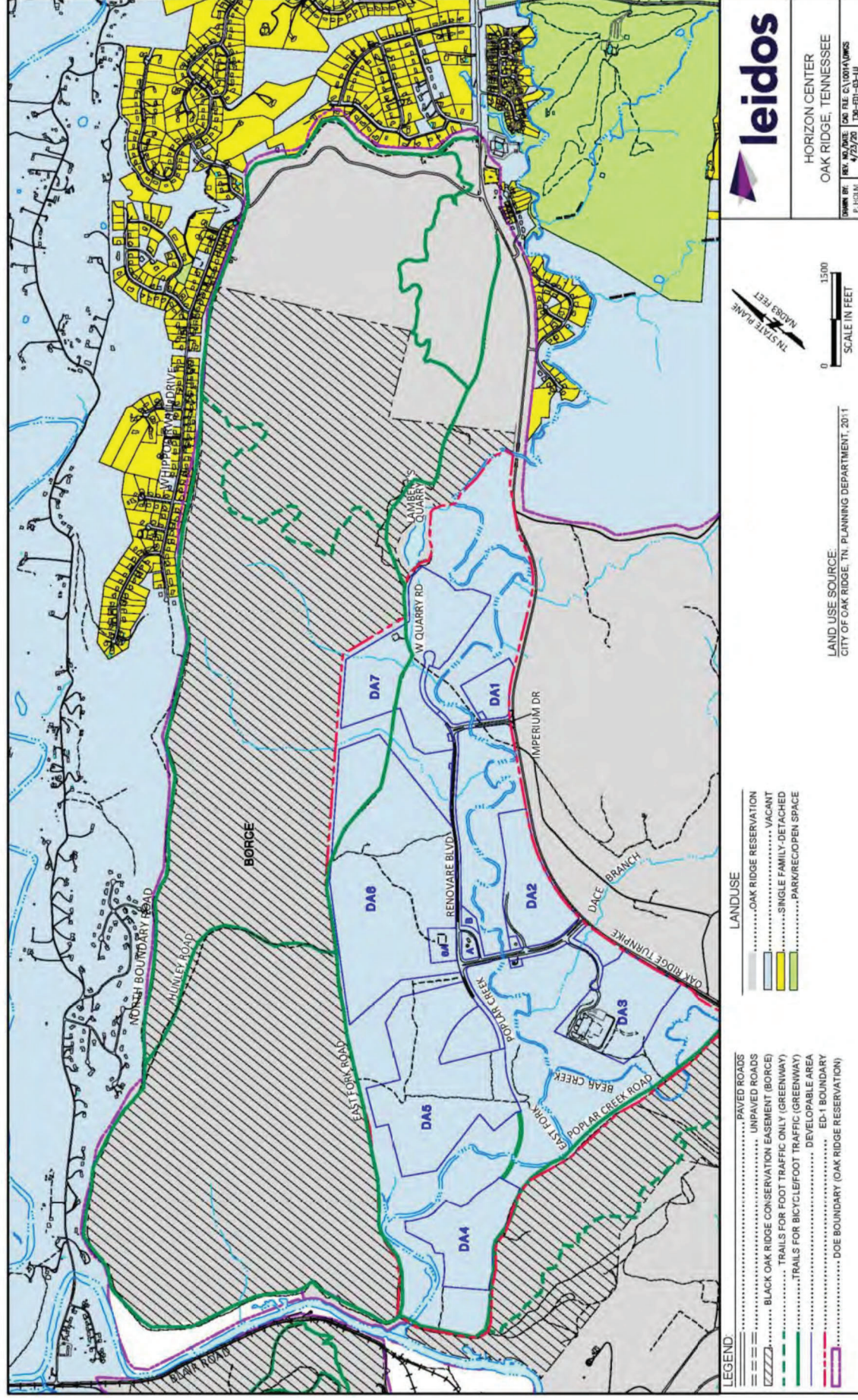
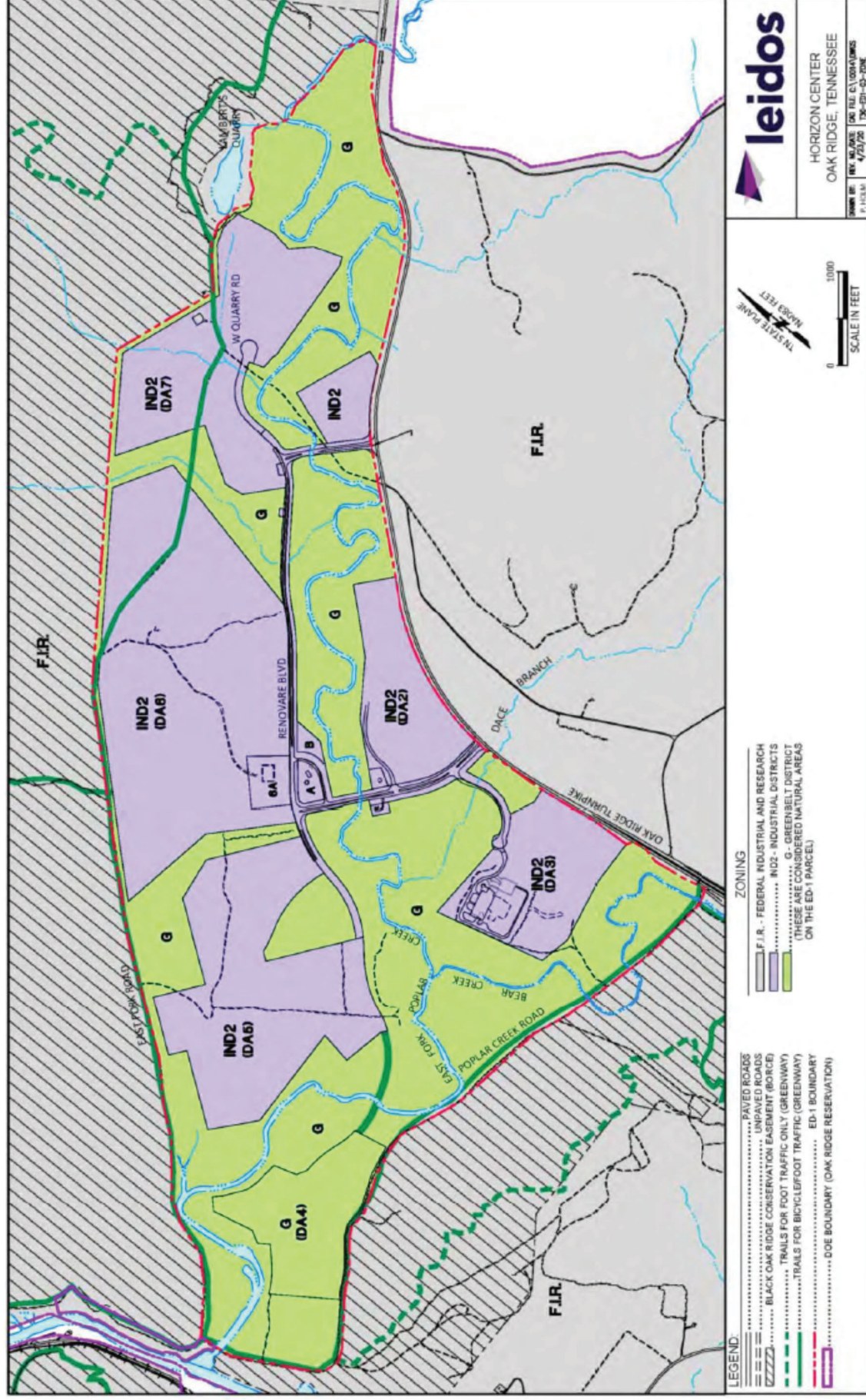


Figure 6. Trails and Greenway



Vegetation within the proposed project site consists mainly of areas of mixed pine-hardwood forests, second-growth loblolly pine forests that naturally revegetated following the 1990's pine beetle outbreaks and cleared areas that have been replanted with tall fescue. Five sensitive vegetation communities are known to occur in the vicinity or within the proposed project site area: beech-maple forest, limestone cliffs, limestone barrens, canebrakes, and walnut plantations. Limestone barrens have been identified within DA 7 (DOE 2020).

Limestone barrens include areas dominated by vegetation exclusive to rocky sites where tree growth is inhibited or slowed due to the following conditions: shallow soils over bedrock, a high degree of exposed surface rock, or steep easily erodible slopes. Within the proposed project site area, there are two possible barren sites located within the forested area in the southwestern portion of the site. These barrens consist of complexes of small openings dominated by grasses and herbaceous plants in a mixed eastern red-cedar hardwood forest (DOE 2020).

The eastern deciduous hardwood forest on the ORR provides habitat for numerous wildlife species. The diversity of wildlife species ranges from common species found in urban and suburban environments to more specialized species such as interior forest bird species. The ORR hosts more than 70 species of fish; about 71 species of reptiles and amphibians (68 species confirmed); 213 species of migratory, transient, and resident birds; and 49 species of mammals, as well as many invertebrate species (NERP 2021). In addition, the Bald Eagle may also be present and is protected under both the *Migratory Bird Treaty Act* and the *Bald and Golden Eagle Protection Act* (USFWS 2021).

The 957-acre Horizon Center (Parcel ED-1) (within which the Project would be sited) has been subject to pre- and post-development monitoring to assess natural succession and impacts of development on natural communities and populations. Monitoring activities were initiated for birds, benthic invertebrates, and fish in 1996. During late 1998, development activities began, and the initial clearing, road and bridge construction, and utility installations were complete by the end of 2000. Monitoring continued during the first few years of the post-development period until 2011. Wildlife observed at Parcel ED-1 includes eight reptile species, two amphibians, 39 species of birds, and 24 mammals (DOE 2020). The *Implementation of Mitigation Action Plan for Parcel ED-1 on the Oak Ridge Reservation* (DOE 2013) provides a complete listing of species observed.

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

The USFWS Information for Planning and Consultation online system was accessed to request an *Official Species List* to identify species protected under the ESA that could occur within the proposed project area. On June 20, 2023, a list was generated by the USFWS Tennessee Ecological Services Field Office containing eight federally listed species with the potential to occur in the vicinity of the proposed project site, however none are known to occur. These included three mammals, one fish, two clams, and two plants (USFWS 2023). These species are listed in Table 2.

There are no USFWS federally listed species known to occur within the Parcel ED-1 site (DOE 2020). Additionally, no critical habitat for USFWS federally species occurs on or near Parcel ED-1. Two federally listed endangered bat species, Indiana bat (*Myotis sodalists*) and Northern long-eared bat (*Myotis septentrionalis*) and the proposed endangered Tricolored bat (*Perimyotis subflavus*) occur within mixed pine-hardwood forests and second-growth loblolly pine forest. The Gray bat (*Myotis grisescens*) inhabit caves year-round, occupying cold hibernating caves or mines in the winter and

warmer caves during the summer.

Table 2. Threatened and Endangered Species

Name	Scientific Name	Habitat	Historically Observed within the ED-1?	Status
Mammals				
Gray bat	<i>Myotis grisescens</i>	Inhabits caves year-round but may sometimes use man-made tunnels as their summer quarters.	No, however roosting habitat occurs within ED-1	Endangered
Indiana bat	<i>Myotis sodalis</i>	Winters in the large, cool limestone caves with high humidity. They rarely inhabit buildings or other man-made structures. Females deliver their young in hollow trees or beneath tree bark.		Endangered
Northern long-eared bat	<i>Myotis septentrionalis</i>	Winters in cool, moist caves and mines. In summer, they roost in a variety of shelters including barns and attics, and under tree bark or shutters. They usually roost singly, except for small maternity colonies. They seem to prefer tight crevices and holes, although they will also frequently hang out in the open.		Endangered
Tricolored bat	<i>Perimyotis subflavus</i>	Hibernates in caves and mines during winter months. In summer, they roost, forage, and travel within forested and wooded habitats and may include emergent wetlands and edges of agricultural fields and pastures.		Proposed endangered
Fish				
Spotfin chub	<i>Erimonax monachus</i>	Clear upland rivers with swift currents and boulder substrates.	No	Threatened
Clams				
Fineyrad pigtoe	<i>Fusconaia cuneolus</i>	Freshwater. Inhabits clear, high-gradient streams in firm cobble and gravel substrates.	No	Endangered
Shiny pigtoe	<i>Fusconaia cor</i>	Freshwater. Found in shoals and riffles of small- to medium-sized rivers in clear streams with moderate to fast current. It is typically well-burrowed in sand and cobble substrates. It does not appear tolerant of deeper water or reservoirs.	No	Endangered
Flowering plants				
Virginia spiraea	<i>Spiraea virginiana</i>	Occurs along rivers and streams and relies on periodic disturbances, such as high-velocity scouring floods, which eliminate competition from trees and other woody vegetation. However, if the frequency and intensity of these floods is too great, the plant may	No	Threatened

		become dislodged and wash downstream into less suitable habitat.		
White fringeless orchid	<i>Platanthera integrilabia</i>	Grows in wet, boggy areas at the heads of streams and on sloping areas kept moist by groundwater seeping to the surface. It is often associated with Sphagnum in partially, but not fully, shaded areas.	No	Threatened

The TDEC maintains the state list of Rare Species by County (TDEC 2021). Of the 68 species listed for Roane County, none is known to occur within the Parcel ED-1 site (DOE 2020).

However, two previously state-threatened plant species have been documented within Parcel ED-1, goldenseal (*Hydrastis canadensis*) and pink lady slipper (*Cypripedium acaule*). These are now listed as “apparently secure (S4)” (DOE 2020). Protected plant species with the potential to occur within the proposed project area are included in Table 2.

3.4.1.1 Environmental Consequences:

Proposed Action

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

Construction

Under the Proposed Action, a main building, access road, parking lot, and storage areas would be constructed in newly disturbed areas within a 5-acre footprint. DOE determined that construction activities would have no effect on the White fringeless orchid, Virginia spiraea, Shiny pigtoe, Fineryad pigtoe, and Spotfin chub because there is no known habitat or occurrences within DA 7 for these species. DOE determined that construction activities may affect, but are not likely to adversely affect, the endangered Gray bat, Indiana bat, and Northern long-eared bat and the proposed endangered Tricolored bat. DOE received concurrence from USFWS on the *may affect, not likely to adversely affect* determination for the four endangered bat species and the *no effect* determination for other species on November 28, 2023. Per the consultation with USFWS, X-energy must complete any tree clearing activities within the winter months (November – March) to avoid potential impacts to bat species. No additional conservation measures are required. Therefore, impacts to threatened and endangered species from construction activities would be short-term and minor.

Operation

Because of the similar nature to current industrial operations within ED-1 and ORR, impacts to biological resources from HTF operations and maintenance activities would be long-term but minor. The Biological Monitoring and Abatement Program (BMAP) for ORR, which monitors the health of East Fork Poplar Creek, would continue and would be used to ascertain any impacts from HTF operations on local aquatic biota. DOE will reconsult with USFWS if the proposed project changes substantially. X-energy will notify USFWS, TDEC, and TWRA if an incident occurs with state- or federally listed threatened and endangered species.

No Action Alternative

Under the No-Action Alternative, the HTF would not be constructed, and biological resources would remain unchanged when compared to existing conditions.

3.4.2 Recreation

Parcel ED-1 provides opportunities for passive and active recreation via its unpaved trails. Parcel ED-1 is part of, and connected to, the City of Oak Ridge's Greenway trails network (City of Oak Ridge 2013), see Figure 4. The Greenway consists of 1600 acres of DOE reservation at the west end of Oak Ridge and includes 14 miles of dirt/gravel roads and singletrack, most of which is open for foot, bicycle and equestrian use. Portions are closed for three spring weekend turkey hunts in April and for deer hunting one weekend in October, November, and December each year in addition to the Saturday before each scheduled hunt weekend for scouting. There is bike lane access via SR 95 to the main entrance of the Horizon Center. Currently, the use of the road along the greenway is permitted under a license granted by DOE to the City of Oak Ridge.

Visual impacts are changes to the scenic attributes of the landscape brought about by the introduction of visual contrasts (e.g., development) and the associated changes in the human visual experience of the landscape. A commonly used guide to assess visual impacts is the BLM Manual H-8410-1 – Visual Resource Inventory. The BLM visual resource inventory process provides a means for determining visual values. The inventory consists of a scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. Based on these three factors, BLM-administered lands are placed into one of four visual resource inventory classes - Classes I and II being the most valued, Class III representing a moderate value, and Class IV being of least value. While the proposed action does not take place on BLM administered lands, these rating criteria are useful in generally characterizing potential visual impacts. Given the existing development within ED-1 and the surrounding area, the project area would likely be considered a Class IV area which includes areas with major modifications to the existing character of the landscape (BLM 1986).

Noise is unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment and can be perceived as a nuisance. Sound intensity varies widely (from a soft whisper to a jet engine) and is measured on a logarithmic scale to accommodate this wide range and is described in dBA. Ambient sound levels have not been measured on ED-1; however, based on existing land use, traffic volume, and population density, ambient levels are estimated to be 50 dBA (DOE 1996). The Average Daily Traffic Count for SR 95 is 14,246 vehicles per day (TDAT 2023). In 2020 noise modeling studies were completed for a racetrack previously proposed on DAs 5, 6, and 7. The modeling indicated that the highest level of anticipated noise from racetrack was estimated to be 103 dBA and the noise would reduce to less than 50 dBA 50 ft from the racetrack (DOE 2020). There are no sensitive receptors (e.g., hospitals, churches, and schools) located within the immediate vicinity of DA 7 (DOE 2020).

3.4.2.1 Environmental Consequences

Proposed Action

Potential impacts to the recreation area are evaluated based on the degree to which recreation area visitors and activities could be affected by the Proposed Action and No-Action Alternative. Impacts are evaluated in terms of visual and/or noise impacts on recreational users of the Greenway.

Construction

Under the Proposed Action, a main building, access road, parking lot, and storage areas would be constructed in newly disturbed areas within a 5-acre footprint that is adjacent to existing public access road and approximately 675 feet from the East Fork Rd. portion of the North Boundary Greenway. The lower portion of the HTF main building would be approximately 18'6" high and the tower portion would be approximately 85' high. HTF construction equipment and construction activities would be visible from the existing public access road and the Greenway. The impacts to the visual landscape from HTF construction would be considered minor and short-term as the project area has already undergone major

modifications to the character of the landscape and similar industrial buildings within ED-1 dominate the viewshed.

HTF construction activities would introduce a new source of noise in DA 7. HTF construction activities would occur during allowable construction hours, typically from early morning to early evening during weekdays. Most construction activities would be between 80-90 dBA with certain activities such as drilling reaching levels up to 120 dBA. Those noise levels can be compared to subway or motorcycle passing (80-90 dBA), gas lawnmower or snowblower (100 dBA), and a large thunderclap (120 dBA) (ANSI 2018). Occasional generator use could occur during the construction period and would be a new source of noise in DA 7. Most 100 kW generators produce between 70-85 dBA (TurnKey 2023). Construction vehicle traffic from 30-40 workers (representing a 4 percent increase in current traffic levels over a 6–12-month period) would also introduce additional noise in the vicinity of DA 7.

As was shown in the 2020 DOE EA, sound levels of over 100 dBA would drop to 50 dBA within 50 ft of the source of noise. The nearest Greenway trail is over 700 ft away from the proposed project location. As such, it can be concluded that construction noise would be 50 dBA or less at the trail, the same as the ambient noise level in ED-1. Moreover, any noise disruption to the recreation area would be confined to allowable construction hours throughout the roughly 12-month construction period. Due to the distance from the Greenway trail and the limited construction period, impacts on recreational users from HTF construction noise would be minor and short-term. Noise impacts from HTF construction traffic would be negligible.

Operation

The tower portion of the HTF main building would be up to 85' high, which would be visible to recreational users of the East Fork Rd. portion of the City of Oak Ridge's North Boundary Greenway. However, the HTF would be similar to the overall existing visual landscape of ED-1. Visual impacts from HTF operation would be long-term but minor.

Noise impacts to the recreational users from HTF operations and maintenance activities not likely exceed current ambient noise levels within ED-1 (estimated to be approximately 50 dBA). Occasional generator use would be the highest source of noise during HTF operation (typically in the range of 70-85 dBA). Noise impacts from regular HTF operations and maintenance activities would be negligible. However, there could be occasional minor and short-term noise impacts from use of a generator.

No Action Alternative

Under the No-Action Alternative, the HTF would not be constructed, and the recreational area would remain unchanged when compared to existing conditions.

3.5 Cumulative Impacts

Cumulative impacts are those that may result from the incremental impacts of an action considered additively with the impacts of other past, present, and reasonably foreseeable future actions. Cumulative impacts are considered regardless of the agency or person undertaking the other actions (40 CFR 1508.7) and can result from the combined or synergistic effects of individually minor actions over a period of time.

3.5.1 Threatened and Endangered Species

Cumulative impacts from continued development in the Horizon Center Industrial Park from the TRISO-X FFF and Lyons activities would further reduce the amount of available habitat for the Gray bat, Indiana bat, Tricolored bat, and Northern long-eared bat. However, given the existing NAs and their continued

protection, cumulative impacts would be expected to be minor. DOE received concurrence from USFWS on November 28, 2023, for a **may affect, not likely to adversely affect** determination for four endangered bat species and **no effect** determination for other species. X-energy must complete any tree clearing activities within the winter months (November – March) to avoid potential impacts to bat species. No additional conservation measures are required. There would be a negligible impact expected from the continued operations of the Horizon Center, ORR, and Y-12 facilities. Because no new habitat loss would occur and the impacts would be similar to the construction of the HTF from the disassembly of the main building, impacts to biological resources from HTF decommissioning would be minor and short-term. The access road, parking lot, and lay down areas would likely remain in place and have the same impacts as HTF operations and maintenance.

3.5.2 Recreation

Cumulative impacts from continued development in the Horizon Center Industrial Park from the TRISO-X FFF and Lyons activities would potentially increase the ambient noise levels. However, given the existing industrial areas and the continued protection of NAs as natural sound buffers, cumulative impacts would be expected to be minor. There would be a negligible impact on noise levels expected from the continued operations of the Horizon Center, ORR, and Y-12 facilities. Decommissioning activities would create impacts similar to those resulting from construction of the HTF. Impacts to the recreation area from HTF decommissioning would be minor and short-term.

SECTION 4 LIST OF AGENCIES AND PERSONS CONSULTED AND PREPARERS

4.1 Agencies consulted (USFWS and State of TN)

On November 15, 2023, OCED submitted a request for informal consultation under Section 7 of the Endangered Species Act to the U.S. Fish and Wildlife Service (USFWS) Tennessee Ecological Services Office. DOE requested concurrence on a may affect, not likely to adversely affect determination for four endangered bat species (Northern long-eared bat, Indiana bat, Gray bat, and Tricolored bat) and a no effect determination for other species. DOE received concurrence from USFWS on these determinations on November 28, 2023. X-energy is required to complete any tree clearing work during the winter months (November – March) to avoid any potential impacts to the bat species.

DOE is required to consult with host states, which means a state within whose boundaries DOE proposes an action. DOE is required to notify the host state of a DOE determination to prepare an. DOE provided this notification on July 7, 2023, to the host state (TN) and provided it with a 14-day opportunity to review the internal, draft EA on October 10, 2023. DOE incorporated comments from the host state (TN) into the final EA.

4.2 Preparers

Table 3. List of Preparers

Name	Organization	Role
Shaina Aguilar	DOE	NEPA Document Manager
Gretchen Applegate	DOE	NEPA Document Manager
Kristin Kerwin	DOE	ES&H Director
Jeff Ciocco	DOE	Supervisory Nuclear Engineer
Carl Friesen	DOE	Engineer
David Yarwood	DOE	Technical Project Officer

SECTION 5 REFERENCES

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