# ENCLOSURE 2

# Responses to Requests for Supplemental Information to Support the TRISO-X License Application

# NON-PROPRIETARY

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**

Docket No. 70-7027; EPID: L-2022-NEW-0005

This enclosure includes responses to the RSIs and Observations listed below. Non-public responses to the remaining RSIs and Observations are included in Enclosure 3.

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**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**

# 1 GENERAL INFORMATION

## 1.1 RSI – (Exemptions)

**Supplemental Information Needed:**

The license application section 1.3, "Special Exemptions and Special Authorizations," contains several exemption requests. The following information is needed to proceed with the formal review of these exemption requests:

- **RSI 1-A – Exemptions for Criticality Monitoring:**
  Provide a sufficient justification for exemption request 1.3.2 – "Criticality Monitoring" consistent with the applicable section(s) of the regulations (i.e., 10 CFR 70.17, "Specific Exemptions").

- **RSI 1-B – Environmental Reviews for Exemption Requests:**
  Provide the appropriate environmental determination and supporting analysis for each of the exemptions. This information can be provided in the license application or addressed in the environmental report. If the information is placed in the environmental report, provide a cross reference in the license application.

- **Observations:**
  - Modify the Special Exemptions and Special Authorizations section to make explicitly clear in the title (or some other means) which requests are exemptions and which are authorizations. Also, consider grouping the Special Authorizations together.
  - Clarify whether section 1.3.7 – "Release for Unrestricted Use" is an exemption request or a special authorization.
  - Clarify what portion of the regulation is being requested for exemption in license application section 1.3.2, "Criticality Monitoring."

**Description of Issue:**

Each exemption request provided in the application needs to address the regulatory criteria for exemptions and include an environmental review. The bulk of the criteria are addressed, but the following issues need to be resolved. The exemption request 1.3.2 – "Criticality Monitoring" needs to address the three criteria in 10 CFR 70.17 and the environmental requirements. The exemption request in 1.3.3 -- "Posting and Labeling," 1.3.4 -- "ICRP-68 DAC and ALI Values," 1.3.5 – "ICRP-60 Organ Dose Weighting Factors," and 1.3.6 -- "Certain Unplanned Contamination Events" need to address the environmental requirements.

**Regulatory Basis:**

Exemption requests must demonstrate compliance with the criteria in the applicable portions of the regulations, which includes 10 CFR 20.2301, "Applications for exemptions" and 10 CFR 70.17, "Specific Exemptions." In addition, exemptions are considered licensing actions and therefore also require an environmental evaluation consistent the requirements in 10 CFR 51 (e.g., 10 CFR 51.21, 10 CFR 51.22(c)(25)), and guidance in NUREG-1748 (Accession No ML032450279).

**TRISO-X Response:**

**RSI 1-A**
The following will be added to Section 1.3.2, "Criticality Monitoring":

> Under the provisions of 10 CFR 70.17, "Specific Exemptions", the Commission may, upon application, grant exemptions from the requirements of 10 CFR 70 when the exemption is authorized by law, will not endanger life or property or the common defense and security and are otherwise in the interest of the public.
>
> The exemption is authorized by law because the Atomic Energy Act of 1954, as amended, contains no provisions prohibiting a licensee from being exempted from CAAS monitoring in a given area in which there is negligible risk of criticality. Granting such an exemption will not endanger life, property, or the common defense and security.
>
> Granting this exemption to 10 CFR 70.24(a) is in the public interest because having criticality accident alarms in an area in which there is a negligible risk of criticality may cause unnecessary evacuations and an emergency response based on a potential spurious alarm. Spurious alarms could also cause unnecessary risk to individuals during an evacuation and provide confusing information about the safety of the facility to the public.

**RSI 1-B**
The requirements in 10 CFR 70.17, "Specific Exemptions," state that the Commission may grant exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. The regulations in 10 CFR 51.21 state that "all licensing and regulatory actions subject to this subpart require an environmental assessment except those identified in 10 CFR 51.20(b) as requiring an environmental impact statement, those identified in 10 CFR 51.22(c) as categorical exclusions...."

The TRISO-X application for a license to possess and use special nuclear material for processing and fuel fabrication is an action for which an Environmental Impact Statement (EIS) will be prepared as required by 10 CFR 51.20(b)(7). This EIS covers all environmental aspects of the TRISO-X facility. Therefore, a categorical exclusion is not needed and specifics of the environmental effects of the exemptions do not need to be specifically addressed, since the environmental impacts of the entire facility will be evaluated as part of the Environmental Report review and EIS preparation.

It should be noted that for previous EIS's for new Fuel cycle facilities, the only exemption requests that were addressed in the EIS related to an exemption for authorizing preconstruction activities (NUREG-1938, Environmental Impact Statement for the Proposed GE-Hitachi Global Laser Enrichment, LLC Facility in Wilmington, NC, ADAMS Accession No. ML12047A040 and ML12047A042). The EIS for the Proposed American Centrifuge Plant in Pike County, Ohio (NUREG-1834), and the EIS for the Proposed National Enrichment Facility in Lea County, New Mexico (NUREG-1790) did not specifically address exemption requests in the application.

**Observations**

License Application Section 1.3 will be separated into subsections as detailed below to provide clarity regarding which sections are special exemptions and which sections are special authorizations:

- 1.3 Special Exemptions and Special Authorizations
  - 1.3.1 Special Exemptions
    - 1.3.1.1 Criticality Monitoring
    - 1.3.1.2 Posting and Labeling
    - 1.3.1.3 ICRP-68 DAC and ALI Values
    - 1.3.1.4 ICRP-60 Organ Dose Weighting Factors
    - 1.3.1.5 Certain Unplanned Contamination Events
  - 1.3.2 Special Authorizations
    - 1.3.2.1 Changes to the License Application
    - 1.3.2.2 Release for Unrestricted Use

For the special exemption related to “Criticality Monitoring,” 10 CFR 70.24 is listed in both paragraphs 1 and 2. More specifically, the exemption reference will be clarified as 10 CFR 70.24(a).

# 5 FIRE SAFETY

## 5.1 RSI – (Fire)

**Supplemental Information Needed:**

Provide the following information in the license application:

A. types of construction, materials, insulation, weight support, and thickness for the buildings and rooms (e.g., wall, ceiling, floor, door, window)
B. ventilation system and exhaust air and particulate systems (number, locations, and discharge rates of air and effluent outlet ducts)
C. temperature detector, fire and smoke detector, and fire alarm system
D. spacer, barriers, walls, windows, or other means to contain fire within the area
E. electric systems in accordance with National Fire Protection Association (NFPA) 70 (National Electrical Code)
F. hour ratings of wall, floor, ceiling, doors, and windows per International Building Code, and
G. fire suppression systems (e.g., sprinklers, extinguishers, fire dampers, hydrants, and standpipe and hose systems)

In addition to the above items, provide the building layouts that show the locations of these fire safety features listed above for justification that the safety features are installed appropriately.

**Description of Issue:**

Section 7.4 of the LA Chapters 1-13 (Enclosure 2) describes the facility design of the TRISO-X fuel fabrication facility. The application needs to detail the fire safety features of the main process building (i.e., Nuclear Manufacturing Building) in Chapter 7, in accordance with NFPA 801, “Standard for Fire Protection for Facilities Handling Radioactive Materials,” and Section 7.4.3.3 of NUREG 1520 Rev.2:

**Regulatory Basis:**

In accordance with 10 CFR 70.22(a)(7), the application must include a “description of equipment and facilities which will be used by the applicant to protect health and minimize danger to life or property.” The guidance in NUREG-1520, Revision 2, includes the acceptance criteria in Section 7.4.3.3, “Facility Design,” which provides an acceptable approach for demonstrating compliance with the regulations.

**TRISO-X Response:**

As noted in Section 4, Item d, of the letter, for fuel facilities, the NRC does not explicitly approve a design. The inference is that the design need not be final at license application.

A. The types of construction, materials, insulation, weight support, and thickness for the buildings and rooms (e.g., wall, ceiling, floor, door, window) are summarized in Section 2.11 of the ISA Summary and further details are provided in Section 5.2 of the Fire Hazards Analysis (FHA) (Att. 1, Item 92).
B. The ventilation system and exhaust air and particulate systems (number, locations, and discharge rates of air and effluent outlet ducts) are still in the design process. Section 7.4 of the FHA (Att. 1, Item 92) provides code requirements for heating, ventilation, and air condition systems. The Design Criteria Manual (Att. 1, Item 22)

also provides code requirements and performance requirements for the ventilation system.

C. The temperature detector, fire and smoke detector, and fire alarm system requirements are summarized in Section 2.11 of the ISA Summary and further details are provided Section 7.2 of the FHA (Att. 1, Item 92).
D. The requirements for spacers, barriers, walls, windows, or other means to contain fire within the area are summarized in Section 2.11 of the ISA Summary and further details are provided Sections 5.2.2, 7.3.2, and Appendix F of the FHA (Att. 1, Item 92).
E. The requirement for electric systems to be in accordance with National Fire Protection Association (NFPA) 70 (National Electrical Code) are summarized in Section 2.3.1 of the ISA Summary and further details are provided Section 7.2 of the FHA (Att. 1, Item 92).
F. The hour ratings of wall, floor, ceiling, doors, and windows per International Building Code are detailed in Sections 5.2.2, 7.3.2, and Appendix F of the FHA (Att. 1, Item 92). These details are also provided in the Design Criteria Manual (Att. 1, Item 22).
G. The fire suppression systems (e.g., sprinklers, extinguishers, fire dampers, hydrants, and standpipe and hose systems) details are provided in Section 7.1 and 7.3 of the FHA (Att. 1, Item 92). These details are also provided in the Design Criteria Manual (Att. 1, Item 22).

The building layouts that show the locations based on the current stage of the design for the fire safety features listed above are provided in Figures 5.2.2.1, 5.2.2.2, 5.2.2.3, 7.3.1, 7.3.2, 7.3.3, Appendix A, and Appendix F of the FHA (Att. 1, Item 92).

License Application Section 7.3, states “An FHA has been developed as required by NFPA 801 (2014 edition).” The FHA provides the details and methods/level of compliance to applicable NFPA Codes and fire safety design requirements. NFPA 801 Sections B.1 and B.2 prescribe the contents of the FHA (Att. 1, Item 92) that includes the details requested above.

Section 7.5.2 of NUREG-1520 states the following for a new facility: “For a planned facility, the reviewers may wish to consult with the facility design team to gain a better understanding of the process, its potential hazards, and safety approaches. Section 7 of the letter includes excerpts from NUREG-1520 that support site visits as a means to “…afford the reviewer(s) an opportunity to seek answers to questions from the applicant (or possibly the ISA team) that may have arisen in the preliminary review of the ISA Summary …” As noted in Section 5, Item f, in the letter, “The level of detail in process safety documentation held at the site would normally be greater than the descriptions in the ISA Summary and may include some or all of the information listed as items i through iv below, as needed.” Examples of process safety information listed as items i through iv on page 3-15 of NUREG-1520 that may be more detailed at the site include basic theory of the process, major components in the process, process design and equipment, and process safety limits.

The FHA (Att. 1, Item 92) and Preliminary General Arrangement layout drawing (Att. 1, Item 23, which is the basis for ISA Summary Figure 2-1) are complete consistent with the stage of design at the time of application and will be available to the NRC during the licensing review through an online reference portal to support in-office reviews and hard copy during site visits.

**5.2 RSI – (Fire)**

**Supplemental Information Needed:**

A. Provide the timeline and process for the NRC staff to access the Fire Protection Program (FPP) and the Fire Hazard Analysis (FHA) for the NRC staff's review (e.g., online) for understanding/evaluation of the fire protection measures and systems at TRISO-X.
B. Provide a table to summarize the key parameters (e.g., process operations, room area size, material construction, etc.) and their values used in the FHA. Provide the likely locations for the fire to occur in the main process building (Nuclear Manufacturing Building).
C. Make the pre-fire plan for the main process building (Nuclear Manufacturing Building) available for staff's review (e.g., online) for understanding and evaluation.
D. Describe key information of the pre-fire plan for the main process building (i.e., Nuclear Manufacturing Building). The pre-fire plan should include information needed by fire-fighting personnel responding to the emergency.

**Description of Issue:**

Chapter 7 of the LA Chapters 1-13 (Enclosure 2) states that there is a FPP designed to provide reasonable protection against fire and explosive hazards, an FHA and pre-fire plans prepared for each building.

**Regulatory Basis:**

In accordance with 10 CFR 70.22, "Contents of applications," the application must provide sufficient description of equipment, facilities and proposed procedures used to protect health and minimize danger to life or property. In addition, in accordance with 10 CFR 70.65(b)(6), the application must describe each IROFS in, "sufficient detail to understand their functions in relation to the performance requirements." The guidance in NUREG-1520, Revision 2, includes the acceptance criteria in Sections 7.4.3.1, "Fire Safety Management Measures" and 7.4.3.2, "Fire Hazard Analysis," which provide an acceptable approach for demonstrating compliance with the regulations.

**TRISO-X Response:**

A. The FHA (Att. 1, Item 92) is complete consistent with the stage of design at the time of application and will be available to the NRC during the licensing review through an online reference portal to support in-office reviews and hard copy during site visits. The Fire Protection Program (FPP) will be developed prior to an Operational Readiness Review (ORR).
B. The FHA (Att. 1, Item 92) describes the key parameters (e.g., process operations, room area size, material construction, etc.) and associated values used in the FHA. Section 4 of the FHA (Att. 1, Item 92) provides the likely locations for a fire to occur in the main process building (Nuclear Manufacturing Building).
C. As stated in the License Application Section 7.2.5, TRISO-X commits to develop pre-fire plans. Pre-fire plans will be completed at the detailed design phase, since they provide information regarding placement of fire extinguishers and location of fire alarms and hose stations which are not known at preliminary design. A pre-fire plan for the main process building will be developed prior to the ORR.

D. As noted in License Application Section 7.2.5, the pre-fire plan will include information needed by fire-fighting personnel responding to the emergency.

As noted in Item B and Section 5, Item b, in the letter, an ORR is expected to be conducted by the NRC to ensure that programs and equipment are in place in accordance with commitments in the License Application and associated safety evaluations before facility operations are authorized to begin. Note that TRISO-X cannot possess special nuclear material until the ORR is complete and approved by the staff.

The License Application, Section 7.3, states "An FHA has been developed as required by NFPA 801 (2014 edition)." The FHA provides the details and methods/level of compliance to applicable NFPA Codes and fire safety design requirements. NFPA 801 Sections B.1 and B.2 prescribe the contents of the FHA (Att. 1, Item 92) that includes the details requested above.

The FHA (Att. 1, Item 92) and Preliminary General Arrangement layout drawing (Att. 1, Item 23, which is the basis for ISA Summary Figure 2-1) are complete consistent with the stage of design at the time of application and will be available to the NRC during the licensing review through an online reference portal to support in-office reviews and hard copy during site visits.

**5.3 RSI – (Fire)**

**Supplemental Information Needed:**

The application needs to clearly specify the applicable passive engineering controls (PECs), active engineering controls (AECs), and administrative controls (ACs) under each of the fire hazard descriptions (types) listed in each of the tables located in Section 3 of ISA Summary (Enclosure 7).

**Description of Issue:**

Section 3 of ISA Summary (Enclosure 7) provides tables for fire hazard summary for all operations of the new TRISO-X fuel fabrication facility application (see Tables 3-1.4, 3-2.4, 3-3.4, 3-4.4, 3-5.4, 3-6.4, 3-7.4, 3-8.4, 3-9.4, 3-10.4, 3-12.4, 3-13.4, 3-13.8, 3-14.4, 3-16.1, 3-17.4 and 3-18.4). Each table contains information on fire hazard description (type), PECs, AECs, and ACs. It's not clear whether all PECs, AECs and ACs listed in a table are applied to all fire hazard types/descriptions or just some of the fire hazard types/descriptions listed in that table.

**Regulatory Basis:**

In accordance with 10 CFR 70.65(b)(3), the ISA Summary must include a description of each process analyzed in the ISA in sufficient detail to understand the theory of operation, and for each process, the hazards that were identified in the ISA, and a general description of the types of accident sequences. The guidance in NUREG-1520, Revision 2, includes the acceptance criteria in Sections 7.4.3.4, "Process Fire Safety," which provides an acceptable approach for demonstrating compliance with the regulations.

**TRISO-X Response:**

Section 3 of the ISA Summary is only intended to provide a general summary of hazards and the programmatic type of controls that may be available. The controls that are

elevated to IROFS to satisfy the performance criteria of 10 CFR 70.61 are identified in Sections 4 and 6 of the ISA Summary.

The ISA Summary, Section 4.2.2, Tables 4-1.1 thru 4-1.6 and Section 4.2.3, Tables 4-2.1 through 4-2.7 provide a summary description of each accident sequence that leads to intermediate and/or high consequences. These include a summary for events involving fire/explosions and resulting radiological and chemical exposure consequences. The FHA (Att. 1, Item 92) also provides additional details for fire protection requirements for events that do not lead to intermediate or high consequences.

As discussed in Section 4, Item c, in the letter, "for the ISA summary, a description of the facility, processes, and IROFS could be at the functional level." Further, in Section 5, Item d, in the letter, "A high level of detail describing the process designs and IROFS might not be submitted with the license application or ISA Summary. In other words, the applicant might not provide information about all the components in a system, because not every component would be a safety-related component. In particular, for proposed new facilities, the level of detail may be limited since the hardware has not actually been fabricated. …The NRC staff may obtain additional details for processes selected for the vertical slice review by visiting the applicant's site." ISA Risk Assessments present the accident sequence and basis for the IROFS applied to prevent or mitigate the event. ISA Summary Tables 6-1.1 through 6-1.24 list the IROFS and summarize the Safety Function / Limit and the related basis.

The supporting ISA Risk Assessment (Att. 1, Item 119) and FHA (Att. 1, Item 92) are complete consistent with the stage of design at the time of application and will be available to the NRC during the licensing review through an online reference portal to support in-office reviews and hard copy during site visits.

ISA Summary Table 4-3.24 will be modified to provide additional details to link the accident sequence to the consequence summaries provided in Sections 4.2.2 and 4.2.3 and to specify the applicable Radiological, Chemical, and/or Fire discipline for each accident sequence. An example of the revised Table 4-3.24 is provided in Enclosure 3, Attachment 1.

**5.4 RSI – (Fire)**

**Supplemental Information Needed:**

Specify editions of the NFPA Codes in the license application and the ISA Summary for the items listed below:

- NFPA 10, Standard for Portable Fire Extinguishers
- NFPA 13, Standard for the Installation of Sprinkler Systems
- NFPA 14, Standard for the Installation of Standpipe and Hose Systems
- NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances
- NFPA 70, National Electrical Code
- NFPA 72, National Fire Alarm and Signaling Code
- NFPA 80, Standard for Fire Doors and Other Opening Protectives
- NFPA 86, Standard for Ovens and Furnaces

- NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems
- NFPA 101, Life Safety Code
- NFPA 220, Standard on Types of Building Construction
- NFPA 400. Hazardous Materials Code
- NFPA 497, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
- NFPA 499, Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
- NFPA 780, Standard for the Installation of Lightning Protection Systems
- NFPA 801, Standard for Fire Protection for Facilities Handling Radioactive Materials
- NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems

**Description of Issue:**
The license application and ISA Summary need to specify the applicable edition on each of the NFPA codes which are cited in the ISA Summary (Enclosure 7) for compliance with the updated fire protection standards. The edition is often based on the year of construction.

**Regulatory Basis:**
In accordance with 10 CFR 70.22(8), “Contents of applications,” the application must provide sufficient description of proposed procedures used to protect health and minimize danger to life or property. Also, in accordance with 10 CFR 70.65(b)(2), the ISA Summary must provide a “general description of the facility with emphasis on those areas that could affect safety.” The guidance in NUREG-1520, Revision 2, includes the acceptance criteria in Section 7.4.3.2, “Fire Hazard Analysis,” which provides an acceptable approach for demonstrating compliance with the regulations.

**TRISO-X Response:**

The FHA includes the codes listed above along with the specified edition, based on the Code of Record of 2018 for start of the facility design. The License Application, Section 7.3, states “An FHA has been developed as required by NFPA 801 (2014 edition).” This document provides the details and methods/level of compliance to applicable NFPA Codes and fire safety design requirements. NFPA 801 Sections B.1 and B.2 prescribe the contents of the FHA (Att. 1, Item 92) that includes the details requested above.

The FHA (Att. 1, Item 92) and Preliminary General Arrangement layout drawing (Att. 1, Item 23, which is the basis for ISA Summary Figure 2-1) are complete consistent with the stage of design at the time of application and will be available to the NRC during the licensing review through an online reference portal to support in-office reviews and hard copy during site visits.

**5.5 Observation – (Fire)**

**Additional Information Needed:**

Please clearly identify in the ISA Summary Table 4-3.24 and Table 6-1.24 the safety disciplines applicable to each of the accident sequences (radiological, chemical and fire) or provide specific tables for each of the disciplines. This will provide the NRC staff with the applicant's identified issues so they will be able to perform the appropriate evaluations on each of radiological, chemical, and fire safety disciplines.

**Description of Issue:**

ISA Summary Table 4-3.24 and Table 6-1.24 present the Radiological, Chemical Safety, and Fire Risk Index Assignments and the IROFS for Radiological, Chemical, and Fire, respectively, without specifying Risk Index Assignments and IROFS that are applicable to fire safety.

**Regulatory Basis:**

In accordance with 10 CFR 70.65(b)(6), the ISA Summary must describe each IROFS in, "sufficient detail to understand their functions in relation to the performance requirements." The guidance in NUREG-1520, Revision 2, includes the acceptance criteria in Sections 7.4.3.4, "Process Fire Safety," which provides an acceptable approach for demonstrating compliance with the regulations.

**TRISO-X Response:**

The ISA Summary, Section 4.2.2, Tables 4-1.1 thru 4-1.6 and Section 4.2.3, Tables 4-2.1 through 4-2.7 provides a summary description of each accident sequence that leads to intermediate and/or high consequences. These include a summary for events involving fire/explosions and resulting radiological and chemical exposure consequences. Table 4-3.24 will be modified to provide additional details to link the accident sequence to the consequence summaries provided in Sections 4.2.2 and 4.2.3 and to specify the applicable Radiological, Chemical, and/or Fire discipline for each accident sequence. Table 6-1.24 will be modified to specify the applicable Radiological, Chemical, and/or Fire discipline for each IROFS. Examples of the revised Tables 4-3.24 and 6-1.24 are provided in Enclosure 3, Attachment 1.

# 6 STRUCTURAL DESIGN

## 6.6 RSI – (Structural)

**Supplemental Information Needed:**
Address the impact of the newly proposed Oak Ridge airport that will be located in close proximity of the TRISO-X Site.

**Description of Issue:**
Section 1.1.1.2 of the enclosure 7 of the application seeks to address the impact of local and regional airports to the facility and its design. The application considered the McGhee Tyson Airport, as the main airport, and other local airports that are operated in the Knoxville region. However, the newly proposed Oak Ridge airport that is planned to be built near the site, and it is not clear how this airport and flight patterns were considered or evaluated for the TRISO-X site. Information about the new airport can be found in the City of Oak Ridge website (http://www.oakridgetn.gov/content.aspx?article=5203)

**Regulatory Basis:**
This information is necessary to demonstrate the licensee's compliance with the performance requirements of 10 CFR 70.61, and the required criteria of 10 CFR 70.62(c)(1)(i)-(iii) for identifying potential accident consequences caused by credible external events.

**TRISO-X Response:**

Based on the information contained in the referenced link, the goal is to have air traffic at the proposed airport as early as 2025. Preliminary information for operations at the proposed Oak Ridge airport is available in DOE/EA-2000, issued February 2016 (ML22123A271). The impact of the proposed Oak Ridge airport on the TRISO-X site will be addressed prior to the airport becoming operational using the methodology in DOE-STD-3014-2006, Accident Analysis for Aircraft Crash into Hazardous Facilities, or another industry accepted method. Once complete, the evaluation of the proposed Oak Ridge airport will be included as part of the LA and/or ISA Summary change process.

# 7 GEOTECHNICAL INFORMATION

## 7.1 RSI – (Geotechnical)

**Supplemental Information Needed:**
Describe the site topography and variation of surface elevation within the proposed site to show that a potential for slope stability problem does not exists.

**Description of Issue:**
The proposed TRISO-X site is located within the Valley and Ridge Province, as stated in LA Section 1.1.1.4, Geology and ISA Summary Section 1.5.1, Geology. The physiography consists of a series of northwest-southwest trending synclines and anticlines. The license application needs to describe the topography of the proposed site. LA Section 1.1.1.4, Geology, states that several shallow draws and depressions exist at the proposed site. If the surface elevation across the proposed site varies significantly, there may be a potential for slope stability problems.

**Regulatory Basis:**
This information is necessary to satisfy 10 CFR 70.22 and 70.65(b)(1).

**TRISO-X Response:**

The terrain within the Horizon Center Site (HCS) boundaries is typical of the Oak Ridge region and generally contains mild rolling hills with ridges and valleys. The existing site surface elevations vary from approximately Elevation 780 feet to Elevation 825 feet in most parts of the HCS, except at the north corner where the existing surface elevation rises to approximately 850 feet. More detailed topography descriptions are included in Section 3.3 of the Environmental Report (ER).

The site development for the project will include extensive site grading with cut and fill. Qualified engineered fill will be used for placement and compaction. The final site grade will be relatively level across the site with most boundaries matching the existing surrounding topography. The only significant slope for the site is on the north side of the facility, separated from the primary facility structures and equipment by a perimeter access road. This slope will be designed with a grade of approximately 3:1 (Horizontal:Vertical) after excavation. The design will be verified by a slope stability calculation and designed using standard geotechnical engineering practice. The toe of the north slope is expected to be at least 150 feet to 200 feet from the edge of the process building (PB).

The License Application and ISA Summary will be updated to include additional discussions on site topography slope stability analysis.

## 7.2 RSI – (Geotechnical)

**Supplemental Information Needed:**
Demonstrate that the potential for a liquefaction of the soil layer(s) at the proposed site using the information from the site-specific geotechnical investigation conducted would not be significant.

**Description of Issue:**
The license application needs to provide information regarding engineering properties of the soil layer(s) at the proposed site to assess the liquefaction potential. LA Section 1.1.1.3, Hydrology, states that the groundwater table, as observed in four observation borings at the proposed site, is approximately 10 to 57 ft below the top of well casing. As stated in LA Section 1.1.1.4, Geology, the bedrock, comprised of dolomite and limestone, is overlain by soil layer(s) having thickness varying from 3.6 ft to 50 ft. Consequently, potential may exist that the soil layer(s) at the proposed site may liquefy under seismic loads.

**Regulatory Basis:**
This information is necessary to satisfy 10 CFR 70.22, 70.64(a)(2), and 70.65(a)(1).

**TRISO-X Response:**

From the site-specific geotechnical investigations performed in 2013 by S&ME, Inc. and 2021 to 2022 by Wood Environment & Infrastructure Solutions, Inc. (Att. 1, Item 120), the overall subsurface profile consists of clay soils underlain by weathered limestone and dolomite to more competent bedrock at greater depths. The clay overburden is classified as CH or CL per USCS (unified soil classification system) and is considered to have negligible potential of liquefaction. The in-situ medium stiff to very stiff or hard clays are not susceptible to strength degradation during seismic events.

The License Application and ISA Summary will be updated to include this RSI response detail regarding soil liquefaction.

**7.3 RSI – (Geotechnical)**
**Supplemental Information Needed:**
Demonstrate that potential differential settlement of the foundation of the proposed facility would not affect the safe operation of the proposed facility.

**Description of Issue:**
Section 1.1.1.4, Geology, and ISA Summary Section 1.5.1, Geology, state that the thickness of the soil layer(s) above the bedrock, measured during the geotechnical drilling program conducted to support the facility design, varies from a minimum 3.6 ft to a maximum 50 ft. The license application should identify the locations within the site where these measurements have been observed. These measurements show that the proposed facility can experience significant differential settlement from both the immediate settlement and the long-term consolidation settlement because of significant difference in soil thickness.

**Regulatory Basis:**
This information is necessary to satisfy the requirements of 10 CFR 70.64(a)(2) and 70.65(a)(1).

**TRISO-X Response:**

Based on the drilling logs from the construction of groundwater monitoring wells (GW-1 to GW-6), the overburden soil thickness varies from 7 feet to 50 feet. The soil thickness

of 50 feet was encountered at GW-1 with the surface elevation at 841.55 feet, which was located on the hill at the north corner of the property boundary. However, the groundwater monitoring wells are located away from the main facilities near the property boundaries. Detailed information about groundwater monitoring wells can be found in Section 3.4.1.2 of the ER.

Based on the soil boring logs from the recent geotechnical investigations performed by Wood Environment & Infrastructure Solutions, Inc. within the footprint of the HCS, the overburden consists of residual clay soils encountered at depths ranging from 3.6 feet to 31.5 feet below the existing ground surface at boring locations. From the earlier 2013 geotechnical investigations by S&ME, Inc., the soil overburden became deeper at locations closer to the north and northwest boundaries on the hill side.

After site grading cut and fill to establish the final grade, the overburden soil thickness below the final grade is expected to vary generally from less than 5 feet to approximately 25 feet within the footprint of the process building (PB). The majority of the PB area, a low-lying area in the middle of the site, will receive fill. Potential settlement in this area will be mitigated with the following measures. The entire PB is proposed to rest on a large mat foundation to reduce the potential for differential settlement. Furthermore, a geotechnical ground improvement approach using an intermediate foundation system is to be proposed to further minimize the potential for differential settlement from the underlying clay soils. This intermediate foundation type is called a rigid inclusion (RI) system, which primarily consists of cement grout columns being installed down to the top of bedrock across the entire PB area in a grid pattern. The RI elements are similar to a pile foundation, without steel reinforcement. Typically, between the foundation mat and the top of the RI elements there is a layer of compacted granular soil called the load transfer platform (LTP). The LTP, RI elements, and the in-situ soils act as a composite matrix system with overall improved engineering properties to mitigate differential settlements.

The large mat foundation supported by the RI matrix system will minimize the potential long-term differential settlement of the PB and ensure the safe operation of the proposed facility.

The License Application and ISA Summary will be updated to include this RSI response detail regarding differential settlement.

**7.4 RSI – (Geotechnical)**

**Supplemental Information Needed:**

Demonstrate that the subsurface material(s) below the foundation has enough bearing capacity to avoid failure after construction of the proposed facility.

**Description of Issue:**

The license application should provide information to show that the subsurface material(s) below the facility foundation have enough capacity to sustain the additional loads imposed from construction of the proposed facility. In addition, as the thickness of soil layer(s) varies significantly within the proposed site, the presence of two materials with vastly different stiffness properties below the foundation may be a possibility resulting in spatially varying bearing capacity.

**Regulatory Basis:**
This information is necessary to satisfy the requirements of 10 CFR 70.64(a)(2) and 70.65(a)(1).

**TRISO-X Response:**

The subsurface medium stiff to very stiff clay soils discovered by the site-specific geotechnical investigations exhibit adequate bearing capacity for the PB with standard factor of safety against general soil failure based on the preliminary analysis. The primary design concern was the potential for differential settlement produced by the underlying clay soils. As discussed in the response to RSI 7.3, the large mat foundation supported by the RI matrix system will minimize the potential for long-term differential settlement of the PB and ensure the safe operation of the proposed facility. With the use of the RI matrix system, the overall foundation bearing capacity will be improved as well. Detailed information about geology and soils can be found in Section 3.3 of the ER.

The License Application and ISA Summary will be updated to include this RSI Response detail on bearing capacity.

**7.5 RSI – (Geotechnical)**
**Supplemental Information Needed:**
Discuss the karst features observed in the dolomite and limestone bedrock during the geotechnical drilling program to support facility design with respect to the footprint of proposed facility, as illustrated in LA Figure 1-2, Site Plan.

**Description of Issue:**
As stated in LA Section 1.1.1.4, Geology, the carbonate rocks at and surrounding the proposed site “are subject to dissolution that may produce a range of features that include solution, collapse, cover-collapse sinkholes and caves. Based on the topography of the site, several shallow draws and depressions exist which may reveal karst features beneath the surface. Voids within the dolomite and limestone bedrock were encountered on the site during the geotechnical drilling program to support facility design.” The current submittal needs a discussion on how the observed karst features within the proposed site have been accounted for in determining the bearing capacity and settlement of the proposed facility and liquefaction at the proposed site.

**Regulatory Basis:**
This information is necessary to satisfy the requirements of 10 CFR 70.64(a)(2) and 70.65(a)(1).

**TRISO-X Response:**

In early 2022, a subsurface investigation was performed to support the facility design, which involved 22 geotechnical soil borings and a surface geophysical investigation. There were 6 borings located within the PB footprint with total boring depths ranging from 30 feet to 100 feet below ground surface (b.g.s.) and rock core total lengths ranging from 22 feet to 100 feet. Voids were encountered during rock coring in most borings within the PB footprint with the vertical dimensions from as thin as 0.2 feet to approximately 2.6 feet. The 2.6 feet opening was at 82 feet deep b.g.s. at one corner of

the PB, while the majority of voids were filled with stiff clay and encountered within the upper 25 feet b.g.s.

The surface geophysical investigation performed shear wave seismic refraction tomography (SWSRT) and electrical resistivity tomography (ERT) to map the subsurface bedrock conditions, including possible major void (empty or soil-filled) anomalies that may be associated with karst features. The tomography survey lines were over 700 feet long each and spaced at 50 feet to cover the entire PB area. The geophysical findings indicated the same general subsurface profiles as discovered by soil borings, which contained shallow residual stiff overburden underlain by weathered bedrock with higher weathering at upper rock formation and very hard competent rock at greater depths. The geophysical report also identified some anomalies where the ERT results showed high resistivity at deep zones compared to the surrounding rock data, although the shear wave velocity at those deep zones did not show abnormal results.

Further soil boring investigations were performed in June 2022 to focus on the anomaly locations identified in the geophysical work and included 6 borings in the PB footprint. Rock coring of 60 feet to 80 feet were performed to reach those anomaly zones as identified by geophysical investigation and 20 feet to 30 feet beyond (deeper) the anomaly locations. These additional rock coring samples did not find any significant voids at those anomalies. The geotechnical report of this additional investigation was finalized and issued on September 9, 2022. Detailed information about geology and soils can be found in Section 3.3, and karst is discussed in 3.3.2, of the ER that will be submitted to the NRC.

The License Application and ISA Summary will be updated to include this RSI response detail on Karst features and potential engineering solutions to minimize the effects.

**7.6 RSI – (Geotechnical)**

Provide information on engineering characteristics of the soil layer(s) and rock layers (e.g., dolomite and limestone) taken as bedrock. In addition, provide a geological cross-section of the site, developed based on the site geotechnical investigation. The plot should identify all the soil and rock layers encountered at the site. Additionally, the plot should also show the location of the proposed facility with respect to these geological units.

**Description of Issue:**

As stated in LA Section 1.1.1.4, Geology, and ISA Summary Section 1.5.1, Geology, the thickness of the soil layer(s) above the rock layers varies from 3.6 ft to 50 ft; however, it is not clear the locations within the proposed site where these measurements have been taken with respect to the footprint of the proposed facility. In addition, the application should include information on the engineering characteristics of the soil and rock layers presented.

**Regulatory Basis:**

This information is necessary to satisfy 10 CFR 70.22, 70.64(a)(2), and 70.65(a)(1).

**TRISO-X Response:**

The soil layer over bedrock generally consists of medium stiff to very stiff CH and CL clay at depths ranging from 3.6 feet to 18 feet below the existing ground surface within the PB footprint. At a boring location to the south of the PB, the clay was encountered to a depth of 27 feet b.g.s. Based on the 12 geotechnical borings performed in the PB/AB area, the limestone and dolomite bedrock exhibit higher weathering at shallower depth (generally upper 10 feet to 20 feet) and became more competent at greater depths. The rock core recovery ranges from approximately 24% to 100% while Rock Quality Designation (RQD) ranges from 0 to 100%. The lower recovery and RQD were mostly within the upper rock layers. The unconfined compressive strength values of intact rock cores range from 4,500 psi to 19,500 psi, which indicates hard to very hard strength.

The cross sections of subsurface soil/rock profiles are provided in Attachment 2.

The License Application and ISA Summary will be updated to include this RSI response detail on Site Cross-Sections (includes the plots).

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**
**Attachment 1**
List of Documents

| Item Number | Document Categories / Names | Document Number |
|---|---|---|
| | **Procedures** | |
| 1 | Integrated Safety Analysis - Process Hazards Analysis (TX-HS-ISA-001) | XE-iFOA-PRO-0012 |
| 2 | Integrated Safety Analysis - Accident Consequence Evaluation (TX-HS-ISA-002) | XE-iFOA-PRO-0016 |
| 3 | Integrated Safety Analysis - Risk Assessment (TX-HS-ISA-003) | XE-iFOA-PRO-0043 |
| 4 | Nuclear Criticality Safety Program | PLD1-NS-002 |
| 5 | Nuclear Criticality Safety Calculations | PLD3-NS-001 |
| 6 | Preliminary Nuclear Criticality Safety Evaluations | PLD3-NS-002 |
| 7 | Nuclear Criticality Safety Evaluation Development for the TRISO-X Facility | PLD3-NS-003 |
| | | |
| | **Process Hazard Analysis Reports** | |
| 8 | Process Hazard Analysis: Preliminary Design Overcoating | XE-iFOA-RPT-0024 |
| 9 | Process Hazard Analysis: Preliminary Design Conversion | XE-iFOA-RPT-0026 |
| 10 | Process Hazard Analysis: Preliminary Design Dissolution | XE-iFOA-RPT-0027 |
| 11 | Process Hazard Analysis: Preliminary Design Pebbles (Part 1) | XE-iFOA-RPT-0028 |
| 12 | Process Hazard Analysis: Preliminary Design Coating | XE-iFOA-RPT-0029 |
| 13 | Process Hazard Analysis: Preliminary Design Quality Lab and Buffer Storage (Part 1) | XE-iFOA-RPT-0030 |
| 14 | Process Hazard Analysis: Preliminary Design Cylindrical Compacts (Part 1) | XE-iFOA-RPT-0031 |
| 15 | Process Hazard Analysis: Preliminary Design Pebbles and Compacts (Part 2) | XE-iFOA-RPT-0032 |
| 16 | Process Hazard Analysis: Preliminary Design Buffer Storage (Part 2) | XE-iFOA-RPT-0034 |
| 17 | Process Hazard Analysis: Preliminary Design Recovery | XE-iFOA-RPT-0035 |
| 18 | Process Hazard Analysis: Preliminary Design Waste Operations | XE-iFOA-RPT-0038 |
| 19 | Process Hazard Analysis: Preliminary Design SNM Receipt/Storage/Package/Ship | XE-iFOA-RPT-0039 |
| 20 | Process Hazard Analysis: Preliminary Design Sol-Gel | XE-iFOA-RPT-0045 |
| 21 | Process Hazard Analysis: Preliminary Design Facility and Utilities | XE-iFOA-RPT-0083 |
| | | |

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**
**Attachment 1**
List of Documents

| Item Number | Document Categories / Names | Document Number |
|---|---|---|
| | **Facility and Site Information** | |
| 22 | TRISO-X Fuel Fabrication Facility Design Criteria Manual | Report SL-015874 |
| 23 | Fuel Fabrication Layout Preliminary General Arrangement Process Level El. 811'-0" | SKM-0010 |
| 24 | Overall Site Plan | C-0003 |
| 25 | Natural Phenomena Highly Unlikely Basis | XE-iFOA-RPT-0081 |
| | | |
| | **Nuclear Criticality Safety Code Validation / Supplemental Reports** | |
| 26 | Technical Basis for Design Basis Criticality Accident Yield | TER-00668 |
| 27 | TRISO-X Fuel Fabrication MCNP6 Radiation Transport Documentation | TER-00677 |
| 28 | Validation of SCALE-6.2.3 with the 252-Group END/B-VII.1 Cross Section Library for Uranium Systems with Enrichments up to 100 wt.% $^{235}U$ | TER-00678 |
| 29 | Validation of MCNP6.2 for Shielding Applications Associated with Criticality Accidents in Uranium Systems | TER-00679 |
| 30 | Self-Shielding Treatment of Doubly Heterogeneous TRISO Particles in TRISO-X | TER-00719 |
| 31 | Off-Site Radiological Dose Due to Criticality Event at the TRISO-X Fuel Fabrication Facility | TER-00752 |
| | | |
| | **Nuclear Criticality Safety Evaluations** | |
| 32 | Nuclear Criticality Safety Evaluation for the Receipt, Handling, and Storage of Source Material | NCSE-TRISO-001 |
| 33 | Nuclear Criticality Safety Evaluation for ADUN Preparation and Storage | NCSE-TRISO-003 |
| 34 | Nuclear Criticality Safety Evaluation for Gel-Sphere Production | NCSE-TRISO-004 |
| 35 | Nuclear Criticality Safety Evaluation for Kernel Conversion Furnace | NCSE-TRISO-005 |
| 36 | Nuclear Criticality Safety Evaluation for the TRISO Furnace | NCSE-TRISO-006 |
| 37 | Nuclear Criticality Safety Evaluation for the TRISO Off-Gas Scrubber | NCSE-TRISO-007 |
| 38 | Nuclear Criticality Safety Evaluation for Overcoating Operations | NCSE-TRISO-008 |

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**
**Attachment 1**
List of Documents

| Item Number | Document Categories / Names | Document Number |
|---|---|---|
| 39 | Nuclear Criticality Safety Evaluation for Pebble Pressing | NCSE-TRISO-010 |
| 40 | Nuclear Criticality Safety Evaluation for Pebble Shaping Operations | NCSE-TRISO-012 |
| 41 | Nuclear Criticality Safety Evaluation for the Buffer Area Operations - Particles | NCSE-TRISO-014 |
| 42 | Nuclear Criticality Safety Evaluation for the High Uranium Density (HUD) Container, Transport Cart, and Storage Rack | NCSE-TRISO-016 |
| 43 | Nuclear Criticality Safety Evaluation for the Low Uranium Density (LUD) Container, Transport Cart, and Storage Rack | NCSE-TRISO-017 |
| 44 | Nuclear Criticality Safety Evaluation for Handling, Inspection, and Storage of Pebbles | NCSE-TRISO-018 |
| 45 | Nuclear Criticality Safety Evaluation for the Quality Control Laboratory | NCSE-TRISO-019 |
| 46 | Nuclear Criticality Safety Evaluation for Dry Recovery | NCSE-TRISO-020 |
| 47 | Nuclear Criticality Safety Evaluation for Container Handling | NCSE-TRISO-021 |
| 48 | Nuclear Criticality Safety Evaluation for the Ventilation System, Including HEPA Filtration | NCSE-TRISO-022 |
| 49 | Nuclear Criticality Safety Evaluation for Shipping Container Loading and Storage | NCSE-TRISO-023 |
| 50 | Nuclear Criticality Safety Evaluation for Solid Waste Handling | NCSE-TRISO-024 |
| 51 | Nuclear Criticality Safety Evaluation for the Utilities | NCSE-TRISO-026 |
| 52 | Nuclear Criticality Safety Evaluation for Inadvertent Containers and Floor Accumulations | NCSE-TRISO-027 |
| 53 | Nuclear Criticality Safety Evaluation for Maintenance Activities | NCSE-TRISO-029 |
| 54 | Nuclear Criticality Safety Evaluation for Compact Pressing | NCSE-TRISO-030 |
| 55 | Nuclear Criticality Safety Evaluation for the High Temperature and Carbonization Furnace | NCSE-TRISO-031 |
| 56 | Nuclear Criticality Safety Evaluation for Handling, Inspection, and Storage of Compacts | NCSE-TRISO-033 |
| 57 | Nuclear Criticality Safety Evaluation for Liquid Recovery and Waste | NCSE-TRISO-034 |
| 58 | Nuclear Criticality Safety Evaluation for the Recovery Oxidation Furnaces | NCSE-TRISO-035 |
| 59 | Nuclear Criticality Safety Evaluation for Solvent Recovery | NCSE-TRISO-036 |
| | | |

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**
**Attachment 1**
List of Documents

| Item Number | Document Categories / Names | Document Number |
|---|---|---|
| | **Nuclear Criticality Safety Calculations** | |
| 60 | Nuclear Criticality Safety Calculation - Parametric Study of the TRISO-X Fuel Fabrication Facility Liquid System Column | NCSC-0001 |
| 61 | Nuclear Criticality Safety Calculation - Parameter Study for the TRISO Particle Furnace | NCSC-0002 |
| 62 | Nuclear Criticality Safety Calculation - Parametric Study of Uranium Compounds in a Spherical Geometry | NCSC-0003 |
| 63 | Nuclear Criticality Safety Calculation - Solution System | NCSC-0004 |
| 64 | Nuclear Criticality Safety Calculation for the TRISO Furnace | NCSC-0005 |
| 65 | Nuclear Criticality Safety Calculation for the TRISO Off-Gas Scrubber | NCSC-0006 |
| 66 | Nuclear Criticality Safety Calculation for the HUD Container, Transport Cart, and Storage Rack | NCSC-0007 |
| 67 | Nuclear Criticality Safety Calculation for the Pebble Furnace | NCSC-0008 |
| 68 | Nuclear Criticality Safety Calculation - LUD Container, Transport Cart, and Storage Rack | NCSC-0009 |
| 69 | Nuclear Criticality Safety Calculation for Pebble Storage and Handling | NCSC-0010 |
| 70 | Nuclear Criticality Safety Calculation for ADUN Preparation and Storage | NCSC-0011 |
| 71 | Nuclear Criticality Safety Calculation - Kernel Conversion Furnace | NCSC-0012 |
| 72 | Nuclear Criticality Safety Calculation - Overcoating Operations | NCSC-0013 |
| 73 | Nuclear Criticality Safety Calculation - Heat Treatment and Carbonization Furnace | NCSC-0014 |
| 74 | Nuclear Criticality Safety Calculations for the Buffer Areas | NCSC-0015 |
| 75 | Nuclear Criticality Safety Calculation for Handling, Inspection, and Storage of Compacts | NCSC-0016 |
| 76 | Nuclear Criticality Safety Calculation - Gelation, Washing, Rinse, and Drying | NCSC-0017 |
| 77 | Nuclear Criticality Safety Calculation for Material Recovery Operations | NCSC-0018 |
| 78 | Nuclear Criticality Safety Calculation for the 20 wt.% Enriched HUD Container, Transport Cart, and Storage Rack | NCSC-0023 |

| Item Number | Document Categories / Names | Document Number |
|---|---|---|
| 79 | Nuclear Criticality Safety Calculation for the 20 wt.% Enriched LUD Container, Transport Cart, and Storage Rack | NCSC-0024 |
| 80 | Nuclear Criticality Safety Calculation for the TRISO Furnace | NCSC-0025 |
| 81 | Nuclear Criticality Safety Calculation for HTCF Under $H_2O$/Air In-Leakage Events and Off Centered Fuel Cores | NCSC-0026 |
| 82 | Nuclear Criticality Safety Calculation for Waste Handling Operations | NCSC-0027 |
| 83 | Nuclear Criticality Safety Calculation for the TRISO Off-Gas Scrubber Train | NCSC-0028 |
| 84 | Nuclear Criticality Safety Calculation for the Process Ventilation System | NCSC-0029 |
| 85 | Nuclear Criticality Safety Calculation - Supplemental Kernel Conversion Furnace Calculations and Additional Single Parameter Limit Calculations | NCSC-0030 |
| 86 | Nuclear Criticality Safety Calculation for Inadvertent Containers | NCSC-0033 |
| 87 | Nuclear Criticality Safety Calculation for Alternate Gel-Sphere Wash/Rinse Solutions | NCSC-0035 |
| | | |
| | **Radiological / Chemical Accident Consequence Evaluations** | |
| 88 | Radiological Accident Consequence Evaluation Methodology | XE-iFOA-RPT-0019 |
| 89 | Chemical Accident Consequence Evaluation Methodology | XE-iFOA-RPT-0020 |
| 90 | Radiological Accident Consequence Evaluation | XE-iFOA-RPT-0085 |
| 91 | Chemical Accident Consequence Evaluation | XE-iFOA-RPT-0087 |
| | | |
| | **Fire Hazards Reports** | |
| 92 | Fire Hazards Analysis for Preliminary Design | XE-iFOA-RPT-0084 |
| 93 | TRISO-X Fire Modeling Analysis: Zones of Influence | 3J002-RPT-01 |
| 94 | TRISO-X Fire Area Analysis Report | 3J002-RPT-02 |
| 95 | Dust Hazard Analysis | 4H2007610.000-DHA-R0 |
| | | |

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**
**Attachment 1**
List of Documents

| Item Number | Document Categories / Names | Document Number |
|---|---|---|
| | **Risk Assessment Reports** | |
| 96 | Nuclear Criticality Safety Risk Assessment for the Receipt, Handling, and Storage of Source Material (NCSE-TRISO-001) | XE-iFOA-RPT-0055 |
| 97 | Nuclear Criticality Safety Risk Assessment for ADUN Preparation and Storage (NCSE-TRISO-003) | XE-iFOA-RPT-0056 |
| 98 | Nuclear Criticality Safety Risk Assessment for Gel-Sphere Production (NCSE-TRISO-004) | XE-iFOA-RPT-0057 |
| 99 | Nuclear Criticality Safety Risk Assessment for Conversion (NCSE-TRISO-005) | XE-iFOA-RPT-0058 |
| 100 | Nuclear Criticality Safety Risk Assessment for the TRISO Furnace (NCSE-TRISO-006) | XE-iFOA-RPT-0059 |
| 101 | Nuclear Criticality Safety Risk Assessment for the TRISO Scrubber (NCSE-TRISO-007) | XE-iFOA-RPT-0060 |
| 102 | Nuclear Criticality Safety Risk Assessment for Overcoating Operations (NCSE-TRISO-008) | XE-iFOA-RPT-0061 |
| 103 | Nuclear Criticality Safety Risk Assessment for Pebbles Part 1 (NCSE-TRISO-010 AND -012) | XE-iFOA-RPT-0062 |
| 104 | Nuclear Criticality Safety Risk Assessment for Buffer Area (NCSE-TRISO-014) | XE-iFOA-RPT-0063 |
| 105 | Nuclear Criticality Safety Risk Assessment for HUDs and LUDs (NCSE-TRISO-016 AND -017) | XE-iFOA-RPT-0064 |
| 106 | Nuclear Criticality Safety Risk Assessment for Handling, Inspection, and Storage of Pebbles (NCSE-TRISO-018) | XE-iFOA-RPT-0065 |
| 107 | Nuclear Criticality Safety Risk Assessment for the Quality Control Laboratory (NCSE-TRISO-019) | XE-iFOA-RPT-0066 |
| 108 | Nuclear Criticality Safety Risk Assessment for Recovery | XE-iFOA-RPT-0067 |
| 109 | Nuclear Criticality Safety Risk Assessment for Container Handling (NCSE-TRISO-021) | XE-iFOA-RPT-0068 |
| 110 | Nuclear Criticality Safety Risk Assessment for Ventilation (NCSE-TRISO-022) | XE-iFOA-RPT-0069 |
| 111 | Nuclear Criticality Safety Risk Assessment for Shipping Container Loading / Storage (NCSE-TRISO-023) | XE-iFOA-RPT-0070 |
| 112 | Nuclear Criticality Safety Risk Assessment for Solid and Liquid Waste Handling | XE-iFOA-RPT-0071 |
| 113 | Nuclear Criticality Safety Risk Assessment for Utilities (NCSE-TRISO-026) | XE-iFOA-RPT-0072 |

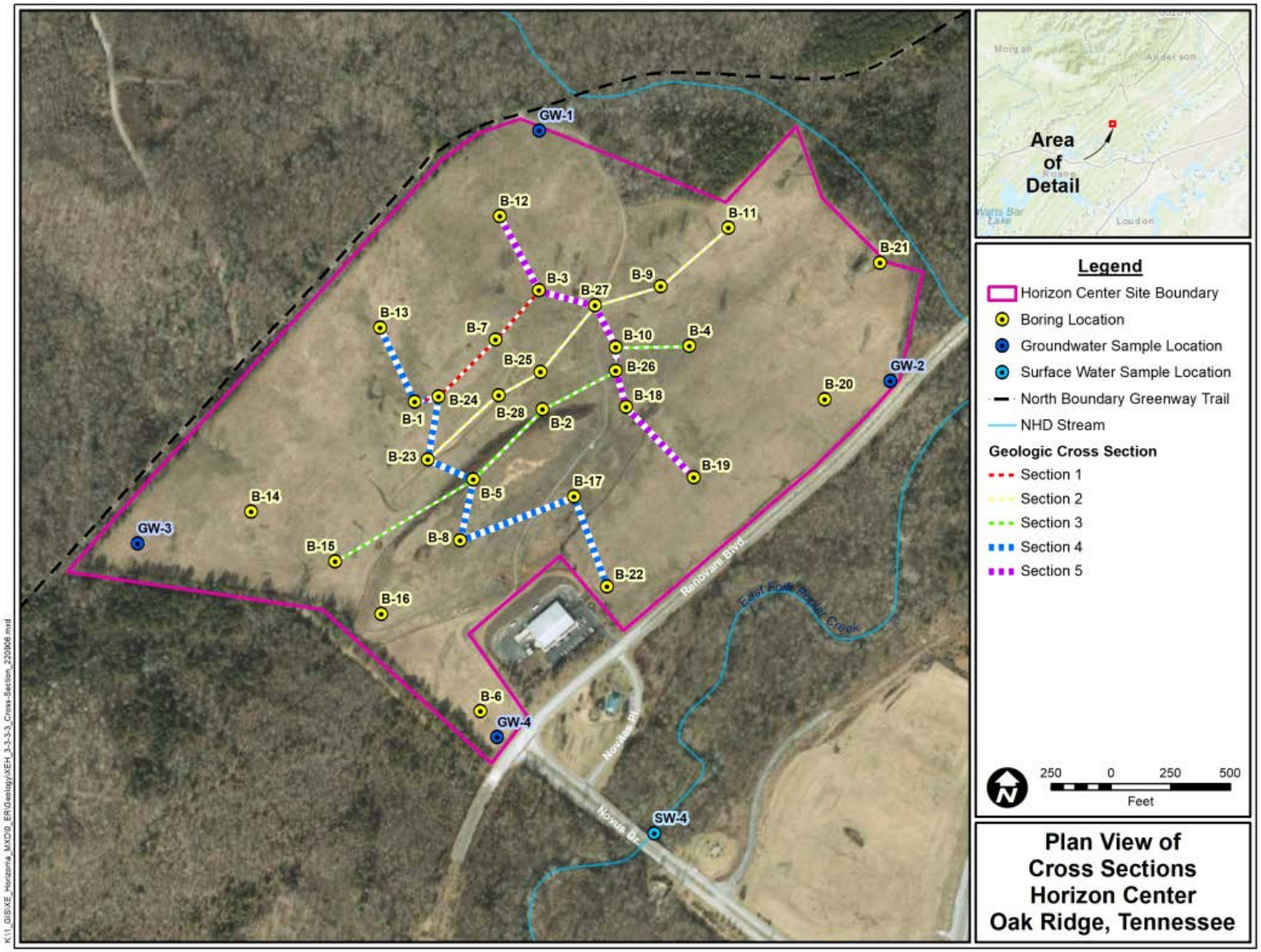
**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**
**Attachment 1**
List of Documents

| Item Number | Document Categories / Names | Document Number |
|---|---|---|
| 114 | Nuclear Criticality Safety Risk Assessment for Inadvertent Containers and Floor Accumulations (NCSE-TRISO-027) | XE-iFOA-RPT-0073 |
| 115 | Nuclear Criticality Safety Risk Assessment for Maintenance Activities (NCSE-TRISO-029) | XE-iFOA-RPT-0074 |
| 116 | Nuclear Criticality Safety Risk Assessment for Compact Pressing (NCSE-TRISO-030) | XE-iFOA-RPT-0075 |
| 117 | Nuclear Criticality Safety Risk Assessment for High Temperature and Carbonization Furnace (NCSE-TRISO-031) | XE-iFOA-RPT-0076 |
| 118 | Nuclear Criticality Safety Risk Assessment for Handling, Inspection, and Storage of Compacts (NCSE-TRISO-033) | XE-iFOA-RPT-0077 |
| 119 | Radiological and Chemical Risk Assessment | XE-iFOA-RPT-0078 |
| | | |
| | **Geotechnical References** | |
| 120 | Site-specific geotechnical investigations performed in 2013 by S&ME, Inc and 2021 to 2022 by Wood Environment & Infrastructure Solutions, Inc | |

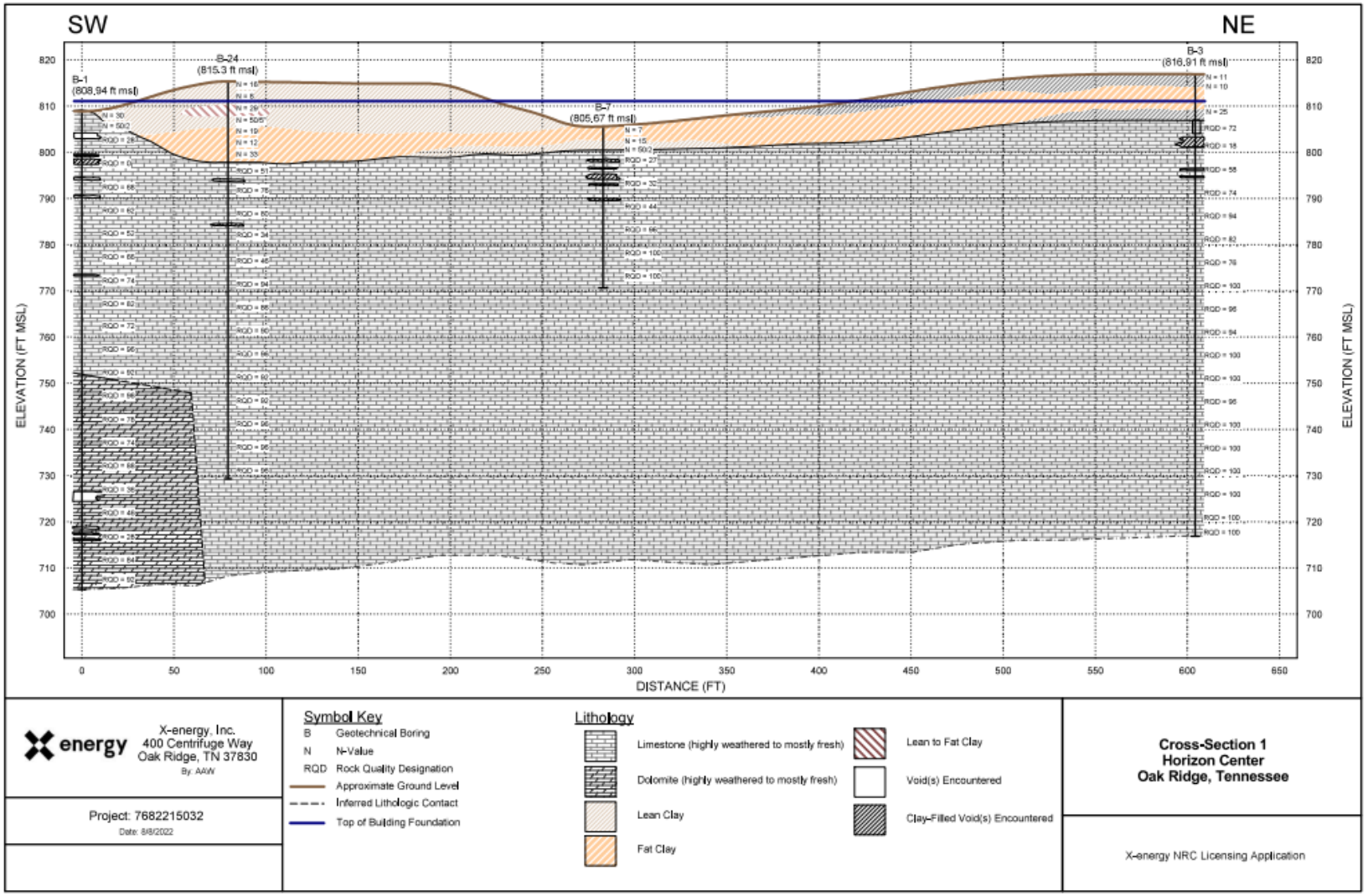
**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**

**Attachment 2**

Geological Cross Sections Based on Soil Borings



**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**
**Attachment 2**
Geological Cross Sections Based on Soil Borings

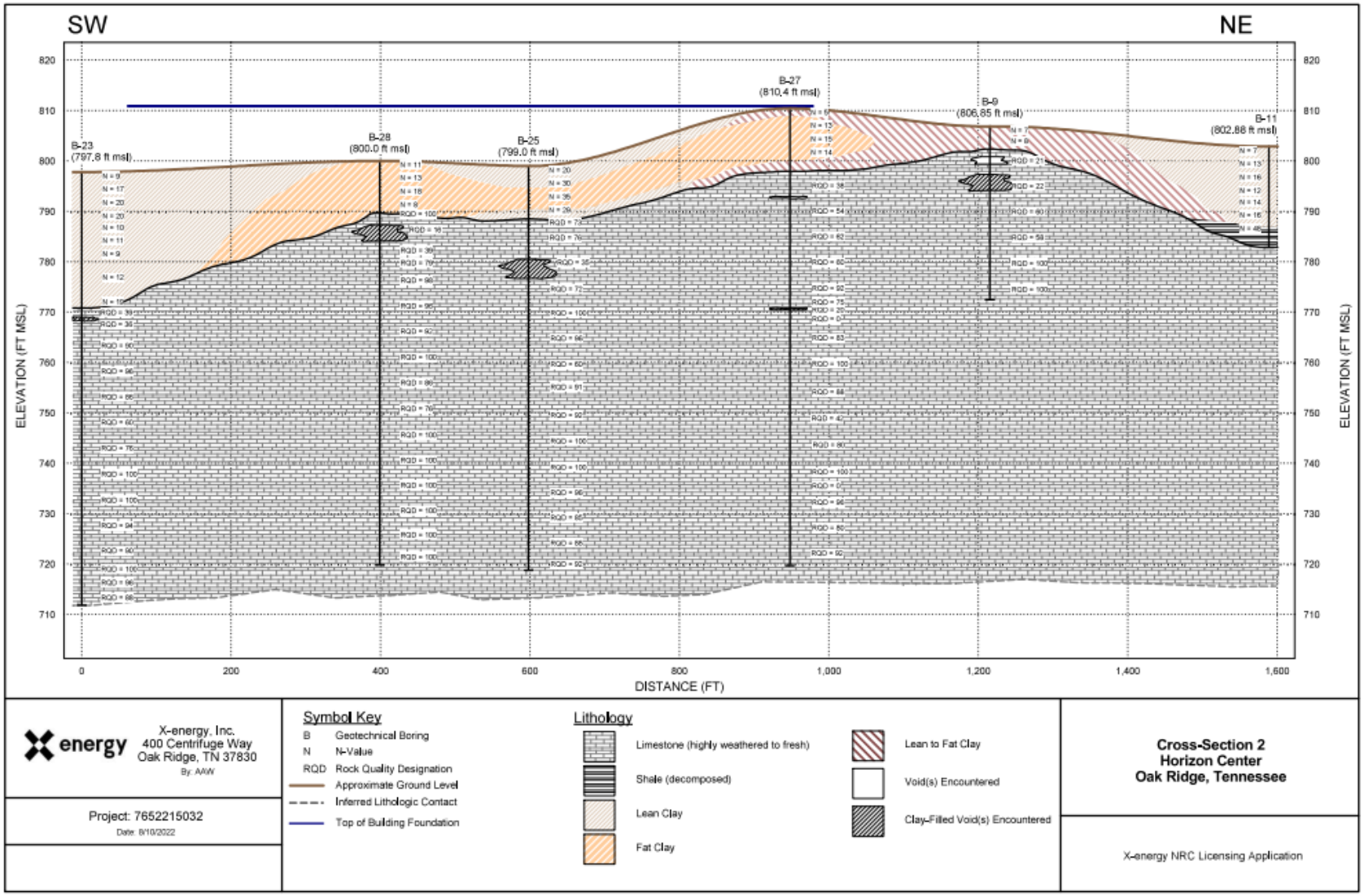



Note: Orientation (angle) of inferred lithologic contact(s) between bedrock (e.g., dolomite and limestone) represents approximate apparent dip (angle, 19 degrees E) calculated from dip observed during drilling operations and adjusted based on actual alignment of cross-section illustrated on the 20:50 vertical-to-horizontal exaggerated-profile scale. N-value and rock quality designation displayed approximately at the mid-point of the run.

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**

**Attachment 2**

Geological Cross Sections Based on Soil Borings

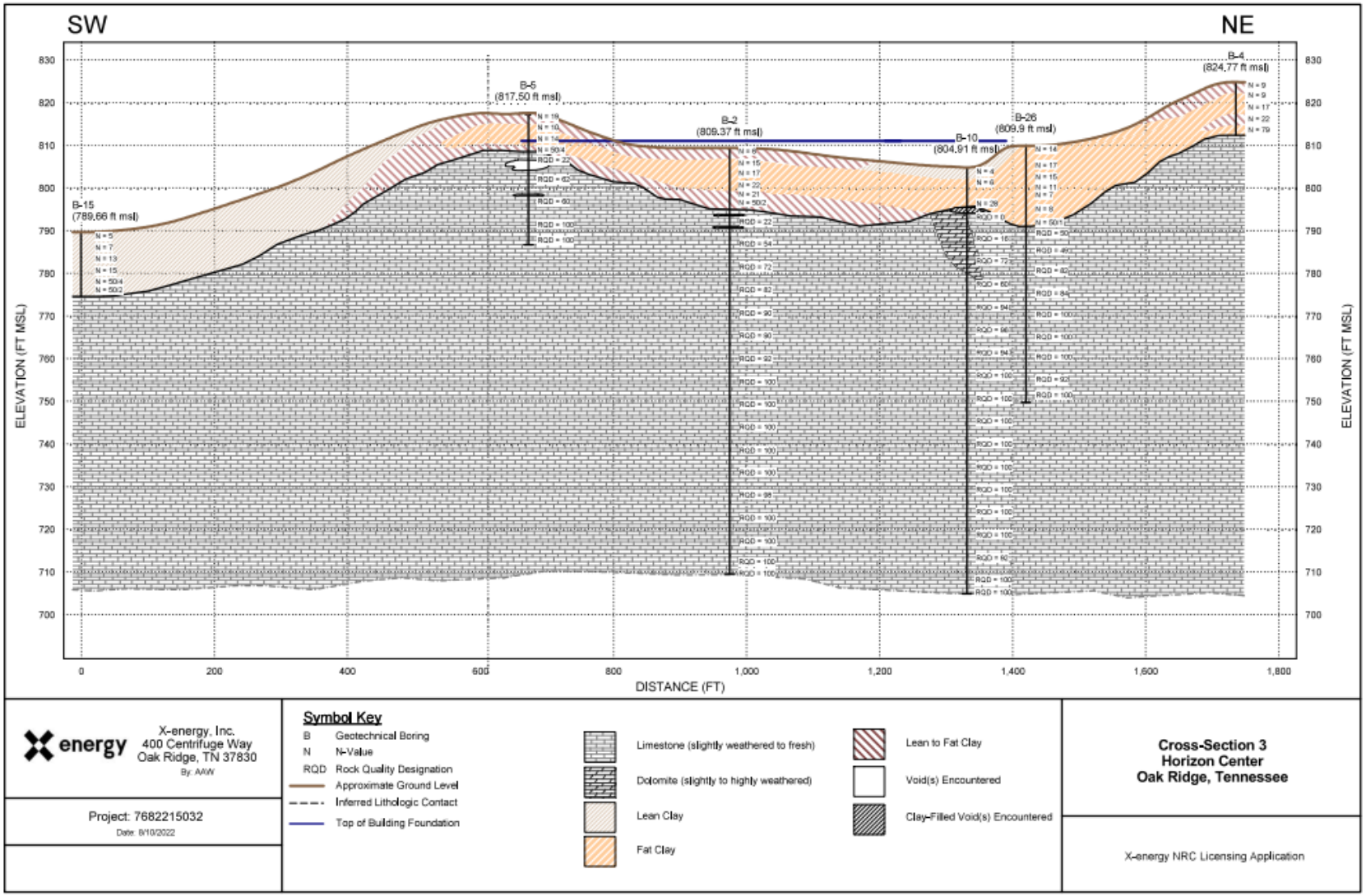



Note: N-value and rock quality designation displayed approximately at the mid-point of the run.

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**

**Attachment 2**

Geological Cross Sections Based on Soil Borings

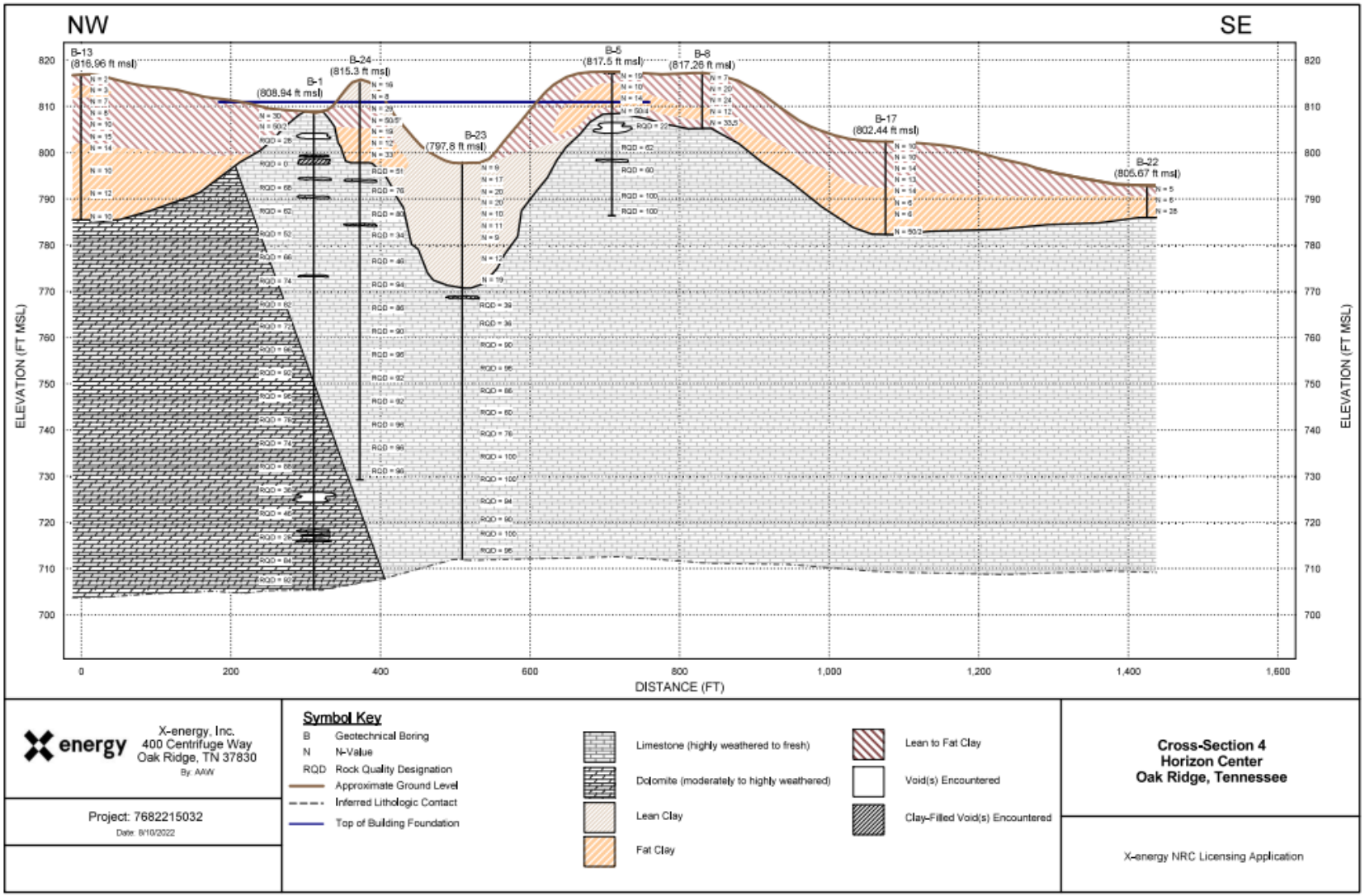



Note: Orientation (angle) of inferred lithologic contact(s) between bedrock (e.g., dolomite and limestone) represents approximate apparent dip (angle, 24 degrees SE) calculated from dip observed during drilling operations and adjusted based on actual alignment of cross-section illustrated on the 30:200 vertical-to-horizontal exaggerated-profile scale. N-value and rock quality designation displayed approximately at the mid-point of the run.

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**

**Attachment 2**

Geological Cross Sections Based on Soil Borings

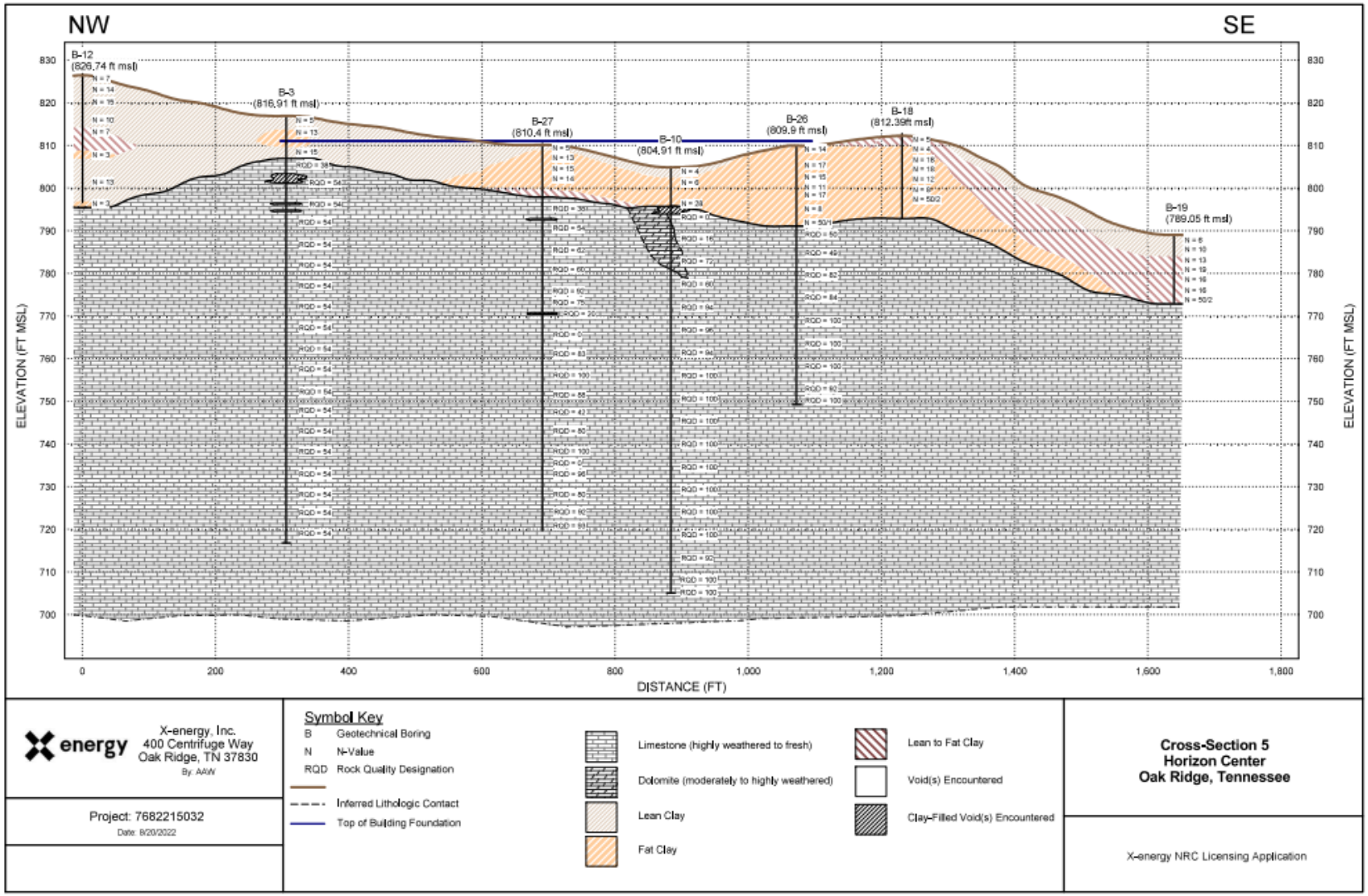



Note: Orientation (angle) of inferred lithologic contact(s) between bedrock (e.g., dolomite and limestone) represents approximate apparent dip (angle, 24 degrees SE) calculated from dip observed during drilling operations and adjusted based on actual alignment of cross-section illustrated on the 34:200 vertical-to-horizontal exaggerated-profile scale. N-value and rock quality designation displayed approximately at the mid-point of the run.

**RESPONSES TO REQUESTS FOR SUPPLEMENTAL INFORMATION TO SUPPORT THE TRISO-X LICENSE APPLICATION (Non-proprietary)**

**Attachment 2**

Geological Cross Sections Based on Soil Borings




Note: Orientation (angle) of inferred lithologic contact(s) between bedrock (e.g., dolomite and limestone) represents approximate apparent dip (angle, 24 degrees SE) calculated from dip observed during drilling operations and adjusted based on actual alignment of cross-section illustrated on the 40:200 vertical-to-horizontal exaggerated-profile scale. N-value and rock quality designation displayed approximately at the mid-point of the run.