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

October 22, 2019

Mr. Luis Hinojosa
Holtec International
1 Holtec Blvd.
Camden, NJ 08104

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE MODEL NO. HI-STAR 180D PACKAGE

Dear Mr. Hinojosa:

By letter dated April 25, 2019, Holtec International submitted an amendment request for Certificate of Compliance No. 9367, for the Model No. HI-STAR 180D package. The U.S. Nuclear Regulatory Commission staff (the staff) performed an acceptance review of your application and accepted your application for a detailed technical review on June 11, 2019 (Agencywide Documents Access and Management Accession No. ML19163A109).

In connection with our technical review, we need the information identified in the enclosure to this letter. We request that you provide this information by November 30, 2019. If you are unable to meet this deadline, you must notify us in writing no later than November 15, 2019, of your new submittal date and the reasons for the delay. The staff will then assess the impact of the new submittal date and notify you of a revised schedule.

Please reference Docket No. 71-9367 and EPID L-2019-LLA-0088 in future correspondence related to this request. If you have any questions regarding this matter, I may be contacted at (301) 415-7505.

Sincerely,

/RA/

Pierre Saverot, Project Manager
Spent Fuel Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9367
EPID L-2019-LLA-0088

Enclosure: Request for Additional Information

SUBJECT: REQUEST FOR SUPPLEMENTAL INFORMATION FOR THE REVIEW OF THE MODEL NO. HI-STAR 180D PACKAGE, DOCUMENT DATED:

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Request for Additional Information
Holtec International
Docket No. 71-9367
Model No. HI-STAR 180D Package

By letter dated April 25, 2019, Holtec International (Holtec) submitted an amendment request for Certificate of Compliance No. 9367, for the Model No. HI-STAR 180D package.

This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission staff (the staff) in connection with its review of the Model No. HI-STAR 180D package application to confirm whether the applicant has demonstrated compliance with regulatory requirements.

The requested information is listed by chapter number and title in the package application. NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel," was used for this review.

1- GENERAL INFORMATION

1-1 Provide the American National Standard Institute (ANSI) N14.5-2014 definition of leaktight on Page G-4 of the application.

On Page G-4 of G-9 of the application, the definition of leaktight does not match the definition of leaktight in ANSI N14.5-2014.

This information is needed to determine compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) 71.51(a)(1) and (2).

1-2 Remove the following two paragraphs from Chapters 7 and 8, respectively, of the application.

"The text matter and data presented in this chapter in bold font (or as otherwise noted) are an integral part of the Certificate of Compliance (CoC) of the package and cannot be altered without NRC's approval through a license amendment. Moreover, essential elements and criteria in Section 7.0 through Section 7.3, essential elements and criteria in Appendix 7.A and the whole of Appendix 7.D have been identified as conditions of the CoC."

"The text matter and data presented in this chapter in bold font (or as otherwise noted) are an integral part of the Certificate of Compliance (CoC) of the package and cannot be altered without NRC's approval through a license amendment. Moreover, essential elements of the acceptance tests In Section 8.1 and of the maintenance program in Section 8.2 have been identified as conditions of the CoC."

The above two paragraphs are inconsistent with Condition 6 of the CoC that states:

"In addition to the requirements of Subpart G of 10 CFR Part 71:
(a) The package shall be prepared for shipment and operated in accordance with Chapter 7 of the application.

(b) The package shall meet the acceptance tests and be maintained in accordance with Chapter 8 of the application."

Therefore, based on Condition 6 of the CoC, any change to Chapters 7 or 8 necessitates NRC staff's approval.

This information is needed to determine compliance with 10 CFR 71 Subpart G and Condition 6 of the CoC.

2- STRUCTURAL AND MATERIALS EVALUATION

2-1 Clarify the set pressure of the neutron shielding pressure relief devices in the licensing drawings.

Holtec Licensing Drawing 8545, "HI-STAR 180D Cask," contains Note 16 which states the maximum set pressure of the neutron shielding pressure relief devices is 35 psig. Note 16 describes that the set pressures of the devices will be lower, if needed, to avoid overstressing neutron shielding cover plates.

Note 16 of the drawing provides no indication of how the lower set pressures would be determined. Calculation 25 of Structural Calculation Package HI-2125252, Rev. 10 and Table 2.1.1 of the application show that several neutron shielding cavities would be overstressed if pressures where allowed to reach 35 psig. The drawing note should more specifically identify the set pressures for the neutron shielding pressure relief devices.

This information is needed to determine compliance with 10 CFR 71.51(a).

2-2 Regarding the impact limiter material properties:

- Revise Section 8.1.5.2 to identify the minimum critical properties of the impact limiter material, as defined in Table 2.2.10 of the application. Otherwise, provide the pertinent drawing (Drawing 8552 per Table 1.5.1 of the application), which identifies all the critical properties of the impact limiter, as defined in Table 2.2.10 of the application.

- Revise Section 8.1.5.2 of the application to identify the standardized method to be followed for characterizing the crush strength of the impact limiter material, and clarify that the minimum critical characteristics, as listed in Table 2.2.10 of the application, incorporate the uncertainties and errors associated with the standardized method.

- Provide reference 2.2.11 in justification of the minimum critical characteristics of the impact limiter material, as defined in Table 2.2.10 of the application.

The minimum critical properties of the impact limiter material are not identified in Chapter 8, which is referred to in CoC condition 6(b). Per the application, critical characteristics of a material are those attributes that have been identified, in the associated material specification, as necessary to render the material's intended safety function.

The staff notes that the method for obtaining these minimum critical properties is not defined, and that the application is unclear on whether the uncertainties/errors of the characterization method are adequately accounted in the minimum critical properties of the impact limiter. The test results in reference 2.2.11 would serve to provide a basis for these properties and the associated uncertainties.

The information is needed to determine compliance with 10 CFR 71.31(c).

2-3 Justify the applicability of the mechanical properties in Table G.1 of Holtec Report No. HI-2125251, Revision 8 (dated March 3, 2019) to the ASTM B29 lead grade/composition used in the transportation package

The finite element analyses of the package do not support that the assumed mechanical properties for the lead material are applicable to the specific lead grade used in the transportation package, as defined in Drawing 8545, Revision 7. These properties were obtained from a different reference than the one cited in Table 2.2.11 of the application.

The information is needed to determine compliance with 10 CFR 71.33(a)(5)(i).

2-4 Reconcile the property values for Holtite-B, as listed in Table 8.1.1 of the application, with those listed in the Holtite B Sourcebook.

The property values for Holtite B in Table 8.1.11 of the application (minimum bulk density, minimum hydrogen density) are different from those listed in Table 1.2 of the Holtite B Sourcebook (Document No. HI-2167314, Revision 5). As these are requirements per CoC condition 6(b), it is important that the minimum values and associated tolerances, if any, be clearly defined.

The information is needed to determine compliance with 10 CFR 71.33(a)(5)(ii).

2-5 Justify the removal of the visual inspection requirement for the representative friction stir weldment specimen from condition 6(b) in the revised CoC.

The requirement for visual inspection, defined in the current CoC, was removed by the applicant without a justification.

The information is needed to determine compliance with 10 CFR 71.33(a)(5)(ii).

2-6 Clarify the intent of the reflooding action described in Section 2.6.1.3.5 of the application, “Re-flood Event.”

Section 2.6.1.3.5 was revised to discuss and reference analyses to demonstrate the integrity of fuel rod cladding inside the HI-STAR 180D cask during a reflood event. The discussion and referenced analyses do not specifically refer to the packaging unloading operations discussed in Section 7.2 of the application. Therefore, it is unclear as to whether reflooding during loading operations is considered in the application.

The information is needed to determine compliance with 10 CFR 71.33(b)(3).

2-7 If a reflooding action may occur prior to transport (in response to RAI 2-6), justify that reflooding will not result in adverse changes to undamaged fuel contents.

The consequences of reflooding to fuel material exposed to water and steam does not appear to be addressed in the application. More specifically, the application should address the potential interaction of water and steam with fuel material through non-gross ruptures in undamaged fuel (i.e., hairline cracks and pinholes).

The staff further notes that the application does not address potential changes to the cladding mechanical properties as a result of reflooding. Therefore, if reflooding of the contents may occur prior to transport, the impacts to the assumed chemical and physical form of the contents should be addressed.

The information is needed to determine compliance with 10 CFR 71.33(b)(3).

2-8 If a reflooding action may occur prior to transport (in response to RAI 2-6), regarding the stress analyses of fuel rod cladding during cask cavity reflooding operations (Document HI-2146017, Revision 2, dated August 21, 2018):

- Provide a basis for the assumed rod internal pressure and the applicability to the allowable fuel contents of the transportation package.
- Provide a basis for the assumed mechanical properties of the cladding, and its applicability to the alloys and maximum average burnup in the allowable contents of the package.
- Describe experimental evidence or testing conducted in support of the stress analyses of the fuel rod cladding during reflooding operations.

The application includes a stress analysis of fuel rod cladding during cask cavity reflooding operations (Document HI-2146017, Revision 2, dated August 21, 2018). The basis for the assumed rod internal pressure is not provided in the analyses, nor a justification on whether the assumed pressure applies only to standard rods or also to integral fuel burnable absorber rods.

Further, the analyses do not provide a basis for the assumed mechanical properties of the cladding, and its applicability to the alloys and maximum average burnup in the allowable fuel contents (i.e., maximum assembly average burnup up to 55 GWd/MTU).

In addition, the analyses do not appear to be benchmarked or validated by any experimental data. Therefore, the conclusion that the classic shell theory solution or a finite element analyses are adequate approaches for assessing fuel rod stresses does not appear to be validated.

The information is needed to determine compliance with 10 CFR 71.33(b)(3).

3- THERMAL EVALUATION

3-1 Clarify that the application's changes in the proposed gaps were incorporated in the thermal normal conditions of transport and hypothetical accident conditions models and that the component temperatures reported in Chapter 3 and thermal calculation HI-2125241 reflect the updated gaps.

The Statement of Changes in the application mention that gaps and differential thermal expansions were revised (DI06, DI15, PC-9). Gap dimensions can impact thermal results, but it was not clear whether the reported results in Chapter 3 and calculation package reflect the gap changes. If the newly proposed gaps were not incorporated in the thermal models, then updated results should be provided for the review.

This information is needed to determine compliance with 10 CFR 71.43(f) and 71.51(a).

3-2 Discuss the impact of the Holtite-B decomposition by-products on the package's thermal performance.

Clarify that the decomposition by-products of Holtite-B (mentioned in DI-11 of Summary of Changes) does not impact package performance, including generation of flammable decomposition by-products during NCT and HAC and the potential for additional thermal input due to combustion during the thermal hypothetical accident condition.

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

3-3 Provide the decay heat axial profiles (chart or table) for the actual decay heat profile (current amendment) and the profile based on the linear-dependent burn-up.

DI13 mentions a change in the decay heat axial profile in HI-2125241 Revision 5 thermal calculation but there was little description provided in Section 7.8.2, "Relationship between the burnup profile and the distribution of the decay heat".

This is relevant considering that item 11 (bottom of page in Chapter 3) states "… the overall package heat transfer through the top end of the package is a fraction of that heat transfer through the entire package."

This information is needed to determine compliance with 10 CFR 71.33 and 71.43(f).

3-4 Clarify that the gap associated with the attachment of the finned enhanced surface was considered in the thermal model presented in Appendix F of the thermal calculation HI-2125241.

The results from Appendix F indicate that the fins result in a reduced surface temperature, compared to a bare surface. However, it was not clear that the gap that formed with the attachment of the finned surface was considered.

If not modeled, the size of a gap should be incorporated in the thermal models because this would impact the results.

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

3-5 Clarify that the enhanced Holtite-B with a new composition does not result in changes to the thermal-related package performance, including density, specific heat, thermal conductivity, maximum and minimum allowable temperatures, and thermal/radiolytic decomposition (e.g., flammable gap generation).

Changes in material composition often result in property changes and corresponding performance changes, but there was no justification to demonstrate there would be no changes. This is especially relevant considering the Holtite-B temperature during normal conditions of transport is slightly below its allowable temperature.

This information is needed to determine compliance with 10 CFR 71.33 and 71.43(d).

3-6 Clarify how the thermal models used to calculate Time-to-Boil time limits would be demonstrated to be the same or consistent with the models used in the safety analyses.

Page 7.0-2 of the application mentions that FLUENT 3D models "consistent" with the application may be used to determine Time-to-Boil time limits. However, no criteria were presented to demonstrate that models utilized are the same or consistent with the models used in the safety analyses. One criterion of the demonstration would be to benchmark the model with the results presented in Table 3.3.6.

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

4- CONTAINMENT EVALUATION

4-1 Provide justification for the temperature limits for the Technetics seal design with a silver jacket material and update Chapter 3 of the application to reflect any changes in seal temperature limits. In addition, clarify if there are any chemical, galvanic, or other reactions due to the Technetics seal jacket material change.

Proposed change DI 11 refers to a seal design featuring a silver jacket material, instead of aluminum, for the HI-STAR 180D Technetics seals. For the staff to evaluate this type of change, a justification is necessary to verify any change in seal temperature limit.

Material compatibility is necessary to ensure there are no significant chemical, galvanic, or other reactions among the packaging components, or between the packaging components and the packaging contents.

This information is needed to determine compliance with 10 CFR 71.43(d), 71.51(a)(1) and (2).

5- SHIELDING EVALUATION

5-1 Clarify the lead slump assumptions in the dose rate evaluation.

On page 5.1-3 of the application, the applicant states: "To model the lead slump as a result of the hypothetical accident conditions, the lead in the bottom lead shield is reduced in the radial direction by 6.35 cm, and in axial direction by 2 mm. These are conservative values since in reality no lead would be removed from the base plate."

The applicant needs to include details on where the slump was applied to in the calculation of the external dose rate (side, top and bottom) and justify that these assumptions are appropriate.

For example, for a drop on the cask's side, a reduction in the radial thickness of the radial shield on one side is conceivable and the reduction of lead shield would increase HAC dose rates in the radial direction. Therefore, this physical phenomenon should be applied to one side as it creates a streaming path at the bottom and dose rates are evaluated near this streaming path.

From the application, it appears that the applicant has chosen to reduce the radial thickness of the bottom plate, equally on either side. However, the staff does not have

enough information to determine how this was done nor if such a reduction is conservative.

This information is needed to determine compliance with 10 CFR 71.51(a)(2).

7- OPERATING PROCEDURES

7-1 Clarify step 7.1.2.2.3 of the application to include torque requirements provided in Table 7.1.1 of the application.

Step 7.1.2.2.3 of the application describes that the containment boundary outer closure lid access port plug is fitted with a new seal and closed; however, it does not describe that torque requirements are provided in Table 7.1.1 of the application. See step 7.1.3.1.e of the application for comparison.

This information is needed to determine compliance with 10 CFR 71.43(c), 71.51(a)(1) and (2).

8- ACCEPTANCE TESTS AND MAINTENANCE

8-1 Clarify Sections 8.1.4 and 8.2.2 of the application to specify an American Society for Nondestructive Testing (ASNT) nondestructive testing (NDT) Level III in leak testing.

An ASNT NDT Level III specifically in leak testing, should write and approve the detailed leakage rate testing procedures for each package.

This information is needed to determine compliance with 10 CFR 71.51(a)(1) and (2).

8-2 Provide justification for, or alternatively revise the factor of 1.86 in Note 1 of Table 8.1.1 of the application.

Based on Section B.15.13, “Example 13,” of ANSI N14.5-2014, for 1.0×10^{-7} ref-cm^3/s, air, the equivalent helium leakage rate at the same reference conditions is 1.85×10^{-7} atm-cm^3/s, helium, rather than 1.86×10^{-7} atm-cm^3/s, helium.

This information is needed to determine compliance with 10 CFR 71.51(a)(1) and (2).