UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 28, 2024

Mike Rose
QAM/ARSO
Industrial Nuclear Company
14320 Wicks Blvd
San Leandro, CA 94577

SUBJECT: APPLICATION FOR REVISION NO. 0 OF CERTIFICATE OF COMPLIANCE NO. 9385 FOR THE MODEL NO. IR-100ST TRANSPORT PACKAGE – SUPPLEMENTAL INFORMATION NEEDED

Dear Mike Rose:

By letter dated August 12, 2024 (Agencywide Documents Access and Management System Accession No. ML24295A159), the Industrial Nuclear Company requested that the U.S. Nuclear Regulatory Commission (NRC) staff perform a review of Revision 0 of the Model No. IR-100ST transport package. The NRC staff performed an acceptance review of your application to determine whether the application contains sufficient technical information in scope and depth to allow the NRC staff to complete a detailed technical review per the Title 10 of the *Code of Federal Regulations* Part 71, "Packaging and Transportation of Radioactive Material."

This letter is to advise you that based on our acceptance review, the application does not contain sufficient technical information. The information needed to continue our review is described in the enclosure to this letter as requests for supplemental information and observations. The staff included observations to allow you to start earlier on items containing the potential to be asked at a later date. Responses to observations are not required for the staff to begin a detailed technical review. Observations are not the result of a detailed technical review and may be resolved once the staff begins a detailed review.

In order to start our technical review and keep this high priority case on schedule, this information should be provided within 3 weeks from the date of this letter. If the NRC receives your response in a timely manner, you should expect to receive a request for additional information in January 2025.

If you wish to discuss these issues in more detail prior to submitting your response, the staff is available for a public meeting. Please reference Docket No. 71-9385 and EPID L-2024-NEW-0008, respectively, in future correspondence related to this action.

If you have any questions regarding these matters, please contact me at Norma.GarciaSantos@nrc.gov.

Sincerely,

Signed by Garcia Santos, Norma
on 10/28/24

Norma Garcia Santos, Project Manager
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9385
EPID L-2024-NEW-0008

Enclosure:
Request for Supplemental Information
and Observations

Request for Supplemental Information and Observations
Model No. IR-100ST
Revision 0
Docket No. 71-9385

REQUEST FOR SUPPLEMENTAL INFORMATION

RSI -Th-1 Provide the analysis of the impact from the bounding effects of the hypothetical accident conditions (HAC) fire and combusting batteries (e.g., concurrent or near concurrent events) to demonstrate that Important-to-Safety components, the content of the package, the shielding material, and the sealed source capsule, can retain their respective shielding capability and containment capability after the HAC drop, puncture, and thermal tests, considering the effects of reacting and combusting battery power cells. An evaluation should also include the number of packages on a conveyance and the material and process used to cover the package during transport.

The application describes a number of energy sources that could combust and raise temperatures beyond those analyzed with the 0.84 W decay heat described in section 3.1.2 of the application and the combusting polyurethane foam during the 30-minute 800°C HAC fire noted in section 3.4.2. For example, section 2.7.4 of the application indicated that the maximum internal temperature of the four lithium power cells could be greater than 1,832°F (1,000°C). In addition, the resulting vented gases from combusting batteries could ignite during this condition.

However, the safety analysis report's (SAR's) thermal evaluation did not consider these additional thermal inputs on the package (e.g., shielding material, lock assembly, outlet port assembly, pigtail assembly, stainless steel housing), and importantly, on the sealed source (i.e., unanalyzed condition). The combined impact of temperature associated with the 1,000°C power cells, their ignition, and the 800°C engulfing fire condition could raise:

1. temperatures higher than the shield material's melting point and
2. temperatures to be near the source capsule's limit for maintaining its integrity (e.g., allowable metal temperature, pressure within the capsule's pressure boundary).

For example, the higher temperatures from the power cells and their combustion during the HAC fire could potentially expose the sealed source to a temperature higher than 800°C for more than 10 minutes, which are sealed source fire conditions described in 10 CFR 71.75(b)(4). These are important considerations because, as noted in section 2.12.1.7.2.4 (SAR revision 4, June 2015), a dummy source is used during the HAC tests. Therefore, the condition of a sealed source after the tests is not evaluated. An analysis of the impact from the bounding effects of the HAC fire and combusting batteries (e.g., concurrent or near concurrent events) at transport conditions should be provided and assumptions should be accurate or conservative, rather than assuming conditions that "minimize" temperatures (see RSI-Th-2, below).

This information is needed to determine compliance with 10 CFR 71.35.

RSI-Th-2 Provide the following:

a) details (including supporting documents) of the combustion time period and combustion thermal energy input (e.g., Btu/hr) to the package from the thermal runaway/combusting batteries used in the package,
b) the bases for the greater than 1,000°C (1,832 °F) battery runaway temperature, and
c) the bases for the assumptions associated with the ignition of battery vent gases.
d) clarification that the depleted uranium (DU) shield will not undergo a pyrophoric reaction when exposed to the combined effect of the 30 minute 800°C HAC fire and potential thermal runaway/combusting batteries.

Section 2.7.4 of the application noted that the battery runaway temperature could be greater than 1,000°C and assumed the following:

1. the urethane sensor surround does not melt or burn during the 30-minute 800°C fire,
2. flames from the batteries would not directly impinge on the stainless-steel housing and would be directed away from the package housing, and
3. the assumptions of the evaluation would “minimize” temperature increases to the stainless-steel housing.

However, the bases for the above assumptions were not clearly described. For example, the application did not include the rationale for:

1. Assuming the urethane sensor surround does not melt or burn during a 30-minute 800°C fire (section 3.4.2 of the application noted that polyurethane foam was completely consumed during the HAC fire).
2. Assuming the flames from the batteries would not impinge on the stainless-steel housing.
3. The manner that high-temperature batteries (greater than 1,000°C) and flames from the batteries would interact with the package and content during a concurrent (or near concurrent) HAC fire.

This information is needed to determine compliance with 10 CFR 71.35.

OBSERVATIONS

Structural Evaluation

Obs-St-1 Provide evaluations for HAC drop and puncture tests considering a package orientation to maximize damage at or near the vent hole located on top of the package [shown on Drawing IR100ST-B, Sheet 3, Revision 0 and Safety Analysis Report (SAR) Figure 2-1], which may result in an excessive opening into the housing cavity for a subsequent fire event.

The SAR section 2.12.1.5 provides the technical basis to select a worst-case package orientation that could potentially compromise DU shield integrity and/or the special form source of the package under the free drop and puncture tests. To maximize the damage to the package and potentially separating the radioactive source, the applicant selected two orientations for the free drop and puncture tests: 1) CG-Over-Lock Assembly: This orientation targets the lock assembly that secures the special form source in the DU shield for both the normal transport conditions (NCT) and the HAC; and 2) CG-Over-Lock Assembly Lower Edge: This orientation again targets the lock assembly by attacking the lower edge to potentially pry the assembly off of the body for both the NCT and HAC.

The SAR package drawing IR100ST-B and the Figure 2-1 depict a vent hole on top the package, which can be a weak point and may result in an excessive opening at this location under the free drop and puncture tests, and should be evaluated for a subsequent fire event. Under this scenario, the shielding integrity may be compromised due to an excessive opening into the housing cavity, and subsequent thermal degradation of the DU shield itself in the HAC fire event.

This information is needed to determine compliance with 10 CFR 71.73.

OBS-St-2 Clarify and correct as necessary the weld details for the support saddle (Item 5) to the housing base (Item 6) shown on the SAR drawing IR100ST-B, Sheet 3, Revision 0.

The SAR drawing IR100ST-B, Section B-B depicts the weld details for attachment of the support saddle (Item 5) to the housing base (Item 6) with a note in the weld symbol tail “TYP, Item 3 to Item 4”. As shown on the bill of material for this drawing, Item 3 is the outlet port assembly and Item 4 is the copper sheet. As a result, it appears that the tail note for this weld symbol needs to be clarified and corrected as necessary since the arrow of a weld indicator line points at the joint between Item 5 and Item 6. Also, the fillet weld size and length are only shown below the weld reference line, which indicates the weld is to be provided only on one side (near side) of the support saddle. If this weld is also required to be placed on the other side (far side) of the support saddle, the fillet weld size and length also need to be shown above the weld reference line.

This information is needed to determine compliance with 10 CFR 71.73 and 10 CFR 71.107(a).

Thermal Evaluation

OBS-Th-1 Demonstrate that the batteries, which are new components to the package, do not affect package temperatures as reported in section 3.3.1 of the application and are bounding during NCT. The response also should consider the effect of the number of packages on a conveyance and the material and process used to cover the package during transport.

Although section 3.3.1 of the application indicated that the maximum package temperature during NCT is 155 °F, section 1.2.1 indicated that batteries can reach temperatures over 250°F. However, the application's thermal analysis for determining package temperatures did not consider the following:

a) decay heat,
b) battery thermal input (approximately 10 Btu/hr.), or
c) potential high battery temperatures (i.e., at temperatures slightly below the maximum normal battery operational temperature setpoint).

Although the new thermal inputs may appear to be negligible, the source's size, the proximity and location of the battery (with a temperature greater than 250°F) to the sealed source, insolation thermal inputs, the manner and number of packages during transport, and the aggregate effects could have an impact on important component temperatures greater than those analyzed (e.g., battery operation limits).

This information is needed to determine compliance with 10 CFR 71.35 and 71.43(g).