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

March 23, 2016

Ms. Kimberly Manzione, Licensing Manager
Holtec International
Holtec Center
One Holtec Drive
Marlton, NJ 08053

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION – APPLICATION FOR AMENDMENT NO. 3 TO CERTIFICATE OF COMPLIANCE NO. 1008 FOR THE HI-STAR 100 DRY CASK STORAGE SYSTEM

Dear Ms. Manzione:

By letter dated September 25, 2015, as supplemented on January 15, 2016, Holtec International (Holtec) submitted a request to the U.S. Nuclear Regulatory Commission to amend Certificate of Compliance No. 1008 for the HI-STAR 100 Dry Storage Cask System.

The staff has determined that further information is needed to complete its technical review. The request for additional information (RAI) is in the enclosure. Your response should be provided by April 29, 2016. If you are unable to meet this deadline, please notify us in writing, at least one week in advance, 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. 72-1008 and TAC No. L25060 in future correspondence related to this request. If you have any questions regarding this matter, I may be contacted at (301) 415-0606.

Sincerely,

/RA/

Jose R. Cuadrado, Project Manager
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 72-1008
TAC No. L25060

Enclosure: Request for Additional Information

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Request for Additional Information

Docket No. 72-1008
Certificate of Compliance No. 1008
Amendment No. 3 to the HI-STAR 100 Dry Cask Storage System

By letter dated September 25, 2015, as supplemented on January 15, 2016, Holtec International (Holtec) submitted an application to amend Certificate of Compliance (CoC) No. 1008 for the HI-STAR 100 Dry Cask Storage System.

This request for additional information (RAI) identifies additional information needed by the NRC staff in connection with its review of the amendment application. The requested information is listed by topic and/or page number in the application and associated documentation. NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems" was used by the staff in its review of the application.

Each individual RAI section describes information needed by the staff to complete its review of the application and to determine whether the applicant has demonstrated compliance with the regulatory requirements.

3.0 Structural Evaluation

3-1 Provide an evaluation that demonstrates that storage of the HI-STAR 100 overpack in a horizontal orientation meets structural performance requirements under normal, off-normal, and credible accident conditions.

The staff has determined that the application does not contain sufficient information to demonstrate that storage of a loaded HI-STAR 100 overpack in a horizontal orientation meets the structural performance requirements in 10 CFR Part 72 under normal, off-normal, and accident conditions. The applicant should provide the evaluations to demonstrate that a loaded HI-STAR 100 overpack in the horizontal orientation properly considers normal, off-normal, and accident conditions, including natural phenomena and man-made events.

This information is necessary to meet the regulatory requirements of 10 CFR 72.236(l).

4.0 Thermal Evaluation

4-1 Provide clarification regarding the fuel transfer conditions temperature limit for moderate burnup fuel (MBF). In addition, provide clarification regarding the repeated thermal cycling fuel applicability and operating restrictions.

Section 4.0, #2 of the application states, “For fuel transfer conditions the fuel cladding temperature should be maintained below 570°C (1058°F) for MBF.” In contrast, ISG 11 Rev. 3 states, “For all fuel burnups (low and high), the maximum calculated fuel cladding temperature should not exceed 400°C (752°F) for normal conditions of storage and short-term loading operations (e.g., drying, backfilling with inert gas, and transfer of the cask to the storage pad). However, for low burnup fuel, a higher short-term temperature limit may be used, if the applicant can show by calculation that the best estimate cladding hoop stress is equal to or less than 90 MPa (13,053 psi) for the temperature limit proposed.” Therefore it is not clear to the staff how the fuel transfer conditions for MBF should be maintained below 570°C (1058°F) for MBF, but rather should be maintained below 400°C (752°F) to assure integrity of the cladding material.

The top of page 2.0-3 of the application states, “iv. For HBF (High Burn-up Fuel), operating restrictions are imposed to limit the maximum temperature excursion during short-term operations to 65ºC (117ºF) and the number of excursions to less than 10.” In contrast, ISG 11 Rev. 3 states, “During loading operations, repeated thermal cycling (repeated heatup/cooldown cycles) may occur but should be limited to less than 10 cycles, with cladding temperature variations that are less than 65°C (117°F) each.” Therefore it is not clear to staff how this only applies to high burn-up fuel, but should apply to all fuel to assure integrity of the cladding material. It is also not clear what specific operating restrictions in the technical specifications are being referred to and how the operating restrictions ensure the cladding temperature variations are less than 65°C (117°F) each and limited to less than 10 cycles.

This information is necessary to meet the regulatory requirements of 10 CFR 72.122(h)(1), 72.122(l), 72.236(m).

4-2 Demonstrate that Metamic material properties are thermally bounded by Boral® material properties.

Section 4.2 of the application states, “The neutron absorber materials Boral® and Metamic are both made of aluminum powder and boron carbide powder. Although their manufacturing processes differ, from a thermal standpoint, their ability to conduct heat is virtually identical. Therefore the values of conductivity of the original neutron absorber (Boral®) continue to be used in the thermal calculations.” Table 4.2.1 of the application states that the thermal conductivity, density, and heat capacity of Boral® and Metamic are from test data, but it is not clear from this table how the values of Boral® are bounding. Also, a reference was given for the Metamic Sourcebook (Reference 4.2.11 of the application), but no year was provided for this reference, therefore it is not clear what specific values are being referenced, how the properties are thermally bounded by Boral®, or if those specific values have already been approved by NRC staff.

This information is necessary to meet the regulatory requirements of 10 CFR 72.236(b) and (f).

4-3 Provide discussion and results of the thermal analysis for the HI-STAR 100 for the MPC-32 during normal, off-normal, and accident storage conditions which addresses the peak cladding temperature and SSCs maximum temperatures, maximum pressure, and maximum thermal stresses. The associated thermal analysis input and output files should also be provided. This analysis should consider all fuel and cladding types, boundary conditions, and the thermal interaction among casks in an array.

It is not clear from the discussion provided in Chapter 4 of the application how the thermal analysis for the vertically oriented HI-STAR 100 MPC-68 during storage is bounding for the vertically oriented HI-STAR 100 MPC-32 during storage. The similarities and differences between the 1) HI-TRAC transfer cask with the HI-STORM 100 from Rev. 2 of the FSAR and the 2) HI-STAR 100 from this application, as well as the similarities and differences for the MPC-32 and MPC-68 within 1) and 2) and between 1) and 2) were not described in the application.

The complexity of these systems does not lend themselves to this type of comparison and a thermal analysis for the vertically oriented MPC-32 in the HI-STAR 100 needs to be provided. In addition, contents with stainless steel cladding are part of CoC No. 1008 Appendix B, Amendment 3. Ensure it is clearly described in Chapter 4 of the application that the thermal analysis specifically addresses each cladding type, or how the thermal analysis is bounding for all fuel and cladding types described in CoC No. 1008 Appendix B, Amendment 3. Also, the thermal analysis should consider all boundary conditions and the thermal interaction among casks in an array. Therefore, the staff cannot make a safety determination based on the limited information provided and the lack of thermal analysis.

This information is necessary to meet the regulatory requirements of 10 CFR 72.236(f).

4-4 Describe in Section 4.2 of the application how the heat conduction elements in the MPC-32 impact the heat transfer.

In Section 4.2 of the application the footnote * states, “In MPC-32, aluminum heat conduction inserts are optional equipment available by user request.” Also, Section 4.4.1.1.10 of the application states, “Due to the high thermal conductivity of aluminum alloy 1100 (about 15 times that of Alloy X), a significant rate of heat transfer is possible along thin flexible plates.” It is not clear how the lack of heat conduction elements in the MPC-32 canister impacts the heat transfer and as a consequence the peak cladding temperature and SSC maximum temperatures.

This information is needed to meet the regulatory requirements of 10 CFR 72.236(f).

4-5 Clarify the discrepancy between the decay heat values referenced in Section 4.4.2.1 of the application and Table 1.2.2 of the application.

Section 4.4.2.1 of the application states, The MPC-68 bounds the MPC-32, both of which have nearly identical decay heat loads (21.4 kW for the MPC-68 and 21.25 for the MPC-32, a difference of only 0.7%).” The decay heat provided in Table 1.2.2 of the application is 18.5 kW for the MPC-32 and MPC-68 in vertical orientation.

This information is needed to meet the regulatory requirements of 10 CFR 72.236(f).

4-6 Address the following regarding the forced helium dehydration system:

a. Section 4.4.2 of the application refers to the design criteria in the HI-STORM 100 technical specifications, yet this application is for the HI-STAR 100.

b. Section 4.4.3 (iii.) of the application refers to subsections 4.4.1.1.1 through 4.4.1.1.4, confirm if those sections are accurate and if those sections are for this application.

It is not clear if the technical specifications and subsections referenced are accurate for the HI-STAR 100 application.

This information is needed to meet the regulatory requirements of 10 CFR 72.236(f).

4-7 Provide justification for the accident design pressure limit of 200 psig in the application.

The design pressure limit was 125 psig and has been revised to 200 psig.

This information is needed to meet the regulatory requirements of 10 CFR 72.236(b).

4-8 Provide discussion and results of the thermal analysis that includes the maximum temperatures, pressures, stresses, associated limits, time-to-boil, etc. for the HI-TRAC transfer cask and of the MPCs and contents while in the HI-TRAC transfer cask. The associated thermal analysis input and output files should also be provided.

Section 1.2.1.4 of the application states, "MPC handling operations are performed using a HI-TRAC transfer cask of the HI-STORM 100 System (Docket No. 72-1014). The HI-TRAC transfer cask allows the sealed MPC loaded with spent fuel to be transferred from the HI-STORM Overpack (storage-only) to the HI-STAR Overpack, or vice versa.," therefore the discussion and the results of the thermal analysis that includes the maximum temperatures, pressures, stresses, associated limits, time-to-boil, etc. for the HI-TRAC transfer cask and of the MPCs and contents while in the HI-TRAC transfer cask should be addressed in the application for normal, off-normal, and accident conditions.

This information is needed to meet the regulatory requirements of 10 CFR 72.236(f).

4-9 Address the following regarding the HI-STAR 100 in horizontal orientation:

a. Provide design drawings, description, etc. for the structure that will maintain the HI-STAR 100 location and horizontal orientation during storage.

b. Provide discussion and results of the thermal analysis for the HI-STAR 100 in horizontal orientation during normal, off-normal, and accident storage conditions which addresses the peak cladding temperature and SSCs maximum temperatures, maximum pressure, and maximum thermal stresses. The associated thermal analysis input and output files should also be provided. This analysis should consider the structure to maintain the location and horizontal orientation, all fuel and cladding types, as well as the thermal interaction among casks in an array. The boundary conditions should be completely described and be valid for the structure used to maintain the HI-STAR 100 location and horizontal orientation during storage.

The design details for the structure to maintain location and horizontal orientation of the cask have not been provided in the application. It is not clear from the discussion provided in Chapter 4 of the application how the thermal analysis for the HI-STAR 100

for transportation is bounding. In addition, contents with stainless steel cladding are part of CoC No. 1008 Appendix B, Amendment 3. Ensure it is clearly described in Chapter 4 of the application that the thermal analysis specifically addresses each cladding type, or how the thermal analysis is bounding for all fuel and cladding types described in CoC No. 1008 Appendix B, Amendment 3. The thermal analysis should consider any structure used to maintain the location and horizontal orientation of the HI-STAR 100, as well as the thermal interaction among casks in an array. It is not clear from the application if horizontal and vertically oriented casks will be mixed. Therefore, the staff cannot make a safety determination based on the limited information provided and the lack of thermal analysis.

This information is necessary to meet the regulatory requirements of 10 CFR 72.236.

5.0 Confinement Evaluation

5-1 Clarify the certification level of the personnel developing/approving the helium leakage rate testing procedures considering that industry standards indicate that this should be performed by qualified personnel.

The applicant described the leakage tests in FSAR Sections 8.1.6 without identifying the certification level of the personnel developing/approving the helium leakage rate testing procedures. For example, ANSI/ASNT CP-189-2006, “Standard for Qualification and Certification of Nondestructive Testing Personnel”, states that a nondestructive testing personnel Level III examiner has the qualifications to develop and approve written instructions for conducting the leak testing.

This information is needed to meet the regulatory requirements of 10 CFR 72.236(e).

5-2 Identify the helium leak rate testing acceptance criteria for the MPC vent and drain port cover plates in the Technical Specifications.

FSAR Section 8.1.6 and Table 9.1.1 both reference that helium leak rate testing shall be performed on the vent and drain port cover plate to MPC lid field welds and the cover plate base metals and that the MPC helium leakage rate test acceptance criteria are defined in the Technical Specifications. The Technical Specifications only identify limits for the overpack helium leak rate and do not identify the MPC helium leak rate test acceptance criteria.

This information is needed to meet the regulatory requirements of 10 CFR 72.236(e).

6.0 Shielding Evaluation

6-1 Provide shielding analyses that demonstrate that the 32/24 scaling of MPC-24 cask external dose rates for the MPC-32 is conservative for PWR fuel storage in the HI-STAR 100 System.

In Section 5.3.3 of the UFSAR, the applicant states that a simple 32/24 scaling of external dose rates for the MPC-24 in the HI-STAR 100 cask system is adequate to determine conservative external dose rates for the MPC-32 in the HI-STAR 100. The applicant should provide a shielding analysis demonstrating that this approach is conservative. Additionally, the applicant should provide a side-to-side comparison of loading criteria for the MPC-24 and MPC-32. This comparison should demonstrate that assuming each fuel assembly in the MPC-32 has the same source term as each fuel assembly in the MPC-24 is appropriate for determining a bounding external dose rate of the MPC-32 in the HI-STAR 100 system.

This information is necessary to meet the regulatory requirements of 10 CFR 72.104, 72.106, and 72.236(d).

6-2 Provide the minimum distance required for various configurations of the most bounding MPC that results in a dose rate below 25 mrem per year.

Provide the calculations necessary to show the annual dose to an individual from a single cask and various arrays of casks does not exceed 25 mrem per year. The applicant only demonstrated this requirement for the MPC-24. Since the MPC-32 will have the bounding external dose rate, per Section 5.3.3, the applicant should revise the site boundary dose rate calculations to consider the MPC-32, or otherwise demonstrate that the current calculation is conservative.

This information is necessary to meet the regulatory requirements of 10 CFR 72.104, 72.106, and 72.236(d).

6-3 Provide and justify the acceptable fuel characteristics of stainless steel clad fuel for storage in the MPC-32.

Table 1.2.1 for the SAR states the MPC-32 can have up to 32 intact zircaloy or stainless steel clad PWR fuel assemblies. Tables 2.1.11 and 5.2.18 of the SAR only list the design characteristics of the stainless steel clad fuel assemblies for the MPC-24 and MPC-68. Furthermore, Table 5.4.14 of the SAR only lists the dose rates of the overpack for the design basis stainless steel clad fuel for the MPC-24 and MPC-68 canisters.

This information is necessary to meet the regulatory requirements of 10 CFR 72.104, 72.106, and 72.236(d).

11.0 Accident Analyses Evaluation

11-1 Provide additional explanation regarding why the partial blockage of the MPC basket flow holes is not credible for each basket type (e.g. MPC-24, MPC-68, and MPC-32).

In Section 11.2.4 of Rev. 3 of the HI-STAR 100 application, the partial blockage of the MPC basket flow holes was a credible accident for the MPC-24 and MPC-68 baskets. In

Section 11.2.4 of Rev. 4 of the HI-STAR 100 application, the inclusion of the MPC-32 basket was also requested. But it is not clear how this type of accident was determined to be not credible for each basket type.

This information is necessary to meet the regulatory requirements of 10 CFR 72.236(f).

11-2 Revise the vertically-oriented and horizontally-oriented thermal analysis in Section 11.2.13.2 of the application to address the environmental temperature of 125°F.

The vertically-oriented analysis in Section 11.2.13.2 of the application summarizes that adding 45°F to temperature of analysis performed at 80°F is also equivalent to performing an analysis at 125°F ambient. In addition, the horizontally-oriented analysis in Section 11.2.13.2 of the application summarizes that adding 25°F to temperatures of an analysis performed at 100°F ambient is equivalent to performing an analysis at 125°F ambient. This methodology does not necessarily result in accurate or bounding temperature results and is not an appropriate methodology for analyzing the off-normal ambient temperature of 125°F. For example, Section 4.8.4 of NUREG-2174, “Impact of Variation in Environmental Conditions on the Thermal Performance of Dry Storage Casks, Draft Report for Comment,” shows an analysis where a 10°F increase in ambient temperature results in a 14.4°F increase in peak cladding temperature.

This information is necessary to satisfy the regulatory requirements of 10 CFR 72.236(f).

11-3 Provide additional details in Section 11.2.3.2 of the application based on the structure used to orient the cask horizontally to confirm that the fuel puddle for a horizontal cask is larger than the fuel puddle for a vertical cask.

Because details of the structure for horizontal orientation were not provided, it is not clear that the fuel puddle for a horizontally oriented cask will be larger than the fuel puddle for a vertically oriented cask. Therefore it is not clear if the fuel depth for a vertically oriented cask will be larger than that for a horizontally oriented cask, or if the fire duration will be larger for a vertically oriented cask.

This information is necessary to meet the regulatory requirements of 10 CFR 72.236(b) and (f).