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*ELECTRONIC DELIVERY*

August 25, 2023

Director, Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

References:
1) Docket No. 70-7027
2) TRISO-X letter from Jennifer Wheeler to Director, Office of Nuclear Material Safety and Safeguards, "TRISO-X Fuel Fabrication Facility License Application Submittal," dated April 5, 2022
3) NRC letter from Matthew Bartlett, Senior Project Manager, Fuel Facility Licensing Branch, to Jennifer K. Wheeler, "Request For Additional Information For The TRISO-X, LLC License Application For A Fuel Fabrication Facility (Enterprise Project Identification Number L-2022-NEW-0005)," dated July 27, 2023

Subject: **Response to Request for Additional Information (Set 2) for the TRISO-X License Application**

TRISO-X, LLC (TRISO-X) hereby submits responses to the subject Request for Additional Information (RAI), regarding the review of the License Application for the TRISO-X Fuel Fabrication Facility (Reference 2). The enclosed responses are for the RAI set transmitted by letter dated July 27, 2023 (Reference 3).

TRISO-X has engaged in informal discussions with the Tennessee Department of Environment and Conservation (TDEC) regarding the responses to Chapter 1 RAI-10 *Source and Byproduct Material* and RAI-11 *Type, Quantity, and Form of Licensed Material.* Discussions remain in-process, therefore TRISO-X will submit these responses to the NRC by September 15, 2023.

## Requests for Withholding

None. The enclosed submittal contains public information.

## Summary of this Submittal

The following Enclosures and Attachments are included with this letter.

**Enclosure 1 – Chapter 1 RAI Responses**

**Enclosure 1 Attachment – Revised Site Layout**

**Enclosure 2 – Chapter 2 RAI Responses**

**Enclosure 3 – Site Emergency Plan RAI Responses**

**Enclosure 3 Attachment – SEP Comments from Local Emergency Response Organizations**

If there are questions or if additional information is required, please contact me at (865) 850-0893 or jwheeler@triso-x.com.

Sincerely,

Jennifer Wheeler

Jennifer K. Wheeler, P.E.
Vice President, Regulatory Affairs

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Copy: Mr. Matthew Bartlett, US NRC, NMSS
TRISO-X Regulatory Records File

# Enclosure 1
# Chapter 1 RAI Responses for the TRISO-X License Application

## RAI-1 Facility Layout Information:

### Regulatory Basis:

The information below is necessary to demonstrate compliance with the regulations in Title 10 to the Code of Federal Regulations (10 CFR) 70.22, “Contents of applications,” subsection (a)(2), which states, “The activity for which the special nuclear material is requested, or in which special nuclear material will be produced, the place at which the activity is to be performed and the general plan for carrying out the activity.” It is also needed to demonstrate compliance with 10 CFR 70.65, “Additional content of applications,” subsections (b)(2-4), which state, “(2) A general description of the facility with emphasis on those areas that could affect safety, including an identification of the controlled area boundaries; (3) A description of each process (defined as a single reasonably simple integrated unit operation within an overall production line) analyzed in the integrated safety analysis in sufficient detail to understand the theory of operation; and, for each process, the hazards that were identified in the integrated safety analysis pursuant to § 70.62(c)(1)(i)-(iii) and a general description of the types of accident sequences; and (4) Information that demonstrates the licensee's compliance with the performance requirements of § 70.61, including a description of the management measures; the requirements for criticality monitoring and alarms in § 70.24; and, if applicable, the requirements of § 70.64 also requires a description of the process with sufficient detail to understand their function.”

Guidance on demonstrating compliance with these regulations is provided in NUREG-1520, revision 2, “Standard Review Plan for Fuel Cycle Facilities License Applications” (NUREG-1520) in sub-section 1.1.4.3.1 “Facility Layout Description,” acceptance criterion 1 which states, “The application presents information at a level of detail that is appropriate for general familiarization with and understanding of the proposed facility. This information should be consistent with that presented in the Integrated Safety Analysis (ISA) Summary but may be less detailed,” and acceptance criterion 2 which states, “The overview should describe the relationship of specific facility features to the major processes that will be ongoing at the facility.”

### Describe Issue:

The facility layout descriptions in License Application (LA) section 1.1.2, ISA Summary section 1.0, LA figure 1-2, and ISA Summary figure 1-2 identify 4 main buildings for the site but do not provide information on the role of these buildings, how they fit in the overall process, their location on the site, their size, etc. In addition, the buildings are difficult to identify in the LA figure 1-2 and ISA Summary figure 1-2, particularly for the security building. In addition, the figures include an incomplete legend and do not provide a scale measure of the grid on the figure. This makes it difficult for the reviewer to obtain a general understanding of the footprint/size and location of the buildings with respect to the other buildings and the site boundary.

### Information Needed:

Provide additional information on the facility layout in the LA. Describe the primary structures on the plant site, their purpose, locations on the site, how they fit into the operations of the facility. Include a cross reference in the LA and ISA Summary to the layout descriptions in supporting documents (e.g., environmental report, emergency

plan). Clarify the layout of the LA figure 1-2 and ISA Summary figure 1-2 to distinguish the 4 main site buildings, ensure they are included in the legend, clarify the items labeled on the figures but not identified on the legend (e.g., CB-1, MH-1), add a scale measure, and clarify the location of the security building.

**TRISO-X Response:**

License Chapter 1, Figure 1-2; ISA Summary Figure 1-2; and Site Emergency Plan (SEP) Figure 1.2-1 use the same base drawing. The base drawing has been revised to include the requested changes and is attached to this letter (Enclosure 1 Attachment). Building descriptions will be updated in the license based on the changes below.

**License and ISA Summary Changes:**

License Chapter 1, Figure 1-2; ISA Summary Figure 1-2; and SEP Figure 1.2-1 will be revised to include the requested changes. The base drawing is attached to this letter (Enclosure 1 Attachment).

License Chapter 1, Section 1.1.2, “Facility Buildings and Structures” will be revised to add the following information after the first paragraph (changes in red).

> A site plan showing the location and arrangement of buildings is included as Figure 1-2. Security fencing along or near the property boundaries defines the Owner Controlled Area. ~~The site includes 4 buildings for nuclear manufacturing, administrative offices, raw material preparation, and security.~~ Four buildings are located on the TRISO-X property: the Security/Emergency Operations Center Building, the Administration Building, the Process Building, and the Graphite Matrix Powder (GMP) Building. Additional structures on-site include exhaust stacks, electrical equipment yards, mechanical equipment yards, cooling towers, roads, parking areas, loading docks, storage tanks, and a detention basin.
>
> The Security/Emergency Operations Center Building is located near the main entrance to the property at Renovare Boulevard and serves as the main entry/exit security checkpoint for vehicles and people accessing the property. The Security/Emergency Operations Center Building also serves as the emergency operations center in the event of a site emergency. No radiological material is housed in this building.
>
> The Administration Building is connected to the southwest corner of the Process Building and contains offices, meeting rooms, locker rooms, restrooms, and a break area for employees and authorized visitors. The Administration Building also contains the entry/exit point for workers accessing the radiologically-controlled Process Building. No radiological material is housed in this building.
>
> The Process Building, located at the center of the property, receives special nuclear material (SNM) and ships out final fuel forms (pebbles, compacts, etc.). The Process Building houses SNM, chemicals, and equipment to support manufacture of coated particle fuel for the next generation of commercial nuclear reactors. The Process Building also receives GMP from the GMP Building. All handling, processing, and storage of SNM occurs in the Process Building.

The GMP Building is located northeast of the Process Building and is used to prepare GMP from raw materials. GMP is transported from the GMP Building to the Process Building to be used in the manufacturing process. No radiological material is housed in this Building.

Additional layout descriptions for the buildings and structures on-site are available in the ISA Summary Section 2.0, and the Emergency Plan Section 1.2.

**RAI-2 Nearby Roads, Trails, and Structures:**

**Regulatory Basis:**

This RAI has the same regulatory basis as RAI 1.

Guidance on demonstrating compliance with these regulations is provided in NUREG-1520, revision 2, “Standard Review Plan for Fuel Cycle Facilities License Applications” (NUREG-1520) in sub-section 1.1.4.3.3 “Site Overview.” This section states, “The license application summarizes the site information contained in the ISA summary. This includes descriptions of the overall facility layout and the drawings to support such descriptions. The license application describes the site’s geographical characteristics and facility structural features (such as buildings, towers, and tanks), transportation rights of way, and proximity to nearby populations. The license application fully describes the facility location. These descriptions are consistent with the information in chapter 8 of this SRP.”

**Describe Issue:**

The LA figures 1-1 and 1-2, ISA Summary figures 1-1 and 1-2 are not sufficiently detailed to get an understanding of the roads and trails near the facility. Emergency Plan (EP) figures 1.3-3 and 1.3-4 provide some information on local trails, roads and nearby structures but the image quality is low and difficult to read, and there is minimal visual distinction between trails and roads.

**Information Needed:**

Provide additional information in the LA and ISA Summary on the local roads, nearby structures outside the site boundary, and hiking trails. Provide corresponding changes to the figures in the LA (e.g., section 1-2, “Site Plan,” ISA Summary figure 1-2, “Site Layout,” EP figures 1.2-1, EP figure 1.3-4) to improve readability, and allow the reviewer to identify nearby roads, buildings, and pedestrian trails. If the information is provided outside of the LA, provide references to the relevant information.

**TRISO-X Response:**

As part of the license application submittal, the following Environmental Report (ER) figures and sections provide additional information on the local roads, nearby structures outside the site boundary, and hiking trails.

- ER Section 2.3.1 discusses nearby businesses at the Horizon Center Industrial Park.
- ER Figure 2.1-1 shows an overall site layout superimposed on an aerial photograph that also highlights nearby creeks, roads, dirt/gravel roads, and trails.
- ER Figure 3.1-1 shows an aerial view of buildings and roads nearest to the site.
- ER Figure 3.1-6 shows other land use features near the site, including trails highlighted by dark green lines.
- ER Figure 3.2-1 shows regional highways and interstates near the site.
- ER Figure 3.2-2 shows areas around the site boundary, including nearby structures and roads with road names.

**License Changes:**

None.

**RAI-3 Process Overview Description:**

**Regulatory Basis:**

This information is necessary to demonstrate compliance with the regulations in 10 CFR 70.22(a)(2 and 4), which require the application to contain a description of "(2) The activity for which the SNM is requested, or in which SNM will be produced, the place at which the activity is to be performed and the general plan for carrying out the activity" and "(4) The name, amount, and specifications (including the chemical and physical form and, where applicable, isotopic content) of the SNM the applicant proposes to use or produce." The information is also needed to demonstrate compliance with 10 CFR 70.65, "Additional content of applications," subsection (b)(2-4), which also requires a description of the process with sufficient detail to understand their function.

Guidance on demonstrating compliance with this regulation is provided in NUREG-1520, 1.1.4.3.1 criterion (1) which states, "The application presents information at a level of detail that is appropriate for general familiarization with and understanding of the proposed facility….." And NUREG-1520, 1.1.4.3.1 (2) which states, "The overview should describe the relationship of specific facility features to the major processes that will be ongoing at the facility." Additional guidance is provided in NUREG-1520 subsection 1.1.4.3.4 criterion (1) "Descriptive Summary of Licensed Material," which states, "The summary should describe chemical and physical forms of SNM in process; the maximum amounts of SNM in process in various building locations; …" and 1.1.4.3.4 criterion (3) "If applicable, the applicant has marked portions of the application to identify any proprietary or sensitive information (e.g., possession limits)."

**Describe Issue:**

The description of the TRISO-X process is provided in several locations: LA section 1.1.3, ISA Summary section 2.1, ISA Summary section 3.0, EP section 1.1.1, environmental report section 2.1.2.1.3, etc. The process overview provided in the LA and ISA Summary are high level and do not provide sufficient information to understand the major steps involved in manufacturing.

**Information Needed:**

Provide in the LA a complete overview of the TRISO-X process from receipt of material through manufacturing, storage, and shipment of product. Include information similar to the manufacturing process provided in the environmental report section 2.1.2.1.3. Include a description of the chemical and physical forms of the SNM as it moves from arrival on site, through the major steps in manufacturing, to storage and shipment off-site. Clarify that the amount of material throughout the process is controlled and tracked by an inventory system with appropriate procedures.

**TRISO-X Response:**

See license changes below.

**License Changes:**

License Chapter 1, Section 1.1.3, “General Process Description” will be revised to add the following information (changes in red).

> TRISO-X FFF manufacturing operations consist of receiving high assay low enriched uranium (HALEU) in the form of uranium oxide powder enriched to less than 20 weight percent U-235; converting the oxide into a uranyl nitrate solution, into gel spheres, and then into fuel kernels; and processing the fuel kernels through coating, overcoating, fuel form pressing, and carbonization. Coated particles and/or final fuel forms are removed from the process at the appropriate point and loaded into licensed shipping containers for shipment to other licensed facilities. These operations are supported by shipping and receiving, laboratory, quality control, research and development, uranium and chemical recovery, and waste disposal processes. Detailed facility and process descriptions are provided in the *TRISO-X Fuel Fabrication Facility Integrated Safety Analysis Summary*.
>
> A list of the major manufacturing steps is provided below in the order in which the material flows through the process building. The maximum quantity of material in the process is controlled by the possession limits for the site as listed in License Chapter 1, Section 1.2.4. Material Control and Accounting procedures used to track and inventory SNM are described in the *TRISO-X Fuel Fabrication Facility Fundamental Nuclear Material Control Plan*.
>
> Receipt of Uranium Feedstock – Incoming $U_3O_8$ feedstock enriched to less than 20 weight percent $^{235}U$ arrives by truck in approved containers licensed by the NRC. Shipping packages are unloaded from the delivery truck and moved to a secure storage location inside the process building. Receipt measurements for Material Control and Accounting are performed, and the feedstock is transferred into portable containers and stored until ready for use in the Dissolution process.
>
> Dissolution – $U_3O_8$ powder is manually transferred from a portable container into a hopper in a glovebox. The $U_3O_8$ powder is then metered into a nitric acid and water solution in a column where it is mixed until the required amount of $U_3O_8$ is dissolved resulting in a uranyl nitrate solution. The uranyl nitrate solution is then transferred to storage columns until it is ready to be used in the Gelation process.

Gelation – The uranyl nitrate solution is mixed with organic additives, and liquid droplets are formed that react with heated silicone oil to produce gel spheres. The gel spheres are aged in silicone oil, washed and rinsed to remove the silicone and additives, and dried. The resulting dried microspheres are combined by mass to form the input batches to the Kernel Conversion process.

Kernel Conversion – The dried microspheres are converted in a high temperature furnace to fuel kernels of uranium compounds, such as uranium dioxide and uranium dicarbide, based on the fuel design being fabricated. The fuel kernels undergo quality checks, and non-conforming products are rejected and sent to the Uranium Recovery process. The fuel kernels that pass the quality checks are combined by mass to form the input batches to the Coating process.

Coating – The fuel kernels are coated with several carbonous layers using a fluidized bed chemical vapor deposition system, resulting in coated particle fuel. When four carbonous layers are used, the resulting uranium-bearing microspheres are known as TRISO particles. The coated particles undergo quality checks and non-conforming products are rejected and sent to the Uranium Recovery process. The coated particles that pass the quality checks are combined by mass to form the input batches to the Overcoating process.

Overcoating – The coated particles are overcoated with a layer of graphite matrix powder, based on the fuel design being fabricated and the packing fraction required in the fuel element. The overcoated particles (OCPs) undergo quality checks and non-conforming products are rejected and sent to a washing station to remove the overcoating layer before being reintroduced into the Overcoating process. The OCPs that pass the quality checks are batched and sent to the Fuel Form Preparation process.

Fuel Form Preparation – OCPs are poured into molds or tooling and compressed or compacted into green fuel forms of the desired geometry, such as compacts or pebbles, based on the fuel design being fabricated. Some fuel designs require encapsulating OCPs in additional GMP and/or shaping. The green fuel forms undergo dimensional checks, and non-conforming products are rejected and sent to the Uranium Recovery process. The green fuel forms that pass the quality checks are batched and sent to the High Temperature Carbonization process.

High Temperature Carbonization – The green fuel forms are processed through a high temperature furnace to convert the green body into a strong carbonized fuel form capable of withstanding handling and reactor service conditions. Final fuel form pebbles are machined to the specified fuel diameter. The final fuel forms undergo quality checks and those that pass are loaded into interim storage containers until an order is ready for loading into shipping containers. Non-conforming products are rejected and sent to the Uranium Recovery process.

Uranium Recovery – Uranium is recovered from damaged, degraded, or otherwise non-conforming product materials through a variety of batch operations. The batch operations size reduce, deconsolidate, oxidize, and/or convert the non-conforming product materials to $U_3O_8$ powder so that it can be used as feedstock for the Dissolution process.

Shipping and Transportation – All shipments of nuclear materials and wastes are conducted in conformance with NRC, U.S. Department of Transportation, and State of Tennessee requirements. Incoming $U_3O_8$ feedstock arrives by truck in approved containers licensed by the NRC. Final fuel forms are shipped out to customers by truck in approved containers licensed by the NRC. Low level waste shipments are appropriately packaged and analyzed for uranium content prior to shipment to licensed low-level waste disposal sites.

## RAI-4 Fuel Kernels and Process Description

### Regulatory Basis:

The following information is necessary to demonstrate compliance with 10 CFR 70.22(a)(4), which requires the application to include, "The name, amount, and specifications (including the chemical and physical form and, where applicable, isotopic content) of the SNM the applicant proposes to use or produce."

### Describe Issue:

The term fuel kernel is used several times throughout the application in the LA (e.g., section 1.1.3 General Process Description), ISA Summary and EP; however, the term is not well defined. In addition, the ISA Summary section 3.4 and EP section 1.1.4 indicate the fuel kernel needs to meet certain quality assurance criteria, which indicates these criteria are important to the process, but there is no indication of how quality assurance is important, if it impacts safety, or what are the quality assurance criteria.

### Information Needed:

Provide a definition for fuel kernel used in the LA. In addition, clarify the importance of the quality assurance checks for the kernel described in the ISA Summary section 3.4 and EP sections 1.1.4 and 1.1.5, etc. Clarify the meaning of the phrase – non-conforming products.

### TRISO-X Response:

Quality assurance checks are in place throughout the manufacturing process to ensure that final products meet required customer specifications. Non-conforming products are those that do not meet the required customer specifications.

The license changes in the response to RAI-3 include a description of the Kernel Conversion process step, which discusses the fuel kernel.

### License Changes:

None.

**RAI-5 Population Near the Site:**

**Regulatory Basis:**

The following information is necessary to demonstrate compliance with the regulations in 10 CFR 70.65(b)(1-2), "(1) A general description of the site with emphasis on those factors that could affect safety (i.e., meteorology, seismology); and (2) A general description of the facility with emphasis on those areas that could affect safety, including an identification of the controlled area boundaries."

Guidance on demonstrating compliance with this regulation is provided in NUREG-1520 sub-section 1.1.4.3.3 "Site Overview" which states, "The LA summarizes the site information contained in the ISA Summary. This includes descriptions of the overall facility layout and the drawings to support such descriptions. The LA describes the site's geographical characteristics and facility structural features (such as buildings, towers, and tanks), transportation rights of way, and proximity to nearby populations. The LA fully describes the facility location. These descriptions are consistent with the information in Chapter 8 of this SRP." NUREG-1520 also states in section 1.3 (2), "The summary provides population information on the basis of the most current available census data. To the extent possible, data reflect observations and measurements made over a period of years, especially for conditions that are expected to vary seasonally (e.g., precipitation, windspeed, wind direction, and groundwater levels)."

**Describe Issue:**

The LA section 1.1.1.1, ISA Summary section 1.2 and EP figure 1.3-3 identify the distance to nearest population and major population centers. They do not indicate a breakdown of the population based on designated distances from the facility, e.g., designated radii from the site. Information on the closest distance to sensitive population groups (e.g., schools, hospitals), see EP section 1.3, is incomplete because it does not indicate the direction. Also, the statement is unclear as to whether the distances are based on a straight line or via road. In addition, LA section 1.1.1.1 identifies critical population near the site including hospitals and schools. The list in the application appears to be incomplete and the distances appear inconsistent with straight line distances based on Google maps (e.g., the closest schools appear to be Dyllis Springs Elementary, 3.5 miles to the northwest, and Linden Elementary School, 4.2 miles to the northwest of the facility).

**Information Needed:**

Provide additional census data on the population surrounding the site including indication of the population rows (e.g., population within 0.5 miles, 1 mile, 2 miles) based on distance from the site and indicate the basis for the values utilized (e.g., 2020 U.S. Census). Ensure that straight line distances are used and provide the relative direction from the facility to the sensitive population group (e.g., northwest, south, east).

Clarify in the application what is the closest school to the facility (e.g., Dyllis springs elementary school) and discuss what other sensitive populations groups (e.g., schools - including pre-schools) were considered based on safety considerations (e.g., exposure risk, notifications during an event). Clarify what these criteria are for determining the

sensitive populations identified. Describe the program that will be used to maintain awareness of the sensitive populations over time.

**TRISO-X Response:**

The following Environmental Report (ER) sections, tables, and figures provide additional information on the population surrounding the site.

- ER Section 3.10 states, "This section describes the population, economic, and community characteristics of the study area surrounding the Horizon Center site (HCS). For the majority of this section, this study area is defined as the five counties surrounding the HCS that are most likely to incur economic, labor force, and infrastructure effects due to the Proposed Action. This study area is also referred to in this section as the Region of Influence (ROI) and includes Roane, Anderson, Knox, Loudon, and Morgan counties. However, pursuant to NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with Nuclear Material Safety and Safeguards (NMSS) Programs, discussions regarding minority populations and households living below the poverty level focus on the approximately 50 sq. mi. (129.5 $km^2$) area (corresponding to a 4 mi. [6.4 km] radius) surrounding the HCS center point radius, which includes only portions of Roane, Anderson, and Morgan counties."
- ER Table 3.10.1-1 presents the population in the ROI from 2000-2020 based on United States Census Bureau data.
- ER Table 3.10.1-2 projects the population in the ROI through 2065.
- ER Table 3.10.1-5 shows the population density in the ROI. Roane County, where the site is located, has the second lowest population density in the 5-county ROI.
- ER Figures 3.10.1-1 through 3.10.1-4 provide population information within the ROI, two of which include a 4-mile radius from the site. Figure 3.10.1-4 shows no resident population south of the site, and 1 – 500 people per square mile west, north, and east of the site.

The following ER sections, tables, and figures provide additional information on the closest school to the site and other sensitive populations surrounding the site.

- As stated in ER Sections 1.3.1.1 and 2.1.2.1.1.1, sensitive populations include schools, daycare facilities, and hospitals.
- ER Section 4.12.2.1.1 lists the nearest sensitive receptors, including full-time residents, elder-care facilities, schools, residential wells, hospitals, and municipal drinking water intakes.
- ER Figure 4.12.2-1 shows these sensitive receptors on a map with straight-line distances from the site. The closest sensitive receptor (a full-time residence) is approximately 0.72 miles from the site.

ER Section 3.10.3.2 discusses education in the ROI and states "The closest school to the HCS is Dyllis Springs Elementary School, located 2.49 miles (4.02 km) west of the site, as depicted on Figure 3.10.3-1." A discrepancy was found in the ER regarding the location of Dyllis Springs Elementary School. The former Dyllis Elementary School located at 510 Dyllis Rd (2.49 miles west of the site) was closed in 2013. The new Dyllis Springs Elementary School located at 120 Ollis Rd (3.2 miles northeast of the site) opened in 2012 and is the closest school to the site.

**License, ISA Summary, and SEP Changes:**

License Chapter 1, Section 1.1.1.1, "Population, Nearby Land Uses, and Transportation" will be revised as follows with changes in red (bottom of 3rd paragraph):

> The closest school to the site is Dyllis Springs ~~Linden~~ Elementary School, located approximately 3.2~~5~~ miles northeast of ~~from~~ the site.

ISA Summary Section 1.2, "Population, Nearby Land Uses, and Transportation" will be revised as follows with changes in red (bottom of 2nd paragraph):

> The closest school to the site is Dyllis Springs ~~Linden~~ Elementary School, located approximately 3.2~~5~~ miles northeast of ~~from~~ the site.

SEP Section 1.3, "Description of Area Near the Site" will be revised as follows with changes in red (beginning of 3rd paragraph):

> The closest school to the TRISO-X FFF is Dyllis Springs ~~Linden~~ Elementary School, located approximately ~~5~~3.2 miles northeast of ~~from~~ the site.

The appropriate ER Figures and Sections will be revised as necessary to correct the discrepancy regarding the location of Dyllis Springs Elementary School.

**RAI-6 Transportation Infrastructure:**

**Regulatory Basis:**

This RAI uses the same regulatory basis as RAI 5.

**Describe Issue:**

The transportation paragraph provided at the end of LA section 1.1.1.1 is not sufficiently detailed and only lists some of the roads near the site. There are some references to the roads near the site spread throughout section 1.1.1 (e.g., access road in section 1.1.1, Poplar Creek Road in section 1.1.1.1, Renovare Boulevard in section 1.1.1.1, TN 95 in 1.1.1.1, I-40 and I-75 in 1.1.1.1), but they do not provide a complete picture of the transportation options and preferences to access the facility and minimize risk to the community due to shipments and potential events. In addition, information on other transportation options indicated by LA figure 1.1 such as airports, railroads, and water traffic, appear incomplete.

**Information Needed:**

Update the application documents (e.g., LA section 1.1.1.1) to provide additional information on the primary routes used to service the site including general direction and distance to major highways or interstates. Clarify whether the shipping routes to and from the site will seek to minimize travel through local population centers (e.g., Oak Ridge).

In the descriptions for the airports (e.g., LA section 1.1.1.1), describe the types of airports and if the prevailing traffic is near the facility. Also, figure 1.1 appears to show a railroad near the site that is not mentioned in the transportation paragraph. Add relevant information on the railroads near the facility, their use in shipping to the facility, and if they were analyzed as part of the ISA. LA figure 1.1 appears to show several bodies of water in the vicinity of the facility; describe if there is any commercial or recreational use of waterways near the site.

**TRISO-X Response:**

The following Environmental Report (ER) figures and sections provide additional information on the transportation infrastructure around the site.

- ER Section 3.2.2 discusses transportation facilities at or near the site.
- ER Figure 3.2-1 shows regional highways and interstates near the site with a scale that can be used to estimate distance from the site.
- ER Figure 3.2-2 shows areas around the site boundary, including nearby structures and roads with road names.
- ER Figure 3.4.2-1 shows rivers and streams within a 3-mile radius of the site.

**License and ISA Summary Changes:**

License Chapter 1, Section 1.1.1.1, paragraph 3, will be revised as follows (changes in red).

> Transportation infrastructure near the site includes Renovare Boulevard; TN 95; two interstate highways – Interstate 40 and Interstate 75 – several Tennessee state highways; and local roads. The McGhee Tyson Airport, which serves public and military needs, is located 26 miles from Oak Ridge by road. Oliver Springs Airport is a small private airport located 6 miles northeast of the site. The closest railroad track is approximately 1 mile southwest of the site boundary, adjacent to Blair Road. The closest major waterway, the Clinch River, is approximately 3 miles west of the site boundary. Shipping of materials and products to and from the site will be conducted by truck; no use of railroad or river barge is planned. Truck shipments would likely use Interstate 40 and State Route 58 west of the site due to the ease of access via 4-lane highways located in less populated areas with less traffic.

A copy of ER Figure 3.2-1 will be added to License Chapter 1 to supplement the road network shown in License Chapter 1, Figure 1-1.

ISA Summary, Section 1.2.1, Public Facility Impacts, will be revised (changes in red) to add a new subsection, 1.2.1.4, Railroads and Waterways.

> The closest railroad track is approximately 1 mile southwest of the site boundary, adjacent to Blair Road. The track is a spur line that serves the East Tennessee Technology Park. Due to the area between the western boundary of the site and the railroad track being over 1-mile of dense forest, and low operating speeds of trains on the dead-end spur line, the railroad spur is not a concern for site operations.

The closest major waterway, the Clinch River, is approximately 3 miles west of the site boundary. Portions of the Clinch River are used for industry and recreation around Oak Ridge. Considering the distance from the site, the river is not a concern for site operations.

**RAI-7 Uses of Ground Water:**

**Regulatory Basis:**

This RAI uses the same regulatory basis as RAI 5.

**Describe Issue:**

The LA section 1.1.1.3, “Hydrology”, states that there are no known uses of groundwater down gradient from the site. The application does not specify how far from the site is included by the phrase down gradient. The statement appears to extend from the facility indefinitely (e.g., to the ocean).

**Information Needed:**

Provide the distance applicable for the statement that there are no uses of groundwater down gradient from the site and describe the basis for this statement (e.g., TRISO-X surveys, state, and local records) in the LA.

**TRISO-X Response:**

The following Environmental Report (ER) figures and sections provide additional information on the groundwater uses near the site.

- ER Section 3.4.1.1.3.1 discusses groundwater wells within the vicinity of the site.
- ER Figure 3.4.1-2 shows groundwater wells within a 3-mile radius of the site.
- ER Figure 4.12.2-1 shows sensitive receptors, including drinking water users, on a map with straight-line distances from the site.

**License Changes:**

License Chapter 1, Section 1.1.1.3, paragraph 5, will be revised as follows (changes in red).

Depth to groundwater measurements taken at the four observation wells vary from approximately 10 to 57 feet below the top of the well casing. Groundwater elevation measurements and modeling indicate that groundwater generally flows in a southwest direction toward East Fork Poplar Creek. Based on a search of several database sources, there are no known household, public, or industrial users of groundwater downgradient of the site for the 3-mile distance that East Fork Poplar Creek travels to empty into the Clinch River. The closest well to the site is a residential well located upgradient, 1-mile north-northwest of the site, within the Poplar Creek Valley which is separated from the site by Blackoak Ridge.

## RAI-8 Wastewater Disposal

### Regulatory Basis:

The following information is necessary to demonstrate compliance with the regulations in 10 CFR 70.22(a)(4), “The name, amount, and specifications (including the chemical and physical form and, where applicable, isotopic content) of the SNM the applicant proposes to use or produce.”

Guidance on demonstrating compliance with these regulations is provided in NUREG-1520 sub-section 1.1.4.3.4 criterion (1), “Descriptive Summary of Licensed Material” which states in part that the application should include “… the types, amounts, and discharge points of waste materials discharged to the environment from the processes.”

### Describe Issue:

There is an apparent inconsistency between the liquid waste description in the LA section 1.1.4(5) and wastewater description in the ISA Summary section 2.6.6, “Wastewater,” and the ISA section 3.13.3 “Process Description – Liquid Recovery and Waste.” The LA section 1.1.4(5) describes processing of solutions contaminated with uranium. It also states, “liquid wastes that have been handled/treated can be sampled and discharged through an inline monitor to shipping packages or conveyances for off ‑site disposal.” This statement is unclear because conveyance to off-site disposal is not well defined and appears to include the sanitary sewer. The statement appears to contradict language in ISA Summary section 2.6.6 “Wastewater,” which states, “The Wastewater System accepts liquid waste from systems and equipment in the non-radiological areas of the facility.”

In addition, the ISA Summary section 3.13.3, “Process Description – Liquid Recovery and Waste,” describes the processing of liquids containing uranium but does not provide a clear description of how waste liquids are handled. The ISA Summary section 3.13.3 description of “Recycled Water and Waste Quarantine Columns,” on page 44 of 60 (adobe 93) states that wastewater must go through quarantine pumps and inline monitoring to ensure the solution is below the transfer limit. There is no description of where the water is being transferred. There is also no indication of what criteria are used to determine when a transfer is appropriate. The LA section 9.3 states that radiological liquid effluents do not occur, but there is no description of an effective monitoring program to ensure liquid effluents do not contain contaminants prior to release offsite.

### Information Needed:

Update the various descriptions of liquid waste and wastewater handling throughout the LA and ISA Summary (any other) to clarify that water that may contain uranium is maintained separate from other process waters (e.g., cooling water, sanitary sewer). Clarify in the LA (e.g., section 1.1.4 (5)) and the ISA Summary (e.g., section 3.13.3) how the transfers of liquids fit within the final disposition of the liquid wastes and effluents. Describe the monitoring programs to be used to assess contaminants in liquid effluents prior to final disposition off-site.

**TRISO-X Response:**

Manufacturing areas which contain radiological material are not equipped with floor drains in order to comply with nuclear criticality safety requirements. In addition, process lines in radiological areas are not physically connected to the sanitary sewer. Liquid waste containing uranium from the manufacturing process is not sent to the sanitary sewer and is instead filtered, recycled, packaged, and shipped offsite for disposal.

Conveyance to off-site disposal does not include the sanitary sewer. This means packaged and shipped off-site for disposal.

**License Changes:**

License Chapter 1, Section 1.1.4, “Raw Materials, Products, By-Products and Wastes” will be revised as follows (changes in red).

5. Process solutions contaminated with uranium that cannot be recovered/recycled are identified as liquid wastes. Liquid wastes are collected and sampled to determine appropriate handling/treatment steps. Treatment typically involves adjustment of pH, filtering, ion exchange, and/or precipitation. Precipitates are de-watered, and the solids are packaged for off-site disposal. If needed, liquid wastes that have been handled/treated can be sampled and discharged through an inline monitor to shipping packages ~~or conveyances~~ for off-site disposal. Used oils may also be sampled and containerized for shipment to a licensed disposal facility.
6. Airborne effluents are discharged to the atmosphere via a number of process stacks. HEPA filtration and dry scrubber systems are used as needed to remove radioactive particulates and chemicals from airborne effluents to assure compliance with 10 CFR 20 and applicable State of Tennessee regulations prior to discharge to the atmosphere.
7. Wastewater from systems and equipment in non-radiological mechanical equipment areas of the facility and sanitary wastes from bathrooms and showers are discharged through piping which goes to the City of Oak Ridge publicly owned treatment works (POTW). The City of Oak Ridge process for permitting discharges to the POTW will define monitoring requirements to assess potential contaminants in sanitary waste streams. No uranium will be present in this wastewater stream. ~~The inputs for the sanitary sewer system from the site include bathrooms and showers.~~

## RAI-9 HEPA Filtration and the Facility Stack

Regulatory Basis:
The following information is necessary to demonstrate compliance with the regulations in 10 CFR 70.22(a)(7), which require the license application to include "A description of equipment and facilities which will be used by the applicant to protect health and minimize danger to life or property (such as handling devices, working areas, shields, measuring and monitoring instruments, devices for the disposal of radioactive effluents and wastes, storage facilities, criticality accident alarm systems, etc.)."

Guidance on one acceptable approach for demonstrating compliance with these regulations is provided in NUREG-1520 sub-section 1.1.4.3.4 criterion (1) which states in part, that the application should include "… the types, amounts, and discharge points of waste materials discharged to the environment from the processes."

**Description of Issue:**

LA section 1.1.4(6) and EP section 1.2.1, state that the facility has multiple effluent stacks. However, the description is unclear on the number and height of each stack. In addition, LA section 1.1.4(6) states that the airborne effluents are sent to the appropriate stacks, but there is no indication of which stack. In addition, the application indicates that HEPA filtration will be used as needed but is unclear on the criteria for determining when filtration is needed.

LA section 9.2.2, "High-Efficiency Particulate Absolute (HEPA) Filtration" states in the first sentence that HEPA filtration is used on stack effluent if it contains radiological contamination. However, the second sentence states that at least one HEPA filter will be used on all effluents. These statements appear contradictory.

**Information Needed:**

Provide additional information on the stacks to be used at the facility (e.g., location, number, purpose, height). Clarify when HEPA air filtration will be used on stack effluents. Clarify in the LA and ISA Summary when exhaust air will be passed through HEPA filtration. For example, clarify the seemingly contradictory language in the LA section 1.1.4(6) to use HEPA filtration "as needed to remove radioactive particulates and chemicals from airborne effluents," and in LA section 9.2.2 that all exhaust air will pass through at least one HEPA filtration.

Describe in the LA the program for changeout, tracking, monitoring, etc. for the use of HEPA filtration and clarify the conditions under which dry scrubber filtration is utilized (e.g., LA 1.1.4(6)).

**TRISO-X Response:**

The TRISO-X FFF uses two process ventilation stacks (shown as Item 10 on License Chapter 1, Figure 1-2) that include active and standby HEPA air filtration with stack monitoring for radiological effluents. As noted in the Environmental Report, Section 4.6.4.2, each stack is 100 feet tall above ground level. Physical characteristics of the stacks (HVAC exhaust) are listed in ER Table 4.6-1.

License Chapter 9, Section 9.2.2, states, “HEPA filtration is used on stacks exhausting air that potentially contain radioactive materials that are significant with respect to the site’s compliance with 10 CFR 20. Exhaust air is passed through at least one stage of HEPA filtration prior to release from the stack.”

The expanded reference from Section 9.2.2 is not inconsistent with Section 1.1.4(6) which is intended to provide a general overview of all airborne effluents. The phrase “as needed” is intended to mean that HEPA filtration is used for exhausting air that potentially contains radioactive materials, while HEPA filtration may not be used for exhausting air from diesel generators or mechanical draft cooling towers, for example.

License Chapter 9, Section 9.2.3 presents details of HEPA filter surveillance. HEPA filter deterioration is monitored through the use of approved procedures, and includes periodic inspection of HEPA filters, periodic measurement of differential pressures across HEPA filter banks, and stack monitoring that alerts maintenance and engineering when action levels are reached. Final HEPA filter installations are equipped with differential pressure monitoring which informs filter changeout/maintenance.

Dry scrubber filtration is used to capture hydrochloric acid off-gas generated from the TRISO coating process. ISA Summary Section 3.5 describes the dry scrubber process.

**License Changes:**

None.

**RAI-10Source and Byproduct Material:**

**Regulatory Basis:**

The following information is necessary to demonstrate compliance with the regulations in 10 CFR 70.21(b), which states, “An application for license filed pursuant to the regulations in this part will be considered also as an application for licenses authorizing other activities for which licenses are required by the Act, provided the application specifies the additional activities for which licenses are requested and complies with regulations of the Commission as to applications for such licenses.” In addition, 10 CFR 70.22(a)(4) requires the application to include, “The name, amount, and specifications (including the chemical and physical form and, where applicable, isotopic content) of the SNM the applicant proposes to use or produce;”

Guidance on one acceptable approach for demonstrating compliance with these regulations is provided in NUREG-1520 sub-section 1.2.4.3.3 Characteristics of the Material, “The application identifies the elemental name, maximum quantity, and specifications, including the chemical and physical form(s), of the licensable material that the applicant proposes to acquire, deliver, receive, possess, produce, use, transfer, or store. For such material, the specifications include the isotopic content and amount of enrichment by weight percent.”

**Describe Issue:**

The LA section 1.2.4 states in the opening sentence that the section only applies to SNM, but it references 10 CFR parts 30 and 40 for byproduct material and source material, respectively. Since the TRISO-X facility is located in the Agreement State of Tennessee, has TRISO-X consulted with the State of Tennessee to determine if the byproduct (10 CFR 30) and source (10 CFR 40) materials can be regulated under the NRC license? Please also note the statement that SNM is regulated under 10 CFR 30 and 40 is not accurate.

**Information Needed:**

Please clarify if the State of Tennessee is in agreement in having the byproduct and source material licensed by the NRC. If so, please provide documentation that shows the State's agreement to have byproduct and source material licensed by the NRC. Ensure that only items to be regulated by the NRC license are listed in LA section 1.2.4.

**TRISO-X Response:**

TRISO-X has engaged in informal discussions with the Tennessee Department of Environment and Conservation (TDEC) regarding their regulatory oversight in accordance with the agreement state letter dated September 1, 1965, between the Atomic Energy Commission and the State of Tennessee. Discussions are still in process with TDEC, therefore TRISO-X will provide a formal response to this RAI by September 15, 2023.

**License Changes:**

None.

**RAI-11Type, Quantity, and Form of Licensed Material:**

**Regulatory Basis:**

This RAI uses the same regulatory basis as RAI 10.

**Describe Issue:**

As discussed in RAI 10, typically byproduct and source material are regulated by the Agreement State. The application should include a justification for including byproduct and source material on the NRC license and confirmation of support from the Agreement State. Without this justification, materials regulated by the Agreement State should be removed from LA section 1.2.4, as follows:

- The first 4 items are SNM and should be licensed by the NRC.
- Item 5 should be licensed by the State.
- Item 6 is strictly byproduct material (although its states "licensed material") and should be rewritten similar to the following for licensing by the State:
    - 2 millicuries of any byproduct material between atomic numbers 3 and 83 as sealed and unsealed radioactive sources for use in measurement and

detection instruments, check sources, instrument response standards, and counting and calibration standards.

- Item 7 would need to split into two parts, one to be submitted to NRC and the second to be submitted to the State since atomic numbers 84 to 96 includes byproduct, source, and SNM.
  - Item 7a (NRC application)
    - 1 microcurie of any SNM as sealed and unsealed radioactive sources for use in measurement and detection instruments, check sources, instrument response standards, and counting and calibration standards;
  - Item 7b (State application)
    - 1 microcurie of any byproduct or source material between atomic numbers 84 and 95 as sealed and unsealed radioactive sources for use in measurement and detection instruments, check sources, instrument response standards, and counting and calibration standards.

**Information Needed:**

Provide a justification for including source and byproduct material on the NRC license and include confirmation of support from the Agreement State. Modify the type, quantity, and form of licensed material identified in the LA (e.g., section 1.2.4) to only include those items to be regulated by the NRC.

**TRISO-X Response:**

See response to RAI-10.

**License Changes:**

None.

**RAI-12Possession Limit for Transuranic Materials:**

**Regulatory Basis:**

This RAI uses the same regulatory basis as RAI 10.

**Describe Issue:**

LA section 1.2.4 indicates that transuranic materials will be present in the form of impurities at a specific concentration per gram. There is no basis stated for this level of concentration or indication of how this level of concentration will be verified (e.g., prior to receipt or via TRISO-X testing). There should be a discussion of how materials that exceed the limit will be handled. As currently stated, receipt of material that exceeds the threshold for transuranic materials would result in a violation of the license. There is no corresponding possession limit for transuranic materials.

**Information Needed:**

Provide the possession limits for transuranic materials, including the bases for the limits. Also, describe the process that will be used to ensure compliance with these limits, i.e. how the limits will be verified (e.g., testing program, shipping manifest), and what actions will be taken if the limits are exceeded (e.g., returned, reported, logged).

**TRISO-X Response:**

The transuranic contamination limits are provided in License Chapter 1, Section 1.2.4. The transuranics are not a separate material and therefore are presented as a contaminant that may be present within uranium materials. A separate possession limit is not warranted since the maximum contaminant concentration limit is provided. The limits are based on ASTM C996-20 – *Standard Specification for Uranium Hexafluoride Enriched to Less than 5% $^{235}U$* and sampling analysis provided by potential suppliers. The limits are verified by supplier sampling through supplier shipper receiver agreements. The sample results are verified by TRISO-X prior to shipment. Any material that does not meet the limits will not be accepted from the supplier. The commitment in License Chapter 11 to conduct operations through approved procedures ensures compliance with the license limits.

**License Changes:**

None.

**RAI-13Research and Development Description:**

**Regulatory Basis:**

The following information is necessary to demonstrate compliance with the regulations in 10 CFR 70.22(a)(2) which require the application to describe, “The activity for which the special nuclear material is requested, or in which special nuclear material will be produced, the place at which the activity is to be performed and the general plan for carrying out the activity;”

Guidance for demonstrating compliance with these regulations is provided in NUREG-1520 sub-section 1.2.4.3.4 “Authorized Uses,” which states, “The application includes a summary, nontechnical narrative description for each activity or process in which the applicant proposes to acquire, deliver, receive, possess, produce, use, process, transfer, or store SNM. The authorized uses of SNM proposed for the facility are described and are consistent with the Atomic Energy Act of 1954, as amended. The description is consistent with more detailed process descriptions submitted as part of the ISA Summary reviewed in chapter 3 of this SRP.”

**Describe Issue:**

The research and development process mentioned in LA section 1.2.5 (3) and ISA Summary section 3.11 is high level. The ISA Summary section 3.11 states that the research activities will be located in a separate room, but the location is unclear based on ISA Summary figure 2-1. The method for keeping research activities separate from

routine activities is not described. In addition, the ISA Summary section 3.11 describes the potential for, “unique safety controls and case specific IROFS,” which seems to indicate the potential for new accident conditions that may require pre-approval by the NRC through the amendment process. It is unclear based on the descriptions in LA section 1.2.5 (3) and ISA Summary 3.11, what the routine operations of the experimental process will involve, if they will be analyzed for requiring or not requiring NRC’s pre-approval under 10 CFR 70.72, and if they will be operated under written and approved procedures.

**Information Needed:**

Describe in the LA how the research activities will have appropriate oversight, utilize written procedures, and have changes evaluated consistent with the requirements in 10 CFR 70.72. Clarify how the research activities will be maintained independent from routine activities and identify where they will be conducted (e.g., manufacturing building). If they are conducted in the manufacturing building, clarify their location on the ISA Summary figure 2-1.

**TRISO-X Response:**

Research activities are conducted with the same oversight as other SNM operations using approved procedures and management measures as outlined in License Chapters 3 and 11.

Equipment in the research and development area is intended to be full scale and installed with the same safety requirements as process equipment, unless otherwise evaluated with unique safety controls and case-specific IROFS. Evaluation of research and development activities follows the ISA process outlined in License Chapter 3. Change control per Chapter 11, Section 11.4.1 is used to ensure any changes are evaluated consistent with the requirements in 10 CFR 70.72. Figure 2-1 of the ISA Summary has the area for research labeled as “R&D, room 40”. However, research may be conducted using process units within the production area as reviewed by change control to ensure changes are evaluated consistent with the requirements in 10 CFR 70.72 per License Chapter 11, Section 11.4.1.

**License Changes:**

None.

**RAI-14Exemptions:**

**Regulatory Basis:**

The following information is necessary to demonstrate compliance with the regulations in 10 CFR 70.17 “Specific exemptions,” section (a) states, “The Commission may, upon application of any interested person or upon its own initiative, grant such 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.”

Guidance for demonstrating compliance with these regulations is provided in NUREG-1520 sub-section 1.2.4.3.5 “Special Exemptions or Special Authorizations,” which states, in part, “The license application clearly describes any proposed exemptions, and authorizations of an unusual nature and adequately justifies them for the NRC’s consideration.”

**Describe Issue:**

Several of the exemptions requests in the application are missing one or more of the required criteria in 10 CFR 70.17 (e.g., authorized by law, will not endanger life or property or the common defense and security, and are otherwise in the public interest).

**14.A Describe Issue:**

The exemption in LA section 1.3.1.2 “Posting and Labeling,” does not provide a basis for why the exemption is in the public interest.

**14.A. Information Needed:**

Provide a basis to the exemption in LA section 1.3.1.2 “Posting and Labeling,” for why the exemption is in the public interest.

**TRISO-X Response:**

The exemption is otherwise in the public interest because the posting approach reduces the expense of having to label every individual container of radioactive material, and therefore reduces unnecessary regulatory costs. This rationale is supported by Section 1.2.3.7.4 of NUREG-2120, *Safety Evaluation Report for the General Electric-Hitachi Global Laser Enrichment LLC Laser-Based Uranium Enrichment Plant in Wilmington, North Carolina*, published by the U.S. Nuclear Regulatory Commission in February 2012 (ML12060A007).

**License Changes:**

None.

**14.B Describe Issue:**

The exemption in LA section 1.3.1.5, “Certain Unplanned Contamination Events,” does not provide a basis for why the exemption is authorized by law.

**14.B. Information Needed:**

Provided a basis to the exemption in LA section 1.3.1.5, “Certain Unplanned Contamination Events,” for why the exemption is authorized by law.

**TRISO-X Response:**

This exemption changes the requirements to report unplanned contamination events if certain conditions are met. This exemption does not change, in any way, the 10 CFR 20

dose limits with which the licensee must comply for its workers and/or members of the public. Granting of this exemption will not result in a violation of the Atomic Energy Act of 1954, as amended, the Commission's regulations, or other laws. Therefore, the exemption is authorized by law.

This rationale is supported by the following documents granting the same exemption.

- NRC Safety Evaluation Report for Global Nuclear Fuel – Americas, Docket 70-1113, SNM-1097, dated July 6, 2020 (ML20139A130 and ML20139A131).
- NRC Safety Evaluation Report for BWXT Nuclear Operations Group, Docket 70-27, SNM-42, dated July 21, 2020 (ML20153A475 and ML20153A480).
- NRC Safety Evaluation Report for Nuclear Fuel Services, Docket 70-143, SNM-124, dated July 30, 2020 (ML20190A213 and ML20190A215).
- NRC Safety Evaluation Report for Framatome, Docket 70-1257, SNM-1227, dated November 5, 2020 (ML20275A336 and ML20275A337).
- NRC Safety Evaluation Report for Honeywell Metropolis Works, Docket 40-3392, SUB-526, dated August 26, 2021 (ML21207A218 and ML21207A219).

**License Changes:**

None.

**RAI-15Development of the Horizon Industrial Park:**

**Regulatory Basis:**

The following information is necessary to demonstrate compliance with the regulations in 10 CFR 70.65(b)(1 and 2) which states that the integrated safety analysis summary must contain, "(1) A general description of the site with emphasis on those factors that could affect safety (i.e., meteorology, seismology); (2) A general description of the facility with emphasis on those areas that could affect safety, including an identification of the controlled area boundaries."

Guidance for demonstrating compliance with these regulations is provided in NUREG-1520 section 1.3(1), "Site Description," which states in part, "The summary briefly describes site geography, including its location relative to prominent natural and manmade features (such as mountains, rivers, airports, population centers, schools, and commercial and manufacturing facilities). The summary also describes the site boundary and the controlled area." It also states in section 1.3 (2), "The summary provides population information on the basis of the most current available census data. To the extent possible, data reflect observations and measurements made over a period of years, especially for conditions that are expected to vary seasonally (e.g., precipitation, windspeed, wind direction, and groundwater levels)."

**Describe Issue:**

LA section 1.1.1.1, "Population, Nearby Land Uses, and Transportation" describes the Horizon Center Industrial Park that has multiple undeveloped plots surrounding the TRISO-X facility. The application does not discuss the potential external hazards from

industrial operations surrounding the site and if they were considered in the design and layout.

**Information Needed:**

Describe how development of the Horizon Center Industrial Park surrounding TRISO-X would impact the facilities protection of safety, security, or protection of the environment. Describe how future developments will be appropriately assessed in the integrated safety analysis.

**TRISO-X Response:**

The ISA Summary, Section 4.2.5 concludes that other than natural phenomena, bulk chemical storage and a potential new airport in Oak Ridge are the only potential hazards external to the facility since there are no major roadways, rail lines or other adjacent facilities close enough to the site that can cause an external impact to the facility. License Chapter 3, Section 3.1.2 commits to maintaining the ISA as required by 10 CFR 70.62(c) to identify facility and external hazards, including those that might be developed after the TRISO-X facility is constructed, and their potential for initiating credible accident scenarios.

**License and ISA Summary Changes:**

See License and ISA Summary changes in the response to RAI-6.

**Observation 1 – Estimates of Financial Ability to Operate:**

**Regulatory Basis:**

The following information is necessary to demonstrate compliance with the regulations in 10 CFR 70.22(a)(8) which states, “Note: Where the nature of the proposed activities is such as to require consideration of the applicant's financial qualifications to engage in the proposed activities in accordance with the regulations in this chapter, the Commission may request the applicant to submit information with respect to his financial qualifications” and 70.23(a)(5), “Where the nature of the proposed activities is such as to require consideration by the Commission, that the applicant appears to be financially qualified to engage in the proposed activities in accordance with the regulations in this part.”

Guidance for demonstrating compliance with these regulations is provided in NUREG-1520 sub-section NUREG-1520 sub-section1.2.4.3.2 “Financial Qualifications,” which states, “Such information could include income statements for three or more of the most recent fiscal years. In addition, the information could include balance sheet forecasts for 3 or more years into the future.”

**Description of Issue:**

The enclosure 9 section, “Financial Ability to Operate the TRISO-X Fuel Fabrication Facility” indicates the estimates are for 3 years but the table 3A-1 and 3A-2 appear to be for 5 years.

**Information Needed:**

Clarify the apparent discrepancy in the LA enclosure 9 section entitled, “Financial Ability to Operate the TRISO-X Fuel Fabrication Facility,” that indicates 3 years of data in attachment 3, while the tables in the attachment appear to contain 5 years of data.

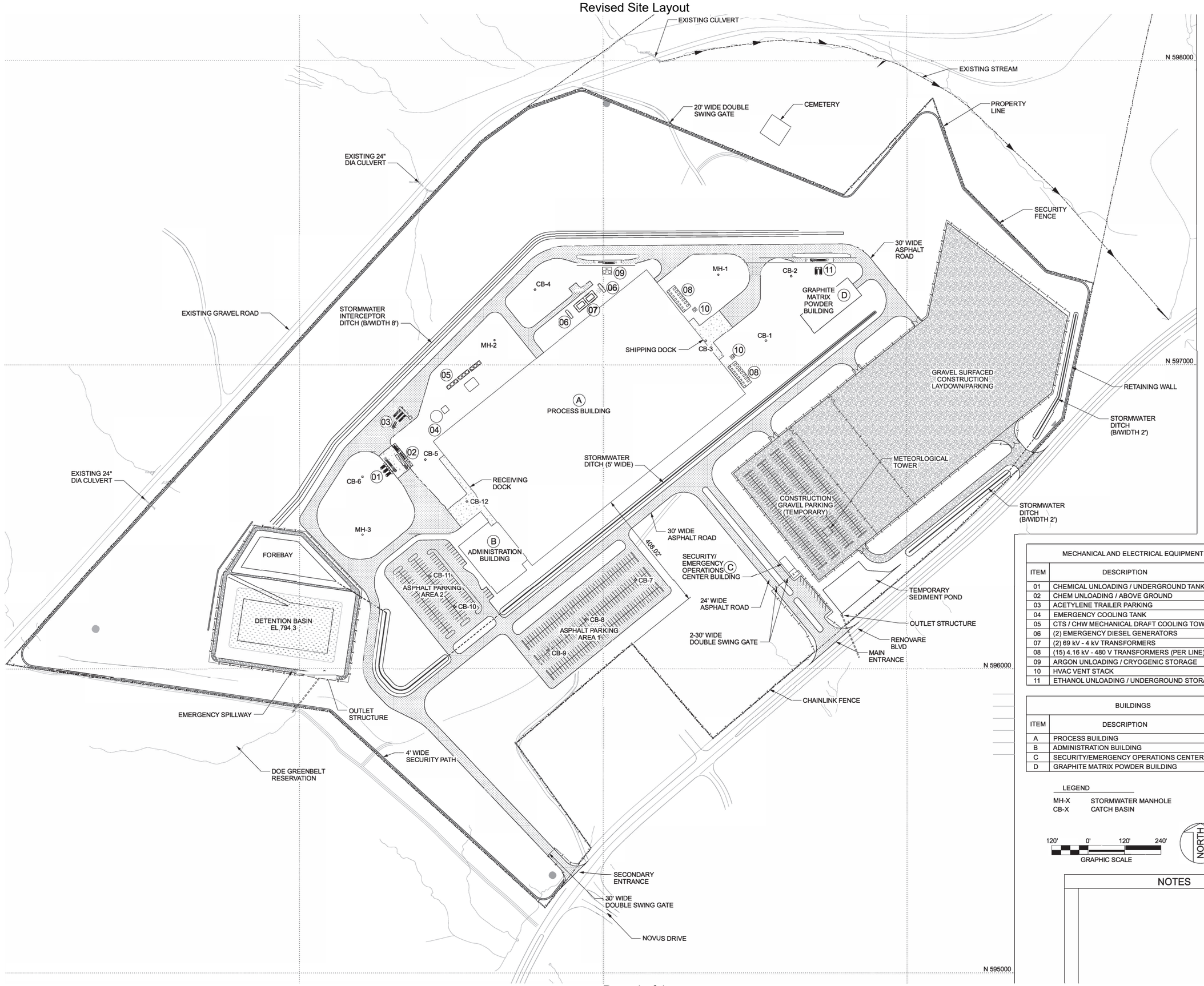
**TRISO-X Response:**

The observation is noted and will be addressed at a later time.

**License and ISA Summary Changes:**

None.

Enclosure 1 Attachment
Revised Site Layout




| MECHANICAL AND ELECTRICAL EQUIPMENT | |
|---|---|
| ITEM | DESCRIPTION |
| 01 | CHEMICAL UNLOADING / UNDERGROUND TANKS |
| 02 | CHEM UNLOADING / ABOVE GROUND |
| 03 | ACETYLENE TRAILER PARKING |
| 04 | EMERGENCY COOLING TANK |
| 05 | CTS / CHW MECHANICAL DRAFT COOLING TOWERS |
| 06 | (2) EMERGENCY DIESEL GENERATORS |
| 07 | (2) 69 kV - 4 kV TRANSFORMERS |
| 08 | (15) 4.16 kV - 480 V TRANSFORMERS (PER LINE) |
| 09 | ARGON UNLOADING / CRYOGENIC STORAGE |
| 10 | HVAC VENT STACK |
| 11 | ETHANOL UNLOADING / UNDERGROUND STORAGE |

| BUILDINGS | |
|---|---|
| ITEM | DESCRIPTION |
| A | PROCESS BUILDING |
| B | ADMINISTRATION BUILDING |
| C | SECURITY/EMERGENCY OPERATIONS CENTER BUILDING |
| D | GRAPHITE MATRIX POWDER BUILDING |

LEGEND

MH-X STORMWATER MANHOLE
CB-X CATCH BASIN

120' 0' 120' 240'
GRAPHIC SCALE

NORTH

NOTES

# Enclosure 2
# Chapter 2 RAI Responses for the TRISO-X License Application

## RAI-1 Management Hierarchy:

### Regulatory Basis:

The information below is necessary to demonstrate compliance with the regulations in Title 10 to the *Code of Federal Regulations* (10 CFR) 70.22, "Contents of applications," sub-section (a)(6), which requires the application to include, "The technical qualifications, including training and experience of the applicant and members of his staff to engage in the proposed activities in accordance with the regulations in this chapter."

Guidance for demonstrating compliance with these regulations is provided in NUREG-1520, revision 2, "Standard Review Plan for Fuel Cycle Facilities License Applications" (NUREG-1520) in sub-section 2.4.3 Regulatory Acceptance Criterion A.1, which states, "The applicant has identified and functionally described the specific organizational groups that are responsible for managing the design, construction, operations, and modifications of the facility or licensed activities. The application also includes organizational charts."

### Describe Issue:

In License Application (LA) section 2.3, "Organizational Responsibilities, Authority, and Qualifications," the second paragraph identifies two levels of managers including plant manager and discipline manager. Other management terms that are used throughout LA chapter 2, "Organization and Administration," include "function" (LA section 2.3.4 and the associated sub-sections), "analyst" (LA section 2.3.4.3), and "individual(s) responsible" (LA sections 2.3.4 and associated sub-sections). The layout in LA figure 2-1, "Functional Organization Chart," also indicates multiple layers of managers but does not identify which positions correspond to the various management terms used throughout LA chapter 2.

### Information Needed:

Clarify the different levels of managers utilized by TRISO-X (e.g., plant manager, discipline, function, analyst, individual(s) responsible) and their hierarchy relative to each other within the TRISO-X management structure. Clarify how the different types of managers identified in the LA are represented in LA figure 2-1.

### TRISO-X Response:

The purpose of License Chapter 2, Figure 2-1, is to depict the functional organization that is described in License Chapter 2, Section 2.3, consistent with NUREG-1520, Section 2.4.3.A.1, which states, "the applicant has identified and functionally described the specific organizational groups…the application also includes organizational charts." Neither License Chapter 2, Figure 2-1, nor License Chapter 2, Section 2.3, are intended to describe the reporting structure or hierarchy of managers within the organization, other than the plant manager having overall responsibility. Levels of management within a given discipline could include discipline manager, function manager, and/or individual(s) responsible for certain programs depending on level of oversight needed, breadth and depth of responsibility, and experience of the person.

As stated in License Chapter 2, Section 2.2, functional disciplines include "manufacturing, engineering, regulatory affairs, and quality assurance." These disciplines are depicted in License Chapter 2, Figure 2-1, in the row of four boxes immediately below "plant manager" and are described in License Chapter 2, Sections 2.3.2, 2.3.3, 2.3.4, and 2.3.5. All other boxes on License Chapter 2, Figure 2-1, below the discipline row are "functions" within manufacturing (2.3.2), engineering (2.3.3), and regulatory affairs, as further described in the subsections of 2.3.4.

**License Changes:**

None.

**RAI-2 Key Management Roles:**

**Regulatory Basis:**

This RAI has the same regulatory basis as RAI-1.

**Describe Issue:**

In LA section 2.3, the third paragraph states that the organizational information provided in LA chapter 2, including the management structure provided in figure 2-1, is generic and does not represent the actual management structure of the TRISO-X facility. In addition, the LA section 2.3 middle of the third paragraph also states, "Similarly, functional areas shown in LA figure 2-1 and described in this chapter may be grouped within their disciplines as needed…." These statements appear to indicate that the organizational information described in the LA does not represents the organizational structure that will be used at the facility.

**Information Needed:**

Provide the names of the management disciplines and functional positions that will be utilized to fill key roles at the facility and include them in LA figure 2-1. Remove or clarify the purpose of the statements in LA section 2.3 in the third paragraph that indicate all management positions, including those in LA figure 2-1 are, "generic in nature and do not reflect specific organizational or job titles." Clarify that the level of training required for each manager will include all the functional areas he/she is responsible to oversee. Provide sufficient descriptions of the actual management breakdown to distinguish independence between regulatory compliance (e.g., safety and security) and operations.

**TRISO-X Response:**

As noted in the response to RAI-1, the purpose of License Chapter 2, Figure 2-1, is to depict the functional organization that is described in Section 2.3, consistent with NUREG-1520, Section 2.4.3.A.1, which states, "the applicant has identified and functionally described the specific organizational groups…the application also includes organizational charts." Neither License Chapter 2, Figure 2-1 nor License Chapter 2, Section 2.3 are intended to describe the reporting structure or hierarchy of managers within the organization, other than the plant manager having overall responsibility.

Levels of management within a given discipline could include discipline manager, function manager, and/or individual(s) responsible for certain programs depending on level of oversight needed, breadth and depth of responsibility, and experience of the person.

As stated in License Chapter 2, Section 2.2, "Figure 2-1 shows the current TRISO-X functional organization, including the independence of manufacturing, regulatory affairs, and quality assurance." License Chapter 2, Section 2.3.4, states, "The Regulatory Affairs discipline is administratively independent of the Manufacturing discipline, but both disciplines may report to a common management position." This independence is depicted in License Chapter 2, Figure 2-1, by the row of four boxes immediately below "plant manager". Each discipline in this row is independent of each other, none report to each other in an administrative sense, but all report to a common manager, the plant manager. This meets the criteria in NUREG-1520, Section 2.4.3.B.3, that notes that for HS&E and operations organizations, "both may report to a common manager."

**License Changes:**

License Chapter 2, Section 2.3, paragraph 3, will be revised as follows (changes in red).

> The positions described in this section are intended to ~~be generic in nature~~ describe the license-related responsibilities and do not reflect ~~specific organizational~~ actual job titles. The responsibilities of the positions described may be fulfilled by one or more different organizational positions as long as the minimum position qualifications specified in this chapter are met for functional areas he/she is responsible to oversee. Similarly, functional areas shown in Figure 2-1 and described in this chapter may be grouped within their disciplines as needed to support the TRISO-X organization as long as the individual(s) responsible for the function(s) have a sufficient background to provide the capability for making sound safety and/or regulatory decisions. A combination of education and experience may be substituted for minimum qualifications described in this chapter if judged appropriate.

**RAI-3 Role of Regulatory Affairs on the Screening Committee:**

**Regulatory Basis:**

The information below is necessary to demonstrate compliance with the regulations in Title 10 CFR 70.22(a)(6), which requires the application to include, "The technical qualifications, including training and experience of the applicant and members of his staff to engage in the proposed activities in accordance with the regulations in this chapter."

Guidance for demonstrating compliance with these regulations is provided in NUREG1520, in sub-section 2.4.3 Regulatory Acceptance Criterion A.2, which states, "Clear, unambiguous management controls and communications exist among the organizational units responsible for managing the design, construction, operations, and modifications of the facility or licensed activities."

**Describe Issue:**

LA section 2.5.1, "Reporting of Potentially Unsafe Conditions or Activities" includes a description of the problem identification system, but does not describe the make of this system, (e.g., it is unclear if it is a computer system, committee, procedure). The section indicates that problems are reported to the Regulatory Affairs discipline, but once in the problem identification system, issues are reviewed by a safety committee that has representation by Regulatory Affairs and other disciplines. It is unclear if this process could lead to Regulatory Affairs being overruled by other disciplines (e.g., operations) which may promote production over safety. The introduction of a screening committee mentioned twice in 2.5.1 is not well defined.

**Information Needed:**

Provide additional information on the problem identification system, including what it consists of and how it works. Clarify the role of the Regulatory Affairs staff in the screening committee. Clarify the roll of the screening committee in the corrective action program, who serves on it, and how it differs from the safety committee. Please update the application, as appropriate.

**TRISO-X Response:**

License Chapter 11, Section 11.6, Incident Investigations and Corrective Action, states, "Events are reviewed and classified based on the safety significance and regulatory compliance, including the impact on the health and safety of the public and the environment; impact on reliability or availability of safety controls; and/or impacts to regulatory commitments." The review and classification process is achieved by a screening process conducted by a screening committee which is described in implementing procedures. The screening committee operates by consensus, not by majority rule, so that no representative can be overruled. If the screening committee cannot reach consensus, then issues are elevated up the management chain until consensus can be reached.

Further, License Chapter 2, Section 2.2 states, "The management positions for each discipline together have the delegated responsibility for plant safety and for compliance with conditions of SNM licenses and with federal, state, and local regulations and laws governing operation of a nuclear facility in order to maintain a safe workplace for all employees. Each discipline management team is responsible for ensuring that conditions adverse to safety are reported and investigated promptly, and that corrective actions are tracked to completion and, as applicable, monitored for effectiveness."

**License Changes:**

License Chapter 2, Section 2.5.1, will be revised as follows (changes in red) to remove redundant information and improve consistency with License Chapter 11, Section 11.6.

> ~~A problem identification system is~~ Procedures are available for any person at the TRISO-X Fuel Fabrication Facility to report potentially unsafe conditions or activities to the Regulatory Affairs discipline. Prompt reporting is expected so that conditions adverse to safety can be corrected as soon as practicable. Personnel have the authority to "stop work" if unsafe conditions or behaviors are observed,

or if any aspect of a procedure is unclear or incorrect as written as noted in Section 11.4. ~~The concern is entered in the system and processed through a screening committee with Regulatory Affairs discipline representation. The screening committee assigns the issue to an owner and defines follow-up investigation/evaluation requirements. Corrective actions are assigned and tracked to completion.~~ The ~~Corrective Action Program~~ incident investigations and corrective action program is discussed further in ~~Chapter 11~~ Section 11.6.

**RAI-4 Role of Regulatory Affairs**

**Regulatory Basis:**

This RAI has the same regulatory basis as RAI 3.

**Describe Issue:**

The description of Regulatory Affairs in LA section 2.3.4 states, "Functional areas include nuclear criticality safety; radiation protection; environmental protection; industrial, chemical, and fire safety; integrated safety analysis; licensing; material control and accounting; security; and emergency preparedness. Emergency preparedness and response programs are supported by each functional area as needed. The integrated safety analysis (ISA) process is supported by each functional area providing ISA team members as needed." Some of the technical areas identified appear to be important for operations as well as safety (industrial and chemical). In addition, there is a statement in LA section 2.3.4 that Regulatory Affairs discipline is administratively independent of the manufacturing but both disciplines may report to a common management position. The connection between Regulatory Affairs seems to undermine the independence of Regulatory Affairs from operations in order to focus on safety.

**Information Needed:**

Clarify the various technical staff (including industrial and chemical) of the Regulatory Affairs are focused on compliance, safety, and security and these roles are independent from manufacturing. Provide additional basis for the statement of independence between Regulatory Affairs and operations despite a common management of both. Clarify that Regulatory Affairs has stop work authority for issues related to safety, security, or protection of the environment.

**TRISO-X Response:**

As noted in the response to RAI-2, License Chapter 2, Section 2.2, states, "Figure 2-1 shows the current TRISO-X functional organization, including the independence of manufacturing, regulatory affairs, and quality assurance." License Chapter 2, Section 2.3.4, states, "The Regulatory Affairs discipline is administratively independent of the Manufacturing discipline, but both disciplines may report to a common management position." This independence is depicted in License Chapter 2, Figure 2-1, by the row of four boxes immediately below "plant manager". Each discipline in this row is independent of each other, none report to each other in an administrative sense, but all report to a common manager, the plant manager. This meets the criteria in NUREG-

1520, Section 2.4.3.B.3, that notes that for HS&E and operations organizations, "both may report to a common manager." License Chapter 2, Section 2.3.4, paragraph 2 states, "The Regulatory Affairs discipline monitors operations to ensure they are conducted in compliance with federal, state, and local regulations, and is authorized to suspend operations…".

**License Changes:**

License Chapter 2, Section 2.3.4, paragraphs 1 and 2, will be revised as follows (changes in red) to clarify that the Regulatory Affairs technical staff are focused on security and protection of the environment, as well as compliance and safety.

> The Regulatory Affairs discipline provides programs, procedures, and reviews to assure worker health and safety; security; environmental protection; and compliance with licenses and permits, including those related to transportation and disposal of licensed material. These activities are conducted with the ALARA principle in mind. Functional areas include nuclear criticality safety; radiation protection; environmental protection; industrial, chemical, and fire safety; integrated safety analysis; licensing; material control and accounting; security; and emergency preparedness. Emergency preparedness and response programs are supported by each functional area as needed. The integrated safety analysis (ISA) process is supported by each functional area providing ISA Team members as needed.
>
> The Regulatory Affairs discipline monitors operations to ensure they are conducted in compliance with federal, state, and local regulations, and is authorized to suspend operations, approve restart of operations, and/or require additional safety precautions when such measures are necessary in the interest of plant safety, security, or protection of the environment. The Regulatory Affairs discipline is administratively independent of the Manufacturing discipline, but both disciplines may report to a common management position.

## RAI-5 Regulatory Affairs in the Safety Committee

**Regulatory Basis:**

This RAI has the same regulatory basis as RAI 3.

**Describe Issue:**

In LA section 2.3.4, the second sentence of the third paragraph states that the chairperson of the safety review committee is considered a member of the council. The term "council" is not defined in the application. In addition, LA section 2.4 indicates that the safety review committee consists of discipline managers, but the relationship of the Regulatory Affairs manager to the safety committee and council is unclear. Also, the discussion of the membership of the safety committee in the middle of the Regulatory Affairs section in 2.3.4 (third paragraph) seems to imply a relationship between the members of safety committee and the Regulatory Affairs manager, but the relationship is not clearly described LA section 2.4.

**Information Needed:**

Clarify the role of the Regulatory Affairs Manager in the safety committee (e.g., see LA section 2.3.4, second sentence of the third paragraph, and LA section 2.4, second paragraph, and the relationship to the chairman of the safety committee. Define the term "council" as used in LA section 2.3.4, third paragraph, and throughout the LA. Clarify the purpose and role of the council and clarify how it fits into the overall discussion on Regulatory Affairs. Revise the LA, as needed, to reflect these clarifications.

**TRISO-X Response:**

As noted in License Chapter 2, Section 2.3.4, "The Regulatory Affairs discipline is responsible for overseeing the safety review committee as described in Section 2.4." This is depicted in License Chapter 2, Figure 2-1, by showing a separate box for the safety review committee chairman as a functional role fulfilled by a qualified person within the Regulatory Affairs discipline. The safety review committee chairman may be any qualified member of the Regulatory Affairs discipline, including, but not limited, to the discipline manager. There is not a separate "Council"; the references in License Chapter 2, Section 2.3.4, relate directly to License Chapter 2, Section 2.4.

**License Changes:**

License Chapter 2, Section 2.3.4, paragraph 3, will be revised as follows (changes in red) to improve consistency with Section 2.4.

> The Regulatory Affairs discipline is responsible for overseeing the safety review committee as described in Section 2.4. The Chairperson of the safety review committee is considered to be a member of the ~~Council~~ committee and he/she may represent one of the disciplines/functions on the ~~Council~~ committee if approved by the plant manager, or designated alternate.

## RAI-6 Staff Qualifications

**Regulatory Basis:**

The information below is necessary to demonstrate compliance with the regulations in 10 CFR 70.22, subsection (a)(6), which requires the application to include, "The technical qualifications, including training and experience of the applicant and members of his staff to engage in the proposed activities in accordance with the regulations in this chapter."

Guidance for demonstrating compliance with these regulations is provided in NUREG1520, revision 2, "Standard Review Plan for Fuel Cycle Facilities License Applications" (NUREG-1520) in sub-section 2.4.3 Regulatory Acceptance Criterion A.3, "The personnel responsible for managing the design, construction, operation, and modifications of the facility or licensed activities have substantive breadth and level of experience and are appropriately available. The qualifications, responsibilities, and authorities for key supervisory and management positions with HS&E [health, safety, and environmental] responsibilities are clearly defined in position descriptions that are

accessible to all affected personnel and to the U.S. Nuclear Regulatory Commission (NRC), upon request."

**Describe Issue:**

LA section 2.3.4 and the corresponding sub-sections that provide the minimum educational requirements for the discipline and functional managers state that individuals must have a Bachelor of Science or Arts (BS/BA) and/or advanced degree in science or engineering. The level of required education appears unclear because of the use of the "and/or", which seems to indicate that in some cases both a BS/BA and advanced degree are required and in other cases a BS/BA or an advanced degree is required. Also, it is unclear under what conditions both a BS/BA and advanced degree would be required.

**Information Needed:**

Clarify the educational requirements for discipline and function managers described in LA section 2.3.4 and corresponding sub-sections. Revise the requirement for a BS/BA and/or advanced degree in science or engineering to clarify when both degrees are appropriate (and) and when one or the other is appropriate (or). Consider replacing the and/or statement with one or the other (e.g., and, or). Identify what is considered an advanced degree in science or engineering (e.g., masters or doctorate). Provide the criteria for the amount of experience that can be substituted for education, if any. Revise the LA, as appropriate, to reflect these clarifications.

**TRISO-X Response:**

The educational requirements for discipline and function managers are a BS/BA or advanced degree in science or engineering. An advanced degree in science or engineering is considered to be a master's or doctorate degree. When substituting experience for education, eight years of applicable experience is equivalent to a BS/BA (four year) degree.

**License Changes:**

In addition to the revisions noted in the response to RAI-2, the last sentence of License Chapter 2, Section 2.3, paragraph 3, will be revised as follows (changes in red).

> A combination of education and experience may be substituted for minimum qualifications described in this chapter if ~~judged appropriate~~ other factors provide sufficient demonstration of the ability to fulfill the duties of a position. When substituting experience for education, eight years of applicable experience is equivalent to a BS/BA (four year) degree.

License Chapter 2, Section 2.3.4 "Regulatory Affairs" will be updated in the corresponding subsections to clarify the educational requirements for discipline and function managers are a BS/BA ~~and/~~or advanced degree (master's or doctorate) in science or engineering.

## RAI-7 Experience for the Manufacturing Function:

### Regulatory Basis:

This RAI has the same regulatory basis as RAI 6.

### Describe Issue:

The experience requirement for the manufacturing discipline described in LA Section 2.3.2 states, "and a sufficient background in manufacturing-related activities to provide the capability for making sound safety decisions." The phrase "sufficient background" is not well defined. Section 2.3.2 provides additional information on the education and experience required for the managers of the manufacturing discipline. This includes a number of "and/or" statements which make the level of education and experience uncertain.

### Information Needed:

Clarify what is meant in LA section 2.3.2 by the phrase "sufficient background in manufacturing-related activities" for the manufacturing discipline. Also, clarify the use of "and/or" in the requirements for manufacturing experience in LA section 2.3.2.

### TRISO-X Response:

TRISO-X is working to fill as many positions as possible with personnel who have nuclear experience. Demand for workers with nuclear experience is high due to a number of factors including:

- Growth in the advanced nuclear reactor sector.
- Limited number of operating nuclear fuel fabrication facilities in the United States.
- A disproportionately high percentage of the nuclear workforce is at or near retirement age.

Therefore, it is possible that situations may arise where a suitable candidate with nuclear experience cannot be hired. Judging equivalency of non-nuclear work experience may be necessary, particularly for the manufacturing discipline. The statement "He/she must have a sufficient background in manufacturing-related activities to provide the capability for making sound safety decisions" is an important criterion for evaluating quality of work experience.

### License Changes:

In addition to the revisions noted in the response to RAI-2 and RAI-6, the last sentence of License Chapter 2, Section 2.3, paragraph 3, will be revised as follows (changes in red).

> A combination of education and experience may be substituted for minimum qualifications described in this chapter if ~~judged appropriate~~ other factors provide sufficient demonstration of the ability to fulfill the duties of a position. When substituting experience for education, eight years of applicable experience is equivalent to a BS/BA (four year) degree. When substituting type of work

experience, two years of non-nuclear experience is equivalent to one year of nuclear experience.

License Chapter 2, Section 2.3.2 “Manufacturing” will be updated to clarify the educational requirements for discipline and function managers are a BS/BA ~~and/~~or advanced degree (master’s or doctorate) in science or engineering.

**RAI-8 Transition to Operations:**

**Regulatory Basis:**

The information below is necessary to demonstrate compliance with the regulations in 10 CFR 70.22(a)(2), which require the application to include, “The activity for which the special nuclear material is requested, or in which special nuclear material will be produced, the place at which the activity is to be performed and the general plan for carrying out the activity.”

Guidance for demonstrating compliance with these regulations is provided in NUREG1520, revision 2, “Standard Review Plan for Fuel Cycle Facilities License Applications” (NUREG-1520) in sub-section 2.4.3 Regulatory Acceptance Criterion A.4, “The applicant has described specific plans to commission the facility’s startup and operation, including the transition from the startup phase to operations, under the direct supervision of the applicant’s personnel responsible for safe operations. The application clearly describes the roles and responsibilities of the different functions engaged in these commissioning activities.”

**Describe Issue:**

LA section 2.6, “Transition from Design and Construction to Operations” refers to functional and acceptance testing to support the transition from design and construction to operations. The description of testing states that following successful testing and commissioning of equipment, a transition plan will be developed to test the equipment. The section does not describe the roles and responsibilities of the different disciplines or functions involved in the transition. Also, it does not provide a description of how corrective actions will be identified, tracked, or resolved.

**Information Needed:**

Clarify how the first, second, and third tests mentioned in LA section 2.6 relate to each other and support the transition plan. Identify a process that goes beyond testing for the transition to include written procedures, corrective actions, management oversight, established goals, etc., as applicable. Identify the management disciplines and functions that will be responsible for implementing the transition plan and clarify the role, if any, of the Regulatory Affairs managers. Describe how TRISO-X will ensure staff have the appropriate training to transition from construction to operations. Update the LA as appropriate.

**TRISO-X Response:**

In the responses submitted on July 28, 2023, to Set 1 RAI questions, a change to License Chapter 2, Section 2.6, paragraph 1, to answer RAI 1-1 clarifies that the TRISO-X organization "as described in Section 2.3" is also responsible for planning, organizing, and overseeing the "construction, installation," initial testing and commissioning of the facility and equipment. The site organization's responsibilities as described in License Chapter 2, Section 2.2 include elements that refer to implementation of procedures; and reporting, investigating, and tracking corrective actions for conditions adverse to safety.

**License Changes:**

License Chapter 2, Section 2.6, will be revised as follows to provide further clarification, as shown in red underlined text.

> **2.6 Transition from Design ~~and~~ ~~to~~ Construction to Operations**
>
> The TRISO-X organization as described in Sections 2.2 and 2.3 represents the personnel responsible for safe operations, and the organization is also responsible for providing direct supervision of the planning, organizing, and overseeing the construction, installation, initial testing and commissioning of the facility and equipment, including modifications in the future, using written plans and procedures.
>
> For initial facility construction, an architect/engineering (A/E) firm has been contracted to specify facility structures and systems, as well as to ensure the design meets applicable U.S. codes and standards. During the construction phase, construction activities and preparation of construction documents are completed using qualified contractors. TRISO-X oversight of the A/E and construction contracts may involve one or more functions as described in Section 2.3, depending on the scope of the design or construction activity. If a construction oversight function is used in addition to oversight provided by the engineering functions, the minimum qualifications required are the same as those for an individual responsible for engineering function(s) as stated in Section 2.3.3.
>
> As the construction of systems is completed, they undergo functional and acceptance testing, as appropriate, as contained in approved procedures. Following successful completion of testing and commissioning, detailed ~~transition~~ plans describe the transition from commissioning / start-up phase to operations. ~~and~~ Operational readiness reviews led by the TRISO-X organization are used to confirm the equipment in each process area is functionally tested and ready to operate, items relied on for safety are in place, license-required programs and commitments are implemented, operating procedures are approved, and the assigned staff is trained and ready to safely commence operations when authorized to do so.
>
> The turnover will include physical systems and corresponding design information and records. Following turnover, the manufacturing organization will be

responsible for system maintenance and configuration control. The design basis is maintained following the configuration management system described in Chapter 11, “Management Measures”.

# Enclosure 3
# Emergency Management RAI Responses for the TRISO-X License Application

## RAI-1 Emergency Response Agreement:

### Regulatory Basis:

This information is necessary to demonstrate compliance with the regulations in the Title 10 of the *Code of Federal Regulation* (10 CFR) 70.22(i)(3)(viii), "Notification and Coordination," which states, in part, that the notification and coordination of offsite response organizations and request for offsite assistance must be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination.

The guidance in NUREG-1520, revision 2, "Standard Review Plan for Fuel Cycle Facilities License Applications," includes the regulatory acceptance criteria in section 8.4.3.1.8, "Responsibilities," which states that NRC reviewers should evaluate the application descriptions to determine if mutual cooperation agreements exist or will be entered into with local agencies, such as fire, police, ambulance and rescue, and medical units.

### Describe Issue:

Enclosure 2 of the application, section 8.4, "Agreements with Offsite Emergency Response Resources," states that formal written agreements with appropriate offsite emergency response organizations (fire, police, medical, etc.) have been established and will be maintained to assure implementation of the TRISO–X Site Emergency Plan (SEP) and emergency response procedures. However, SEP section 4.3.2, "City of Oak Ridge Fire Department," and section 4.3.3, "Law Enforcement/Security," both state that agreements have been requested. In addition, SEP section 4.3.1, "Medical Treatment," is silent as to whether a mutual emergency response agreement has been established with the Methodist Medical Center of Oak Ridge or the University of Tennessee Medical Center, which, as stated in the SEP, has staff trained in radiological decontamination. Thus, the license application does not provide clear and unambiguous descriptions of the TRISO–X facility local offsite emergency response organizations mutual cooperation agreements that have been established.

### Information Needed:

Clarify in the TRISO–X facility application the descriptions of the mutual cooperation emergency response agreements that have been entered into with local offsite agencies.

### TRISO-X Response:

The City of Oak Ridge Fire Department and Police Department do not enter into agreements with private industry to secure emergency services; however, they are required by Tennessee state law to respond based on TRISO-X notifying 911 dispatch. TRISO-X will offer specific training to first responders and request participation in emergency response drills and exercises.

TRISO-X has written mutual aid agreements in place with Methodist Medical Center of Oak Ridge and with the University of Tennessee Medical Center in Knoxville. These hospitals will serve as emergency response hospitals for injured individuals that may be contaminated or exposed to radiological materials. Hospital staff have also received training from the Radiation Emergency Assistance Center/Training Site in Oak Ridge.

**License Changes:**

License Chapter 8, Section 8.4, will be revised as follows (changes in red).

> Formal written agreements with ~~appropriate~~ offsite ~~emergency~~ medical response organizations (~~fire, police, medical, etc.~~ Methodist Medical Center and University of Tennessee Medical Center) have been established and will be maintained to assure implementation of the emergency plan and emergency response procedures. These hospitals will serve as emergency response hospitals for injured individuals that may be contaminated or exposed to radiological materials. Hospital staff have also received training from the Radiation Emergency Assistance Center/Training Site in Oak Ridge. These agreements are reviewed and renewed as described in the emergency plan and are maintained on file at the TRISO-X Fuel Fabrication Facility. Local fire, police, and ambulance services (City of Oak Ridge, Roane County) are required by Tennessee state law to respond to emergencies when 911 is called.

**RAI-2 Ambulance Service Emergency Response Agreements:**

**Regulatory Basis:**

This information is necessary to demonstrate compliance with the regulations in 10 CFR 70.22(i)(3)(viii), “Notification and Coordination,” which state, in part, that an emergency plan must include a commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance including medical assistance for the treatment of contaminated injured onsite workers when appropriate.

The guidance in NUREG-1520, revision 2, “Standard Review Plan for Fuel Cycle Facilities License Applications,” includes the regulatory acceptance criteria in section 8.4.3.1.2, “Onsite and Offsite Emergency Facilities,” that states an emergency plan should include a description of the onsite and offsite services that support emergency response operations including ambulance services.

**Describe Issue:**

The TRISO–X SEP section 4.3.1, “Medical Treatment,” states that for serious injuries or medical conditions, an ambulance service is called to transport a patient to one of two nearby medical centers. However, the staff was not able to identify TRISO–X application description details of the identity of the ambulance service or the emergency response mutual cooperation agreement established with the ambulance service. It is not clear that there is agreement to transport a contaminated injured person from the site.

**Information Needed:**

Submit a description with details of the mutual cooperation emergency response arrangements that have been established for the ambulance service that will be called to transport a TRISO–X facility patient to one of two nearby medical centers.

**TRISO-X Response:**

TRISO-X does not currently have a mutual cooperation agreement in place with an ambulance service. Anderson County Emergency Medical Services and Roane County Office of Emergency Services provide ambulance services to the TRISO-X surrounding areas. These services are required by Tennessee state law to respond based on TRISO-X notifying 911 dispatch.

**License Changes:**

See license changes in response to RAI-1.

**RAI-3 Site Emergency Plan Comments:**

**Regulatory Basis:**

This information is necessary to demonstrate compliance with the regulations in 10 CFR 70.22(i)(4), which state, “The licensee shall allow the offsite response organizations expected to respond in case of an accident 60 days to comment on the licensee's emergency plan before submitting it to NRC. The licensee shall provide any comments received within the 60 days to the NRC with the emergency plan.”

The guidance in NUREG-1520, includes the regulatory acceptance criteria in section 8.4.3.1.14, “Responsibilities for Developing and Maintaining the Emergency Program and Its Procedures,” Item 3, that states that the emergency plan should describe the procedures for allowing offsite response organizations 60 days to comment on an emergency plan before it is submitted to the NRC and that any comments received within the 60 days shall be provided to NRC with the emergency plan.

**Describe Issue:**

The staff was not able to identify offsite organization comments received from the review of the SEP from offsite response organizations expected to respond in case of a facility accident within the application.

**Information Needed:**

Submit to the NRC any comments received from the review of the TRISO-X Facility SEP by offsite response organizations expected to respond in case of an accident at the facility.

**TRISO-X Response:**

The City of Oak Ridge Fire Department, Roane County Office of Emergency Services, and Tennessee Emergency Management Agency (TEMA) completed reviews of the TRISO-X SEP. The City of Oak Ridge Fire Department responded with comments that are attached to this letter. These comments have been incorporated in a draft revision of the SEP.

Roane County Office of Emergency Services and TEMA had no comments following their respective reviews of the SEP. Correspondence indicating the no comments received is also attached to this letter.

**License Changes:**

None.


OAK RIDGE FIRE DEPARTMENT
(865) 425-3520

May 19, 2022

Ms. Jennifer Wheeler, PE
X-Energy, LLC
Director, Regulatory Affairs, Fuel Production
400 Centrifuge Way
Oak Ridge, TN 37830

Subject: TRISO-X Fuel Fabrication Site Emergency Plan Review

Dear Ms. Wheeler:

The Oak Ridge Fire Department has reviewed your Site Emergency Plan and has discussed our comments with Gerard Couture, Safeguards Program Manager in a Teams Meeting on May 19, 2022.
The following items were discussed for consideration by TRISO-X:

- On page 1-8 Fire Station #1 is noted as the closest Fire Station at approximately 5.5 miles from the site. Fire Station #4 is actually the closest station to your site at 3.7 miles. Perhaps you would consider referencing both Stations.

- On page 4-8 it is noted that you plan to have Agreements in place with both the Oak Ridge Fire Department and Police Department. Internal discussions are currently taking place on entering into Agreements with private industry to secure our emergency services that are outside the normal response duties.

- Within the Site Emergency Plan a reference is made to the Facility IC determining when the emergency has been mitigated, when in actuality if emergency responders are called they will determine when the emergency is over, in coordination with the Facility IC.

- Since your company chooses to use the Incident Command Structure ICS), there were several instances where the terminology used was not the standard ICS terminology. For example, the Liaison Officer and Safety Officer should be part of the Command Staff and not down in the General Staff. We are supplying Gerard Couture with the ICS organization chart for comparison of how the rest of the world uses it.

We thank you for the opportunity to review this plan. We expressed an interest in a briefing for all the Oak Ridge emergency response departments during our Teams Meeting call perhaps in the fall. If we can be of further assistance, please contact us. We look forward to working with you.

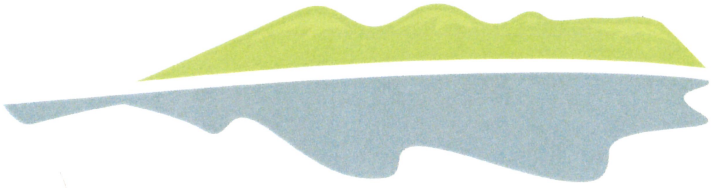
Sincerely,

[redacted]

Fire Chief

[redacted]

Emergency Management Consultant &
Anderson County LEPC Chair



Post Office Box 1 | Oak Ridge, Tennessee 37831-0001

**Summary of May 19, 2022 Phone Call**

**TRISO-X Response to Comments from City of Oak Ridge on SEP**

**Oak Ridge Comment 1**

On page 1-8 Fire Station #1 is noted as the closest Fire Station at approximately 5.5 miles from the site. Fire Station #4 is actually the closest station to your site at 3.7 miles. Perhaps you would consider referencing both stations.

**TRISO-X Response:** Text will be updated to reflect the proximity of Fire Station #4 and will also note the next closest station would be Fire Station #1.

**Oak Ridge Comment 2**

On page 4-8 it is noted that you plan to have agreements in place with both the Oaf Ridge Fire department and Police Department. Internal discussions are currently taking place on entering agreements with private industry to secure our emergency services that are outside the normal response duties.

**TRISO-X Response:** Text will be updated to reflect that fire and police response is based upon the facility notifying the 911 dispatch. Text here and elsewhere about written agreements will be removed. Text will remain that written correspondence from the facility will be used by the facility offering facility specific training to first responders and requesting participation in emergency response drills and exercises.

**Oak Ridge Comment 3**

Within the Site Emergency Response Plan a reference is made to the Facility IC determining when the emergency has been mitigated, when in actuality if emergency responders are called they will determine when an emergency is over, in coordination with the Facility IC.

**TRISO-X Response:** Text will be updated to make this correction. The Facility IC would only have this duty if the situation were classified as a Local event. In a Local event, off site response has not been requested. If emergency responders are called they will determine when an emergency is over, in coordination with the Facility IC. Offsite emergency response would occur in an event classified as an Alert or Site Area Emergency.

**Oak Ridge Comment 4**

Since your company chooses to use the Incident Command Structure (ICS), there were several instances where the terminology used was not the standard ICS terminology. For example, the Liaison Officer and Safety Officer should be part of the Command Staff and not down in the General Staff. Commenter provided the facility a copy of the ICS structure organization chart used by the city of Oak Ridge.

**TRISO-X Response:** The facility organization chart will be modified to match the organizational structure used by the City of Oak Ridge and the text for the organizational structure modified accordingly.

## Burns Cunningham

**To:** Gerard Couture
**Subject:** RE: Emergency Plan development

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**From:** Gerard Couture
**Sent:** Wednesday, June 22, 2022 3:24 PM
**To:** [redacted]@roanecountytn.org>
**Subject:** RE: Emergency Plan development

Thanks.

Yes agreed!

We will of course drill and practice though when we get our facility built, just in case.

I will ensure your office receives all the updates and controlled copies once finalized.

Best regards,

Gerard Couture

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**From:** [redacted]@roanecountytn.org>
**Sent:** Wednesday, June 22, 2022 2:04 PM
**To:** Gerard Couture <gcouture@x-energy.com>
**Subject:** Re: Emergency Plan development

> **Notice:** This email originated from outside of the organization. *Do not click links or open attachments unless you recognize the sender and know the content is safe*.

Mr. Couture,

I have reviewed the site plan you dropped off for us and I think everything looks pretty well in order. It seems to line up very similarly to other NRC style plans that I have read in the past. The contact information is one of the most important to us. I do know that Oak Ridge City will be the primary and first to respond to any incident at your facility and I am sure they have a copy of this as well. I hope to never have to use any part of this plan, as I am sure you would agree, but Oak Ridge has some of the best response personnel in the area. The Roane County Office of Emergency Services will always help in any way possible.

Respectfully,

[redacted]
Operations Chief
Roane County Office of Emergency Services

On Tue, Mar 15, 2022 at 1:12 PM Gerard Couture <gcouture@x-energy.com> wrote:

Good afternoon [redacted],

It was good to chat briefly with you today about our company and plans for the future development of a manufacturing facility in Roane County.

Our company, TRISO-X, LLC, is currently in the process of evaluating sites for a new Nuclear Fuel Fabrication plant.

No firm location has been finalized, however, one site under serious consideration is in the Horizon Center industrial park, owned by the City of Oak Ridge Industrial Development Board (IDB).

As Director of the Roane County Local Emergency Management Agency, I would like to discuss appropriate steps to interact with yourself and the Roane County LEPC regarding the plants Site Emergency Plan under development.

The plant will be a Nuclear Regulatory Commission (NRC) licensed facility. Our current plans include submittal of the License Application and the associated Emergency and Security plans by the 2Q of 2022. One of the key elements of this overall process is community engagement, especially in emergency planning. Perhaps a Zoom/Teams meeting between us would be an appropriate first step.

Please feel free to contact me at your convenience.

Best Regards,

Gerard Couture |*Safeguards Program Manager, Fuel Production*

Mobile: (803) 216-4649

gcouture@x-energy.com

400 Centrifuge Way

Oak Ridge, TN 37830

www.x-energy.com

**From:** Gerard Couture
**To:** Burns Cunningham
**Subject:** FW: TRISO-X Emergency Plan review status
**Date:** Wednesday, August 16, 2023 7:29:09 AM
**Attachments:** image001.png
image002.png

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**From:** Jennifer Wheeler <JWheeler@triso-x.com>
**Sent:** Monday, May 1, 2023 10:08 AM
**To:** Gerard Couture <gcouture@triso-x.com>
**Subject:** FW: TRISO-X Emergency Plan review status

FYI – no comments from TEMA on the EPlan at this time.

Jennifer

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**From:** [redacted]@tn.gov>
**Sent:** Monday, May 1, 2023 7:44 AM
**To:** Jennifer Wheeler <JWheeler@triso-x.com>
**Subject:** RE: TRISO-X Emergency Plan review status

> **Notice:** This email originated from outside of the organization. *Do not click links or open attachments unless you recognize the sender and know the content is safe.*

Hi, Jennifer.

Sorry it's taken me this long to respond, I was out of town last week. Thank you, again, for sending us your plan. At this time we do not have any comments. Please let me know if I can be of any assistance.

---

**From:** Jennifer Wheeler <JWheeler@triso-x.com>
**Sent:** Tuesday, April 25, 2023 11:17 AM
**To:** [redacted]@tn.gov>
**Subject:** [EXTERNAL] TRISO-X Emergency Plan review status

[redacted],

I wanted to check in to see if you have had a chance to review our Emergency Plan, and if you have any comments to share. NRC is actively reviewing the Plan now.

Thanks,
Jennifer

TRISO

**Jennifer K. Wheeler, PE**
Vice President, Regulatory Affairs

**Mobile:** 865.850.0893
jwheeler@triso-x.com



---

**From:** Jennifer Wheeler
**Sent:** Tuesday, February 7, 2023 8:54 AM
**To:** [redacted]@tn.gov>
**Subject:** RE: Contact info and Safety plan

Thanks [redacted]. If you end up needing more than 30 days, just let me know. I figured some kind of rough timeline would be helpful for us both.

Jennifer

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**From:** [redacted]@tn.gov>
**Sent:** Tuesday, February 7, 2023 8:29 AM
**To:** Jennifer Wheeler <JWheeler@triso-x.com>
**Subject:** RE: Contact info and Safety plan

> **Notice:** This email originated from outside of the organization. *Do not click links or open attachments unless you recognize the sender and know the content is safe.*

Good morning, Jennifer –

I received your plan yesterday. Thank you. We will review and any comments that we have, I will forward to you. Thanks, again, for sending us your Emergency Plan.

[redacted]

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**From:** Jennifer Wheeler <JWheeler@triso-x.com>
**Sent:** Monday, February 6, 2023 9:04 AM
**To:** [redacted]@tn.gov>
**Subject:** [EXTERNAL] RE: Contact info and Safety plan

[redacted],

I mailed out the Emergency Plan to you on Friday with expected delivery by 6pm today.

Jennifer

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**From:** [redacted]@tn.gov>
**Sent:** Wednesday, February 1, 2023 10:56 AM
**To:** Jennifer Wheeler <JWheeler@triso-x.com>
**Subject:** RE: Contact info and Safety plan

> **Notice:** This email originated from outside of the organization. *Do not click links or open attachments unless you recognize the sender and know the content is safe.*

Fantastic! Thanks, Jennifer.

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**From:** Jennifer Wheeler <JWheeler@triso-x.com>
**Sent:** Wednesday, February 1, 2023 10:54 AM
**To:** [redacted]@tn.gov>
**Subject:** [EXTERNAL] RE: Contact info and Safety plan

Great. We will be sending out the Plan to you this week, and I'll send you a follow up email to let you know when it is on the way.

Jennifer

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**From:** [redacted]@tn.gov>
**Sent:** Wednesday, February 1, 2023 10:14 AM
**To:** Jennifer Wheeler <JWheeler@triso-x.com>
**Subject:** RE: Contact info and Safety plan

> **Notice:** This email originated from outside of the organization. *Do not click links or open attachments unless you recognize the sender and know the content is safe.*

Jennifer –

Yes, please address it me. We have a secure area that it will be stored in and only those that would be involved in a response will have access to it.

My address is as follows:

[redacted]
DOE Program manager
803 N. Concord St.
Knoxville, TN 37919

Thanks, again, and we look forward to reviewing it.

[redacted]

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**From:** Jennifer Wheeler <JWheeler@triso-x.com>
**Sent:** Wednesday, February 1, 2023 9:02 AM
**To:** [redacted]@tn.gov>
**Subject:** [EXTERNAL] RE: Contact info and Safety plan

[redacted],

I am working on a letter to send out the Emergency Plan for TEMA review/comment. Should I address the letter to you directly, or is there someone else in your office I should send it to?

The Plan is marked Security-Related and Proprietary and should be withheld from public disclosure in accordance with 10 CFR 2.390. As an agency that may assist with response activities in the event of an accidental release at the site, you and others in your office have a need to know the information contained in the Plan.

Thanks,
Jennifer


**Jennifer K. Wheeler, PE**
Vice President, Regulatory Affairs

**Mobile:** 865.850.0893
jwheeler@triso-x.com



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**From:** [redacted]@tn.gov>
**Sent:** Friday, January 27, 2023 6:21 AM
**To:** Jennifer Wheeler <JWheeler@triso-x.com>
**Subject:** RE: Contact info and Safety plan

Jennifer –

We would be more than happy to share our comments or suggestions with you after reviewing the plan. Once we have reviewed it, we can meet and discuss if you would like to do so. Please let me know how you would like to transmit the plan. Thank you, again, for the opportunity to review your Emergency Plan.

[redacted]

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**From:** Jennifer Wheeler <JWheeler@triso-x.com>
**Sent:** Thursday, January 26, 2023 5:35 PM
**To:** [redacted]@tn.gov>
**Subject:** [EXTERNAL] RE: Contact info and Safety plan



[redacted],

It was nice to meet you too, and we look forward to working with you and others at TEMA. The Emergency Plan that we submitted to NRC in April 2022 is marked Security-Related Information, which is not quite as stringent as Safeguards Information. As long as the recipient has a need to know, which your office does for potential support during an emergency at our site, we can get you a copy of the same Plan we provided to NRC for their review and approval. We have already shared the same copy with Roane County and the City of Oak Ridge for their review and comment. We received a few minor comments from the City, and no comments from Roane County.

Would you be willing to share any comments you may have after reviewing the Plan? We would also be happy to set up a meeting if you have questions or need more information about the facility. We could do this before and/or after you review the Plan.

Let me know what works best for you.
Jennifer

TRISO

**Jennifer K. Wheeler, PE**
Vice President, Regulatory Affairs
**Mobile:** 865.850.0893

jwheeler@triso-x.com



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**From:** [redacted]@tn.gov>
**Sent:** Thursday, January 26, 2023 8:17 AM
**To:** Jennifer Wheeler <JWheeler@triso-x.com>
**Subject:** Contact info and Safety plan

> **Notice:** This email originated from outside of the organization. *Do not click links or open attachments unless you recognize the sender and know the content is safe.*

Good morning, Jennifer –

It was a pleasure to meet you last night at the NRC public meeting. I appreciate you taking the time to speak with me. My contact information is below, please feel free to reach out to me if there is anything I or TEMA can do for you or TRISO-X.

As we briefly discussed last night, what are your criteria for sending us the Safety Plan for the proposed plant at the Horizon Center? We have a safeguards information currently at our facilities and can pretty much accommodate any of your requirements.

Thank you and let us know how we can be of any assistance.

TN Department of Military | TEMA

[redacted] | Program Manager
Technical Hazards Branch
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