Request for Supplemental Information
Holtec International
Docket No. 71-9375
HI-STAR ATB 1T Package

By letter dated September 23, 2015, Holtec International (Holtec) submitted an application for Certificate of Compliance No. 9375, Revision No. 0, for the Model No. HI-STAR ATB 1T package.

This request for supplemental information (RSI) identifies information needed by the U.S. Nuclear Regulatory Commission staff (the staff) in connection with its acceptance review of the Model No. HI-STAR ATB 1T package application to confirm whether the applicant has submitted a complete application in compliance with regulatory requirements.

The requested information is listed by chapter number and title in the package application. NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material," was used for this review.

Chapter 1 – General Information

1-1 Clarify the amount of plutonium that will be transported by the Model No. HI-STAR ATB 1T package.

Page 1-17 of the application indicates that a small amount of plutonium may be transported. Table 7.1.2 is reported to have the quantities of plutonium but such information could not be found in the table.

This information is needed by the staff to determine compliance with 10 CFR 17.33 and 71.63.

1-2 Provide center of gravity information for the Model No. HI-STAR ATB 1T package for all package configurations.

Page 5 of 15 of the document titled "Structural Calculation Package for HI-STAR ATB 1T" indicates that center of gravity information for the package has been provided in Table 1.1.1 of the application. However, this information appears to be missing from the table.

This information is needed by the staff to determine compliance with 10 CFR 71.33 and 71.45.

Observation

1-3 Indicate on the licensing drawings what welding process, weld filler material, and welding notes/inspection method will be used at each of the welds specified on the plans along with associated welding calculations.

Base material welding calculations have been provided in the application, but the weld's calculations themselves have not been. Weld filler material and welding process have not been provided either. Reference to the ASME codes alone is insufficient.

This information is needed by the staff to determine compliance with 10 CFR 71.45, 71.71, and 71.73.

1-4 Clarify what is meant by better mechanical properties with respect to the general notes on drawing sheet 1 of 5.

Note E on drawing sheet 1 of 5 states that: "The ASME and/or ASTM designation(s) of each material type specified herein is intended to fix its chemical and metallurgical attributes, not its raw material product form (viz. plate or forging, seamless or welded tube, etc.). Alternate product forms having the same chemical designation and equal or better mechanical properties may be substituted by the manufacturer. Alternate material types shall be tested in accordance with the applicable ASME Code requirements for the product type."

It is unclear what constitutes "better" mechanical properties. Selecting a raw form with higher yield stress may be viewed as "better" but may have less ductility, which can affect the energy dissipation characteristics of the package. In addition, describe what tests will be performed in this case. Stating that tests shall be in accordance with ASME Code is insufficient.

This information is needed by the staff to determine compliance with 10 CFR 71.33.

1-5 Clarify what components could be possibly fabricated from multiple pieces.

Note 4 of sheet 1 of 5 of the drawings indicates: "Parts may be made of multiple pieces provided acceptable safety factors are maintained." It is unclear what safety factors will be maintained, and their amount. Provide details indicating what pieces will be fabricated from multiple pieces, how these separate pieces will be joined, and what dimensions these pieces will have. Coordinate this note on the drawings as it applies to what is mentioned on page 2-25 of the application which states: "The Top Flange and the Closure Lid are monolithic sections."

This information is needed by the staff to determine compliance with the requirements of 10 CFR 71.33.

1-6 Justify the permission of oversized and undersized welds in the package.

Note 2 on page 1 of 5 of the drawings states that: "All structural weld sizes are minimum values; larger welds may be specified on the fabrication drawings as long as they do not create any interference or excessive deformation issues. Local areas of undersize weld are acceptable within the limits specified in the applicable Holtec standard procedure."

Welds must be as per the standard to which they are specified, and to the size specified on the drawings. Welds smaller than those specified are not acceptable.

This information is needed by the staff to determine compliance with 10 CFR 71.33.

1-7 Clarify the tolerances provided on the licensing drawings.

Note F on page 1 of 5 of the licensing drawings states that: “Dimensions without tolerances are nominal values. Dimensional tolerances on this drawing are provided solely for licensing purposes to define limits on dimensions used in licensing basis analysis. Hardware is fabricated in accordance to ensure with the fabrication drawings, which have tolerances appropriate to ensure component fit-up. Do not use worst case tolerance stack-up from this drawing to determine component fit-up. Dimensions indicated as "reference" are subject to tolerance stack-ups; dimensions indicated as "nominal" will vary in the manufactured hardware to the extent typical in applicable fabrication operations (such as rolling, plasma cutting and machining). Dimensions indicated as minimum or maximum are considered to be controlling dimensions.”

It is unclear what the tolerances are for the package components despite this note. Tolerances for all parts of the package that are important to safety should be specified in a clear manner. Additionally, it is unclear how tolerance stack-up is not possible for some parts while being possible for others.

This information is needed by the staff to determine compliance with 10 CFR 71.33.

Chapter 2 – Structural Evaluation

2-1 Provide additional information to support the benchmarking effort used for modeling the package with respect to the free drop tests specified under normal conditions of transport (NCT) and hypothetical accident conditions (HAC).

The applicant benchmarked physical drop testing of the multi-canister over pack (MCO) package tested by Idaho National Labs (INL) using LS-DYNA in an effort to support the use of LS-DYNA for modeling of the HI-STAR ATB 1T package. The HI-STAR ATB 1T package is rectangular, weighs upwards of 244,000 lb, and has dimensions of approximately 147” x 113” x 71” which is vastly different from the 24” diameter and 14 feet long MCO package tested by INL.

Calibrating a physical test to a model has an advantage that is readily apparent when a model is not behaving properly. Here, the applicant’s LS-DYNA model cannot benefit from physical testing. Without physical testing, the model must be one of “quality”, which currently does not have a quantitative definition. It must be able to accurately capture bolt behavior, plate vs shell behavior, welds that are three dimensional in behavior rather than just two dimensional, etc.

It is still unclear if the model presented in this application can, or cannot, capture this physical behavior. The lid closure mechanism in the ATB 1T has no physical counterpart in the MCO package and it is unclear how it will perform during drop testing. Given this, physical evidence that the model can replicate the physical phenomena expected from a package which has not been physically tested is requested.

This information is needed by the staff to determine compliance with 10 CFR 71.71 and 71.73.

2-2 Describe the content location within the BFA tanks themselves and their interaction with the package.

A maximum content weight has been provided; however, it is unclear how those contents are distributed within the package along with any dunnage and how they will interact with the package as its mass and center of mass changes.

This information is needed by the staff to determine compliance with 10 CFR 71.33, 71.71, and 71.73

Observations

2-3 Clarify the package tie-down system (bolts) and transportation frame as being integral to the package or not.

Page 1-11 of the application states: *"The HI-STAR ATB 1T transport cask is engineered for shipment by both waterways and roadways using appropriate supports and restraints. Packaging supports and restraints considered as auxiliary equipment, such as the transport frame and the package tie-down system (bolts) are necessary as part of the transport package. Non-integral appurtenances to the cask, such as the tie-down system and the transport frame are not structural parts of the HI-STAR ATB 1T Package and, as such, are not designated as packaging components."*

It is unclear if the transportation frame and tie down system, as mentioned above, are, or are not, integral appurtenances (structural package components).

This information is needed by the staff to determine compliance with 10 CFR 71.33.

2-4 Clarify the initial ambient temperature used for the tests specified under normal and accident conditions of transport.

Ambient temperatures of 100^{o}F to -20^{o}F do not appear to have been examined for the increased external pressure, minimum external pressure, vibration and shock, and 1-foot free drop tests (22^{o}C appears to be examined according to model details). It is unclear how this temperature range affects stresses in the package.

This information is needed by the staff to determine compliance with 10 CFR 71.71 and 71.73.

2-5 Describe the packages performance with respect to drop orientations not described for normal conditions of transport (NCT) and hypothetical accident conditions (HAC).

1.) Describe how the package will perform for HAC and NCT when the package is dropped at shallow angles relative to the end, side, and corner drop configurations mentioned in the application. Note that in the case of the aforementioned corner drop configuration, it is expected that the corner of the long dimension of the package would be directly impacted by slap down effects.

2.) Describe how the package will perform in the side drop configuration mentioned in the application, except that the package has been rotated 45^{o} relative to its long axis and the corner of the long dimension of the package is struck flush.

This information is needed by the staff to determine compliance with the requirements of 10 CFR 71.71 and 71.73.

2-6 Justify the fatigue endurance of the Model No. HI-STAR ATB 1T package with respect to NCT.

Section 2.6.5 of the application states that stresses encountered during NCT will be small due, in part, to the stiffness of the package. However, it is unclear just how small these stresses are since a more quantitative analysis has not been provided. It has been noted that the corners of the package could be most susceptible to fatigue cracks since three plates are welded at this location.

This information is needed by the staff to determine compliance with the requirements of 10 CFR 71.71(c)(5).

2-7 Describe the performance of the package for the HAC puncture scenario when a trunnion is struck perpendicular to its protrusion beyond the outside face of the cask.

Trunnions appear to project around 1 11/32" beyond the face of the cask. Staff is concerned that a direct strike by the penetrating bar may damage the trunnion such that it may get loose and potentially fall out of the cask, adversely affecting dose rates readings in the area.

This information is needed by the staff to determine compliance with the requirements of 10 CFR 71.73(c)(3).

2-8 Describe the performance of the package for the HAC puncture scenario when a previously damaged corner of the cask, as a result of the 9 m drop, is struck once more by the bar described in the puncture scenario.

Large plastic deformations were observed in the cask corner as a result of the 9 m drop (corner drop configuration) test as reported in Figure 2.7.5 on page 2-64. It is unclear with respect to cumulative damage, how the same region of the cask will perform during the puncture test if the cask is dropped in a corner drop configuration onto the bar specified.

Note that the cask could strike the puncture bar at a slightly rotated orientation. That is, the cask does not necessarily have to strike the puncture bar flush.

This information is needed by the staff to determine compliance with the requirements of 10 CFR 71.73(a), 71.73(c)(1), and 71.73(c)(3).

2-9 Describe the performance of the package for the HAC puncture scenario when the trunnion area is struck directly by the bar described in the puncture test.

Trunnions (item 19) have been described as being able to sustain a direct impact observed in the puncture scenario by retracting back into a cavity. However, it is unclear how the trunnion hollow shaft (item 20) surrounding the trunnion will behave when it becomes the recipient of all the forces generated by the puncture bar once the trunnion (item 19) retracts.

Note that the upper long containment plate wall plate (item 4) backing the trunnion hollow shaft (item 20) is thinner in this region due to the presence of the trunnion assembly itself.

This information is needed by the staff to determine compliance with 10 CFR 71.73(c)(3).

2-10 Describe the amount of torque used for the bolts that secure the BFA tank lid.

Page 7-4 states that bolts that are part of the BFA tank will be installed and torqued by the supplier. It is unclear what torque will be used to minimize vibrational effects in the bolt assemblies.

This information is needed by the staff to determine compliance with 10 CFR 71.71(c)(5).

2-11 Justify how the closure lid locking system (CLLS) will remain functional during NCT and will prevent the lid of the package from coming loose during drop and penetration tests described under HAC.

No physical drop testing data has been presented related to the CLLS and its interaction with the package for drop tests specified under NCT and HAC. It is unclear how the CLLS will perform when the package is dropped since analytical models of the CLLS using LS-DYNA are not linked to physical drop test data.

This information is needed by the staff to determine compliance with 10 CFR 71.71 and 71.73.

2-12 Justify the classification of the cylinder systems as not important to safety with respect to the closure lid locking system.

The package's ability to maintain the closure lid in place is based on the CLLS ability to function properly via a cylinder system. If the cylinder system were to fail during normal and hypothetical accident conditions, the CLLS could potential fail in its ability to retain the closure lid. This system and its components should be shown in the licensing drawings and its ability to withstand normal and accident conditions should be proven.

This information is needed by the staff to determine compliance with 10 CFR 71.33, 71.71, and 71.73.

Chapter 3 – Thermal Evaluation

3-1 Provide documentation, e.g., vendor datasheets, confirming the performance of the CLLS fluid and lubricants.

Information necessary to perform a detailed technical review includes the following:

a) Provide the allowable temperature range of the CLLS, including the hydraulic fluid, and explain the behavior of the CLLS hydraulic fluid when exposed to low and high temperatures during NCT and HAC.

b) Provide the maximum temperature of the CLLS system, including lubricant and hydraulic fluid, during NCT and HAC.
c) Confirm that the hydraulic fluid has sufficient expansion volume to accommodate reduced density at high temperatures.
d) Provide documentation that supports Section 2.2.7 statements that the lubricant and fluid are non-flammable and have sufficient radiation resistance.

This information is needed by the staff to determine compliance with 10 CFR 71.33.

3-2 Provide vacuum drying thermal models or clarify that the NCT and HAC thermal models are bounding.

Temperatures within a package often rise during the vacuum drying process. Section 3.3.11 indicates that vacuum drying would be performed, but no thermal analysis was provided nor was there discussion stating that the supplied analyses were bounding.

This information is needed by the staff to determine compliance with 10 CFR 71.33 and 71.71.

3-3 Confirm that the methodology of not modeling the content during HAC results in a bounding thermal analysis.

According to Section 3.4.3.2 of the application, the HAC thermal models do not explicitly model the package cavity and content. Provide an analysis explaining why applying a constant temperature to the content is bounding, rather than modeling the thermal mass associated with the content/container during the HAC and post-fire cooldown.

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

Observations

3-4 Provide further details on the proposed content, especially as it relates to pyrophoric and radiolysis-related considerations, which could impact the operation of the package.

Section 1.2.2 of the application indicates that content is non-fuel waste, which can include debris/chips. It is not certain if the varied non-fuel waste could include small metal filings/powder that could be pyrophoric or could include materials that undergo radiolysis, such as plastics.

This information is needed by the staff to determine compliance with 10 CFR 71.43(d).

3-5 Explain how the content will be accurately determined to ensure that the content's decay heat will be limited to 1.75 kW and its activity limited to the quantity described in Table 7.1.2.

There is no description in Chapter 7 that explains how the content's decay heat and activity would be confirmed prior to shipment. In addition, the activity listed in Table 7.1.2 should be clarified (i.e., 9010 times a Type A quantity).

This information is needed by the staff to determine compliance with 10 CFR 71.33.

3-6 Explain the effect of thermal stresses on the behavior of the CLLS wedge closure.

The effectiveness of the containment boundary is dependent on the package lid, which is closed using the CLLS wedge design. However, an explanation of the CLLS performance during HAC, especially due to thermal stresses, was not provided.

This information is needed by the staff to determine compliance with 10 CFR 71.33 and 71.73.

Editorial:

Correct page 2-55 of the application, or clarify whether the stress analyses assume a 30 minute or 15 minute HAC fire.

Chapter 4 – Containment Evaluation

4-1 Provide documentation, e.g., vendor datasheets, supporting the effective performance of the FFKM seals, which are part of the containment boundary, during NCT and HAC.

Documentation provided should address the following:

a) allowable temperature range,
b) short term maximum temperature time period allowed by manufacturer,
c) resistance to radiation,
d) thermal expansion coefficient and the impact of temperature change on seal effectiveness, and
e) resistance to helium permeation, which affects leakage testing of the seal material.

This information is needed by the staff to determine compliance with 10 CFR 71.33 and 71.51.

4-2 Provide details of the O-ring gland dimensions from the seal manufacturer in the licensing drawings.

The FFKM O-rings are an important component of the containment boundary and, according to Section 2.2.4 of the application, seal performance is dependent on proper sizing between the O-ring and the gland dimensions. However, gland and O-ring details were not provided either in the drawings or the application.

This information is needed by the staff to determine compliance with 10 CFR 71.33.

Observations:

4-3 Specify the qualifications of the individuals performing the leak test and writing the leak test procedures.

Chapter 8 of the application did not specify the qualifications of those involved in writing and performing helium leak testing. The “American Society for Nondestructive Testing Standard for Qualification and Certification of Nondestructive Testing Personnel

(ANSI/ASNT CP-189-2006)" and the "Recommended Practice No. SNT-TC-1A" provides the minimum training, education, and experience requirements for NDT personnel who perform leak testing and write leak test procedures.

This information is needed by the staff to determine compliance with 10 CFR 71.37(b) and 71.87.

4-4 Specify the quality assurance category of the FFKM seal.

Section 2.2.4 of the application indicates that the FFKM seal is "important to safety". However, there was no indication that the seals are associated with the more rigorous quality assurance category commensurate with its function.

This information is needed by the staff to determine compliance with 10 CFR 71.33.