Request for Additional Information
Holtec International
Docket No. 71-9373
Model No. HI-STAR 190 Package

By letter dated August 7, 2015, Holtec International (Holtec, or the applicant) submitted an application for Certificate of Compliance No. 9373, Revision No. 0, for the Model No. HI-STAR 190 package. Staff issued a request for supplemental information dated October 1, 2015, and a request for additional information (RAI) letter dated April 8, 2016. Holtec provided RAI responses by letter dated August 19, 2016.

This second RAI letter identifies information needed by the U.S. Nuclear Regulatory Commission staff (the staff) in connection with its review of the Model No. HI-STAR 190 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.

Chapter 2 – Materials Evaluation

2-1 Justify the adequacy of the proposed sampling process using MIL-STD-105 for reasonably demonstrating that MPCs, with degraded conditions exceeding surface defects equal to or greater than 2mm depth, will be identified prior to transport.

In response to RAI 2-8, dated April 8, 2016, the applicant stated that the MPC enclosure vessel shell shall undergo a surface defect inspection prior to shipment to ensure that existing defects and flaws do not develop into cracks during hypothetical accident conditions of transport. The applicant further stated that this inspection may be conducted on the population of MPCs at an Independent Spent Fuel Storage Installation (ISFSI) using a statistical testing approach suggested in Military Standard MIL-STD-105E (1989) titled "Sampling Procedures and Tables for Inspection by Attributes". The applicant clarified that not every MPC at a given ISFSI requires inspection.

However, the applicant did not provide a basis for the adequacy of the proposed standard guide for reasonably demonstrating that MPCs, with degraded conditions exceeding the proposed acceptance criteria, are adequately identified prior to transport.

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

2-2 Revise the application to include the referenced engineering evaluation (technical bases) in response to RAI 2-10 regarding the radiation hardness of the elastomeric seals.

In response to RAI 2-10, dated April 8, 2016, the applicant stated: "Holtec has performed an engineering evaluation to establish bounding maximum service life limits for the

elastomeric seals used in HI-STAR 190. A maximum replacement duration based on the evaluation is added to SAR table 8.2.1. SAR Sections 2.2.3, and 8.2.3.6 are updated to include discussions of elastomeric seals." The referenced engineering evaluation is not cited in the revised application.

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

2-3 Revise the application to require inspection of MPCs loaded with high burnup fuel (HBF). Revise the application to require MPCs loaded with HBF in their initial storage period to also be inspected for unacceptable defects due to age-related degradation.

In response to RAI 2-10, dated April 8, 2016, the applicant revised the application to require that MPCs containing HBF *and* stored beyond the duration of the initial 20-year storage period under the provisions of 10 CFR Part 72 shall undergo an MPC enclosure vessel shell surface defect inspection prior to shipment, according to Appendix 7.B. The application, however, does not provide a technical basis that assures MPCs loaded during the initial 20-year storage period will be free of defects exceeding the proposed 2mm depth acceptance criterion.

Therefore, the staff expects that the proposed surface defect inspections will also be performed in MPCs loaded with HBF per a justified sampling process irrespective of their storage period, i.e., MPCs loaded under their initial storage period (up to 20 years per current CoC 1032 and CoC 1040) as well as those under any renewed storage period (beyond 20 years up to 60 years).

This information is required to determine compliance with 10 CFR 71.55(e), 71.73 and 71.85(a).

2-4 Revise the application to remove all referencing to a ductile-to-brittle transition temperature for the various zirconium-based cladding contents, and clarify that the proposed licensing basis relies on defense-in-depth analyses assuming justified cladding failure and fuel reconfiguration.

The proposed technical basis for a ductile-to-brittle transition temperature (DBTT), as discussed in response to RAI 8-2, is inadequate and insufficient. The discussion does not support adequate DBTTs with reasonable confidence, e.g. demonstrate with 95% confidence that the proposed DBTT values bound the 95th percentile of the DBTT statistical distribution in the reviewed data.

Further, the applicant's conclusion that "M5® cladding studies show that due to low hydrogen absorbed content the alloy keeps a significant residual ductility and it is expected that the DBTT for M5 alloy will be bounded by DBTT reported for Zircaloy" is inconsistent with the existing database of ring compression testing of M5®.

The staff, however, notes that an approach using DBTT test data is not required if safety analyses are performed assuming fuel reconfiguration based on 3% and 100% (or a justified %) cladding failure for normal conditions of transport and hypothetical accident conditions, respectively [see draft Regulatory Information Summary - ADAMS Accession No. ML14175A203]. These analyses are already part of the application per Table 1.2.4 of the application, "Multi-Layered Approach for Transport Safety for HBF." Therefore,

the DBTT discussion is not necessary per Enclosure 2, "High Burnup Fuel Transportation Licensing Approach," of the draft RIS.

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

Chapter 3 - Thermal Evaluation

3-1 Revise the convergence index (GCI) calculation using non oscillating results from the different grids to demonstrate that they are in the asymptotic region. Show that an order of accuracy larger than 1 can be used to obtain the GCI.

Section 3.3.1.6 of the SAR states that "*It is demonstrated in the GCI calculation that the calculated peak cladding temperatures are in the asymptotic region for the simulation series.*" However, the staff examined the results provided in calculation package (Holtec Report HI-2146286) and observed the calculated results are oscillating. Therefore, oscillating results can't be used to demonstrate asymptotic convergence. Procedures to demonstrate asymptotic convergence are provided in American Society of Mechanical Engineers Verification and Validation 20-2009 (ASME V&V 20-2009), "Standard for Verification and Validation in Computational Fluid Dynamics and Heat Transfer". Also an order of accuracy larger than one (equal to the calculated value) can be used to obtain the GCI as long as the criteria specified in ASME V&V 20-2009 are met: "*A minimum of four grids is required to demonstrate that the observed order p is constant for a simulation series. A three-grid solution for the observed order p may be adequate if some of the values of the variable φ predicted on the three grids are in the asymptotic region for the simulation series.*" Otherwise first order of accuracy should be used in the GCI calculation. The staff needs this information to evaluate the accuracy of the discretization error and its impact on predicted thermal results.

This information is required to determine compliance with 10 CFR Part 71 (71.71 and 71.73)

Chapter 5 – Shielding Evaluation

Refer to proprietary enclosure.

Chapter 7 – Package Operations

7-1 Revise Chapter 7, "Package Operations", of the application to clarify that the user must confirm that the analyzed configuration of stored high burnup fuel has been maintained throughout the renewed storage period of the MPC prior to transport in the Model No. HI-STAR 190 package.

The application assumes that the configuration of HBF stored in an MPC during a renewed storage period (i.e. 20-60 years) has been maintained. Although age-related degradation of the fuel is not expected to compromise the configuration of the fuel during the renewed storage period, an Aging Management Program (AMP) is expected to be in place for providing confirmation to this effect (refer to Appendices B and D in NUREG-1927, Rev. 1).

Therefore, prior to transport in the Model No. HI-STAR 190 package, the user would be expected to confirm that the general licensee implementing the approved HBF AMP has

not concluded that the analyzed configuration has been compromised during the renewed period of dry storage.

This information is required to determine compliance with 10 CFR 71.55(e), 71.73 and 71.85(a).