

NRC RSI 2.1

Provide the following software input files reported missing by ANSYS and LSDYNA to support submitted calculations related to lifting, normal conditions of transport, and hypothetical accident conditions.

(i) HI-STAR 1TB 1T STEP.STEP. ANSYS expects this file to be located at D:\Project\2404-Drop Test\step files\HI-STAR 1TB 1T STEP.STEP and is used for calculation 2 in support of the HI-2177540 calculation package.

(ii) 9786-1000.step. ANSYS expects this file to be located at D:\PROJECTS\2404-Full model\9786-1000.step and is used for calculation 3 in support of the HI-2177540 calculation package.

(iii) ATB-CASK.DYN, ATB-TANK.DYN, BAR-PV.DYN. These LS-DYNA files are reported to be missing when the run.dyn file for the 1 m-CGOC puncture scenario is opened. These files support the HI-2177539 calculation package.

(iv) ATB-CASK.DYN, ATB-TANK.DYN, CONTACTS.DYN. These LS-DYNA files are reported to be missing when the run.dyn file for the 30 foot bottom end drop scenario is opened. These files support the HI-2177539 calculation package.

(v) CONTACTS.DYN. This LS-DYNA file is reported to be missing when the run.dyn file for the 30 foot oblique drop scenario is opened. This file supports the HI-2177539 calculation package.

This information is needed to determine compliance with 10 CFR 71.45 and 71.73(c)(1).

Holtec's Response to RSI 2.1

2.1(i)

This warning is regarding the missing original step/geometry file. Since the entire geometry, the FE mesh and the loading is already saved under the workbench database file named "ATB\_New.wbpj", the missing step file warning may be ignored. The relevant database file can be opened by accepting the warning.

2.1(ii)

This warning is regarding the missing original step/geometry file. Since the entire geometry, the FE mesh and the loading is already saved under the workbench database file named "ATB\_New.wbpj", the missing step file warning may be ignored. The relevant database file "ATB\_New.wbpj" can be opened by accepting the warning.

2.1(iii)

The missing files have been copied to the folder “Missing Files for 1m-CGOC Files”

This folder is contained in Enclosure 6 to Holtec Letter 2404005-NRC.

2.1(iv)

The missing files have been copied to the folder “Missing Files for 30 ft Bottom End Drop”

This folder is contained in Enclosure 6 to Holtec Letter 2404005-NRC.

2.1(v)

The missing file has been copied to the folder “Missing Files for 30 ft Oblique Drop”

This folder is contained in Enclosure 6 to Holtec Letter 2404005-NRC.

NRC RSI 2.2

Provide the following documents used to support normal conditions of transport and hypothetical accident conditions:

(i) Reference 2.6.7 of the SAR titled: SAND2017-0404 "Holtec HI-STAR ATB 1T Impact Test Program Report", Sandia National Laboratories, January 2017.

(ii) Reference 3.8 of report HI-2167517R1 titled: Holtec Dwg. 10429, Revision 2

(iii) Reference A.1 of report HI-2167517R 1 titled: "Construction of True-Stress-True-Strain Curves for LS-DYNA Simulations," Holtec Position Paper DS-307, Revision 1.

This information is needed to determine compliance with 10 CFR 71.71 and 71.73

Holtec's Response to RSI 2.2

The requested references are contained in Enclosure 6 to Holtec Letter 2404005-NRC.

NRC RSI 5.1

Provide a complete characterization of the proposed contents, including the scope of physical form(s), their material properties, and the radionuclides along with their maximum allowable quantities.

In accordance with 10 CFR 71.33(b), the description of the contents should be complete with respect to the chemical and physical form of the material, as well as its radioactive content (radionuclides and quantity). The Division of Spent Fuel Storage and Transportation's Interim Staff Guidance-20 (SFST-ISG-20), "Transportation Package Design Changes Authorized Under 10 CFR Part 71 Without Prior NRC Approval," states that the content description must be consistent with the assumptions made about the contents in the package evaluation (e.g., in the containment, shielding, and criticality evaluations). These features must be described in sufficient detail to provide a basis for evaluating the package.

The application only currently discusses typical form(s) and materials that the proposed contents include. This is not adequate to characterize the contents because it indicates contents of different materials properties are, or may also be, intended for transport in the package. In terms of radionuclides, the application only describes fissile nuclides, taken from the 10 CFR Part 71 definition of fissile material, and cobalt-60 and limits that apply to these nuclides.

However, the application indicates that other nuclides may also be present in the contents but neither identifies these nuclides nor provides limits for the allowable quantities of these nuclides. These indications include the use of a 10% increase in the package dose rates for cobalt-60-bearing contents. The supporting basis for this factor is not provided and cannot be evaluated without an understanding of the materials properties and radioactive characteristics (including the radionuclides, their allowable quantities, concentrations, and energy spectra) for all of the contents for which use of the package is intended. The contents characterization may also impact the evaluation of the amount of material considered releasable as well. Since the applicant is seeking a Type B package certification, the contents characterization should provide a sufficient description of the allowed contents, including the different radionuclides that may be present in the contents and their allowable quantities.

The package analyses, including shielding, should be modified as necessary to adequately address the scope of the contents for which use of the package is intended. For example, as described in NUREG-1609, Section 5.5.2, "Radiation Source," the contents used in the shielding analysis should be consistent with the contents specified in the "General Information" section of the application. This guidance section also states that shielding analyses for packages with multiple types of contents should identify and evaluate the contents that produce the highest dose rates at each location around the package.

This information is needed to determine compliance with 10 CFR 71.33(b), 71.47, and 71.51.

### Holtec's Response to RSI 5.1

A more detailed description of the physical form and material properties of the package waste content (reactor internals) to be loaded in the HI-STAR ATB 1T package is added to Subsection 1.2.2 [1], and some editorial clarifications are made in Chapter 5 [1]. Several figures have been added to the Shielding Calculation Package [2] to visually show the physical form of the reactor internals to be loaded into the HI-STAR ATB 1T package.

The Containment Chapter 4 (Paragraph 4.4.2.1) is updated to address radionuclide concentrations ( $\text{Ci}/\text{cm}^3$ ) used in the Containment calculations with an editorial addition that cites the effect of the Cobalt-60 on the  $A_2$  of the crud [3].

Source term calculations are added to Appendix 5.A [1] to provide more information on radionuclides other than Cobalt-60 that also contribute to package dose rates. SAS2H and ORIGEN-S are used to calculate the gamma source terms as a function of burnup at several cooling times for irradiated reactor internal typical materials. The results in terms of specific activity ( $\text{GBq}/\text{kg}$ ) for each radionuclide that contributes to package dose rates are presented in Appendix 5.A of the HI-STAR ATB 1T SAR (Proposed Revision 2) [1].

Table 5.A.3 through Table 5.A.6 provide a supporting basis that using 10% additional Co-60 to account for other radionuclides is conservative for shielding calculations.

This analysis shows that by limiting Co-60 to a certain specific activity (Table 7.1.2 [1]), and by requiring a cooling time of at least 1 year (Table 7.1.2 [1]), that the radionuclides other than Co-60 that contribute to package dose rates are limited to contribute less than 10% additional to package dose rates. For this reason, the shielding calculations that credit an additional 10% Co-60 specific activity beyond the limit in Table 7.1.2 [1] provides a conservative and simplified approach for calculating the maximum dose rates of the HI-STAR ATB 1T in Sections 5.1 and 5.4 of the HI-STAR ATB 1T SAR [1].

### **RSI 5.1 References**

- [1] *HI-STAR ATB 1T SAR*, HI-2146312, Proposed Revision 2, Holtec International.
- [2] *HI-STAR ATB 1T Shielding Calculation Package*, HI-2156583, Revision 2, Holtec International.
- [3] B.L. Anderson et al., "Containment Analysis for Type B Packages Used to Transport Various Contents", NUREG/CR-6487, UCRL-ID-124822, Lawrence Livermore National Laboratory, November 1996.

NRC RSI 5.2

Provide technical design drawings for all proposed packaging components, including the Type E waste packaging.

Section 1.4 of NUREG-1609 states "The design must be shown on engineering drawings that can be referenced in the certificate of compliance." The application indicates that there are five waste package types, Types A through E. However, only drawings for Types A through D are provided. The applicant reasons that because the Type E packaging includes a secondary container and optional waste basket that are not important to safety that drawings for the Type E packaging are not needed.

This statement is not correct. Since the components associated with the Type E configuration are part of the packaging and intended to be used with the certified package, the application needs to include drawings for these components. The level of details in the drawings should be commensurate with how these components are relied on in the package analyses and operations.

For example, the drawing does not need to include component tolerances that can impact a component's shielding capability (e.g., thickness tolerances) for a component that is not credited in the shielding analyses to reduce package dose rates. However, as described in NUREG-1609, Section 1.5.1.1 and guidance in SFST-ISG-20 regarding engineering drawings (pages 2-3) the package drawings, which the CoC will incorporate by reference, still need to include these components in order for the components to be considered as part of the package and to ensure the package configuration with those components is authorized by the CoC.

This information is needed to determine compliance with 10 CFR 71.33(a).

Holtec's Response to RSI 5.2

To address this comment, Table 7.1.2 of Chapter 7 is revised to more clearly indicate that the loading control parameters associated with the Type E waste package represent the case of a HI-STAR ATB 1T cask loaded directly with waste material, without the BFA-TANK or BTC described in this application. Other dunnage, as necessary for handling or positioning the waste package contents, may be loaded into the HI-STAR ATB1T cask along with the waste contents. Such dunnage shall be considered as part of the waste contents and are considered in the evaluation of the waste contents, but are not licensed components as they do not provide any safety function in the waste package. The following note is added to the Type E waste package description in Table 7.1.2:

The Type E waste package payload consists of its allowable radioactive contents and optional stainless steel dunnage. The dunnage may take various forms such as boxes, cans, stock plate/bar and various weldments.

The weight of both radioactive contents and dunnage must not exceed the maximum weight of contents specified in the Certificate of Compliance.

Because the dunnage associated with Type E package does not represent a licensed packaging component, engineering drawings are not required in this licensing application.

Other revisions to more clearly reflect the nature of the Type E package are made in the following sections of Chapter 7:

- Section 7.1 is revised to more clearly reflect the three allowable loading scenarios for the cask, including direct loading of material (Type E) which is designated Loading Scenario 3 (LS-3);
- Section 7.1.2.3 (Package Loading) is added to more clearly define LS-3;
- Section 7.2.2 (Package Unloading) is revised to include LS-3.

Section 1.1 of Chapter 1 and other miscellaneous references to the Waste Package Types throughout Chapter 1 are revised to reflect this clarification of the Type E waste package. Minor related editorial changes were made to Subsections 8.1.6 and 8.2.3 of the SAR.

NRC RSI 7.1

Provide operations descriptions addressing the following scenarios:

- a. Loading the package when loading of the BFA tank occurs when the BFA tank is not already within the ATB 1T cask (outer packaging),
- b. Loading of the BTCs for the possible loading sequences and configurations identified in the application.

Section 7.5.1.2, "Loading of Contents," of NUREG-1609, describes the minimum information that the package operations in the application should address in terms of package loading. Similar guidance is also given in NUREG/CR-4775, "Guide for Preparing Operating Procedures for Shipping Packages," Section 1.3, "Package Loading," which is in the chapter that addresses operating procedures in safety analysis reports. The BFA tanks and the BTCs are components of the package.

Thus, the package operations in the application should describe the essential elements of loading operations applicable to these components, consistent with guidance in SFST-ISG-20 regarding package operations descriptions. This includes appropriate operations descriptions that address the different configurations and sequences identified or considered in the application for package loading, such as those identified in this RSI question. Including these descriptions will ensure the package is operated and will perform consistent with the technical analyses in the application and in compliance with relevant regulatory requirements.

This information is needed to determine compliance with 10 CFR 71.35(a) and 71.87.

Holtec's Response to RSI 7.1

To provide comprehensive descriptions of all package operations, Section 7.1.2.2 is revised to describe the process of loading the package when the BFA tank has already been loaded with the BTC, which may have been previously performed using either the HI-STAR ATB 1T Cask or similar equipment. General controls and processes for the loading of waste material into BTCs or directly into the cask are added to Subsections 7.1.2 and 1.2.4.