April 15, 2008

Ms. Tammy Morin, Acting Licensing Manager
Holtec International
Holtec Center
555 Lincoln Drive West
Marlton, NJ 08053

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF THE CERTIFICATE OF COMPLIANCE NO. 9261, REVISION 6, FOR THE MODEL NO. HI-STAR 100 PACKAGE

Dear Ms. Morin:

By letter dated October 5, 2006, Holtec International (Holtec) submitted an application in accordance with 10 CFR Part 71 for an amendment to Certificate of Compliance (CoC) No. 9261 for the Model No. HI-STAR 100 package. NRC staff issued a request for additional information (RAI) by letter dated June 15, 2007. Holtec responded to that RAI by letters dated August 3, September 27, and October 5, 2007.

This revision focuses on the addition of the Model No. HI-STAR 100 designed for use at Humboldt Bay to the CoC. Other supporting changes are proposed, and an update to the cask identification to B(U)F-96 in accordance with 10 CFR 71.19(e) is requested.

In connection with our review of all information received to date, we need the information identified in the enclosure to this letter to continue with this review. Additional information requested by this letter should be submitted in the form of revised Safety Analysis Report pages. To assist us in scheduling staff review of your response, we request that you provide this information by May 2008. If you are unable to provide a response by that date, our review may be delayed.

A meeting to discuss each question with your staff, prior to submitting your responses, would be beneficial. Please call me to schedule a meeting if you would like.

Please reference Docket No. 71-9261 and TAC No. L24029 in future correspondence related to this request. The staff is available to meet to discuss your proposed responses. If you have any questions regarding this matter, I may be contacted at (301) 492-3339.

Sincerely,
/RA/

Kimberly J. Hardin, Senior Project Manager
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9261
TAC No. L24029

Enclosure: Request for Additional Information

Please reference Docket No. 71-9261 and TAC No. L24029 in future correspondence related to this request. The staff is available to meet to discuss your proposed responses. If you have any questions regarding this matter, I may be contacted at (301) 492-3339.

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Enclosure: Request for Additional Information

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OFC:	SFST	SFST	SFST	SFST	SFST	SFST
NAME:	KHardin	MDeBose	DTang	CInterrante	MCall	RParkhill
DATE:	3/21/08	3/25/08	3/26/08	4/15/08	3/25/08	3/21/08
OFC:	SFST	SFST	SFST	SFST	SFST	SFST
NAME:	NJordan	CRegan	MWaters	LCampbell	RNelson	
DATE:	4/1/08	3/31/08	3/24/08	3/26/08	4/15/08	

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Request for Additional Information
Holtec International
Docket No. 71-9261
Certificate of Compliance No. 9261
Model No. HI-STAR 100 Package

By application dated October 5, 2006, as supplemented August 3, September 27, and October 5, 2007, Holtec International (Holtec or the applicant) requested an amendment to Certificate of Compliance (CoC) No. 9261 for the Model No. HI-STAR 100 package. This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission staff in connection with its review of the application. The requested information is listed by chapter number and title in the applicant's Safety Analysis Report (SAR). NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel," was used by the staff in its review of the application.

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

Technical Specifications (TS)

TS-1. Verify the number of 6x6D assemblies containing rods with maximum initial enrichments of 5.5 wt.%.

The applicant indicates that only two of these 6x6D assemblies may be loaded in the HI-STAR HB (see note 14 of Table A.3 in Appendix A to the CoC). However, Table 3.1-2 of the Humboldt Bay (HB) ISFSI FSAR indicates there are four such assemblies. Table A.3 of Appendix A of the CoC and Table 1.I.4 of the SAR should be updated as necessary.

This information is needed to confirm compliance with 10 CFR 71.33(b).

TS-2. Justify the proposed limit of 1 kg of stainless steel for stainless steel clad fuel debris in a HB damaged fuel container (DFC).

The applicant has proposed to limit the amount of stainless steel in a HB DFC to 1 kg. The basis for this limit is not clear. Further, the practicality of ensuring compliance with this proposed limit is also not clear. The applicant should establish a limit that is based upon such considerations as the amount of stainless steel clad fuel debris known/estimated to be at the HB plant and the ability to ensure compliance with the limit as well as consistency with the limits given in the HB ISFSI license and technical specifications. Analyses in the SAR should support whatever limit is established for this material.

This information is needed to confirm compliance with 10 CFR 71.33(b) and 71.35.

Chapter 2 Structural Review

NOTE: Holtec proprietary Report, HI-2073743, “Benchmark the LS-DYNA Impact Response Prediction Model for the HI-STAR Transportation Package Using the AL-STAR Impact Limiter Test Data,” presents the LS-DYNA approach to modeling the free-

drop rigid body impact response for the HI-STAR family of transportation packages, including the HI-STAR HB. The staff evaluated the report and documents for the issues for which the attached proprietary additional information is needed to complete the review listed as questions 2-1 through 2-11. Recognizing that long lead-time may potentially be needed to resolve the issues, the staff will review other justifiable methods, if proposed, for determining rigid-body decelerations for the HI-STAR HB cask. As discussed in the review below in questions 2-1 through 2-4, this includes, but is not limited to, model similitude analyses for applying the Appendix 2.A differential equation method, which is based on the impact limiter drop tests of a ¼-scale HI-STAR 100 package, to the HI-STAR HB with identical impact limiter configurations except for aluminum section crush strengths.

2-1 Refer to Drawing 5014-C1765, Sheet 3 of 7 (Revisions 13 and 13a). Perform an analysis by using the Appendix 2.A differential equation method or other justifiable means to support the Note 3 design change statement, “As an option for HI-STAR 100, aluminum section Types 2 and 5 may be replaced in full by 1,420 psi (NOM.) uni-directional material.”

Drawing 5014-C1765, Sheet 6 of 7 (Revision 12), depicts the previously approved crush strengths of 700 psi (uni-directional) and 2300 psi (cross core) for the aluminum section Types 2 and 5, respectively. Sheet 3 of 7 (Revision 12) depicts that, for the top impact limiter, six (6) Type 5 and ten (10) Type 2 interior sections are used. As displayed in Sheet 7 of 7 (Revision 12), all sixteen (16) aluminum honeycomb sections are of Type 2 construction for the bottom impact limiter. The staff notes that the proposed optional strength of 1,420 psi for the Type 2 sections is much higher than the previously approved 700 psi. As such, the optional crush strength may potentially result in higher cask decelerations, which must be shown to remain bounded by the design bases, including the 60 g for the bottom end HAC drop test.

This information is needed to confirm whether the package design and contents complies with 10 CFR 71.35(a) requirements.

2-2 Refer to Drawing 5014-C1765, Sheet 6 of 7 (Revision 13a). Perform an analysis by using the Appendix 2.A differential equation method or other justifiable means to support the proposed design changes of revising the previously approved (Revision 12) and recently documented/proposed (Revisions 13, 13a) crush strengths for all Types 1, 2, 3, 4, and 5 aluminum sections for the HI-STAR 100 transportation package.

The staff notes the design changes for the aluminum section crush strengths as follows.

Section Type	Proposed Strength (psi) Rev. 13a	Appr'd/Docum'd Strength (psi) Revs. 12, 13

Type 1 (outer)	780	700
Type 1 (inner)	1,940	1,700
Type 2	780	700
Type 3	2,500	2,300
Type 4A	2,500	2,300
Type 4B	1,230	1,100
Type 5	2,500	2,300

It's unclear what evaluations were performed to justify the crush strength design changes to ensure that the resulting cask free-drop cask decelerations remain to be bounded by the previously established design bases for HI-STAR 100, including the 60 g for all HAC drop orientations.

This information is needed to confirm whether the package design and contents complies with 10 CFR 71.35(a) requirements.

2-3 Refer to the August 3, 2007, response to the Request for Additional Information, Q 1-1. Verify the statement made on the optional aluminum section crush strengths, "[A]s part of the LAR, for the generic HI-STAR 100, a uniform arrangement of 1,455 psi crush strength material is added as an option….a similar option has been added to the licensing drawing for HI-STAR HB to use a material with uniform crush strength of 690 psi as seen on Drawing 5014-C1765 (Revision 13a), Sheet 3, Note 4."

The subject drawing identifies the optional crush strength of 1,420 psi, contrary to the 1,455 psi cited above, for the generic HI-STAR 100. Also, Note 4 is added to the Revision 13a drawing, Revision 13a, which identifies the optional crush strength of 800 psi, in lieu of 690 psi, for HI-STAR HB. The optional crush strengths noted in the drawings are different from those discussed in the RAI response.

This information is needed to confirm compliance with 10 CFR 71.7(a).

2-4 Considering the impact limiter crush strengths tabulated in Drawing 501-C1764, Sheet 1 of 7 (Revisions 13, 13a), provide calculations to show that the most damaging rigid body cask decelerations for the HI-STAR HB remain to be bounded by the design basis of 60 g for the HI-STAR 100 subject to the HAC drop tests.

The staff agrees with the Holtec assertion that HI-STAR 100 structural analysis results bound HI-STAR HB results for the same cask decelerations of 60 g. Hence, should the Appendix 2.A differential equation method be used for determining rigid body decelerations for the HI-STAR HB cask, justification must also be provided to demonstrate that the dynamic multipliers, Zs, which were originally determined for HI-STAR 100, are appropriately reduced for the HI-STAR HB application.

This information is needed to confirm whether the package design and contents complies with 10 CFR 71.7(a) and 71.35(a).

2-5 Justify that the spent fuel inspection performed by PG&E at the Humboldt Bay ISFSI, adequately characterizes fuel defects and damage to the degree needed to ensure that fuel condition for transportation is known and that the fuel will not reconfigure during transportation.

10 CFR 71.33(b)(3) requires that the chemical and physical form of the content be specified. 10 CFR 71.55(d)(1) and (2) requires that under normal conditions of transport that: 1) the contents will be subcritical, and 2) the geometric form of the packaging content would not be substantially altered. Furthermore, 10 CFR 71.55(b) requires the system to stay subcritical under the most reactive credible configuration and with the cask fully moderated. Based on the lack of reactor records at Humboldt Bay indicating that the fuel assemblies were intact and the inability of the exterior four sided visual examination performed by PG&E to determine if the internal rods of the assembly are grossly beached or have had a weakening of the cladding due to an interaction of the pool water and the UO_2 material, there is inadequate assurance that the condition of the fuel is known and that the cited requirements can be satisfied without appropriate measures taken to load the fuel as damaged per the proposed SAR definition.

A revised definition of an undamaged fuel assembly, for example: all the exterior rods in the assembly visually being shown to be intact while the interior rods being of unknown condition, as allowed by the latitude in ISG-1 Rev 2, may satisfy regulatory requirements with commensurate supporting analyses. For example, a criticality analysis would consist of addressing where assemblies with intact outer rods could potentially have multiple damaged fuel rods in the inner fuel rod positions. Additionally, a revised shielding analysis would need to demonstrate that this condition is bounded.

This information is needed to satisfy the criteria of 10 CFR 71.33 and 71.55.

Chapter 3 Thermal Review

3-1 Remove statements from the application that the thermal properties of Holtite-A won't change over time, or explain the changes and any resulting impact it would have on the Hi-Star 100 thermal analysis.

Staff expects that the performance of the periodic thermal test will continue to be included in the technical specifications unless or until additional testing described as follows have been performed. Holtite-A is a polymer and, as such, is typically susceptible to heat and radiation degradation. There is no direct correlation between the testing documented in the reports submitted by Holtec (see the referenced reports below) and providing assurance that the thermal conductivity of Holtite-A does not change with time. The physical properties monitored during the Holtec testing are not directly related to thermal conductivity. In addition, the tested samples should be exposed first to thermal aging and then to irradiation aging, to measure the combined effect, rather than aging the samples independently and only looking at the singular effect of aging (i.e., either radiation or thermal). As a result, the staff requests that Holtec perform testing to determine the time dependent effect of radiation and heat on the thermal conductivity of Holtite-A.

Reference reports:
1) "Holtite-A: Results of Pre- and Post- Irradiation Tests and Measurements," HI-2002420, Rev. 1, dated 4/8/03.

2) “Holtite-A Development History and Thermal Performance Data,” HI-2002396, Rev. 3, dated 4/10/03.

This information is needed to confirm whether the package design and contents complies with 10 CFR 71.33.

Chapter 6 Criticality Review

6-1 Revise Note 16 on Drawing Number 4103, Sheet 1, Revision 3, to ensure that, for two pieces, the combined free space at the top, bottom, and gap between the poison plate segments totals to no more than ¼ inch to assure proper control of the potential size of the gap between the two plate segments.

Section 6.4.13 states that during the manufacture of the spent nuclear fuel (SNF) basket, a maximum gap of ¼ inch is permitted between neutron absorbing plates.

This information is needed to confirm compliance with 10 CFR 71.55 and 10 CFR 71.59.

6-2 Use sufficiently conservative boron density assumptions to estimate K_{eff}. Provide additional justification supporting the conclusions presented in Section 6.4.14 which demonstrate that inhomogeneities of less than 8 cm in length in the neutron poison plates will not have an adverse effect on Keff.

It may be unreasonable to assume an area of a neutron poison plates that is deficient in boron is located adjacent to an area of a neutron absorber plates that exceeds the minimum required content. Similarly, it may be non-conservative to assume that each individual neutron absorber (plate or region) consists of alternating boron-rich and boron-poor regions. The latter assumption may be considered to be valid, however, if it can be demonstrated that the configuration is the most conservative.

Additionally, the analysis presented in Section 6.4.14 assumes that boron-poor regions of the neutron poison plates have no less than 80% of the minimum boron content. It is unclear why a boron-poor region in a METAMIC plate could not contain less than 80% of the minimum required boron, taking thinning into account.

This information is needed to determine compliance with 10 CFR 71.55(d)(1) and 10 CFR 71.55(e).

6-3 Revise Note 10 on Drawing Number 4103, Sheet 1, Revision 3, to explicitly prohibit poison plates with manufacturing damage and (or including) weld-related or any other damage greater than the equivalent of a 1” diameter hole in each panel. Provide a note consistent with Note 16 of this same drawing.

This information is needed to confirm compliance with 10 CFR 71.55 and 71.59.

6-4 If it is possible to load more than the specified number of fuel rods (2) with an initial maximum rod enrichment greater than that stated in Table A.3 (≤ 4.0 wt.%), revise the criticality analyses to address loading more than two of these fuel rods as either intact or damaged rods. (See question TS-1.)

This information is needed to confirm compliance with 10 CFR 71.55 and 71.59.

Chapter 7 Package Operations

7-1 Revise the descriptions of package operations in Chapter 7 of the SAR as follows:

a. Revise Step #2 of Section 7.1.3.1 to have the receipt inspection of the MPC and removal of road dirt/debris and any foreign material performed prior to the other activities described in this step. The activities should be described in the sequence in which they are to be performed; the current text does not do this.
b. Include language in Step #1 of Section 7.1.5 that states leak testing will also be done after de-tensioning one or more overpack lid bolts, the drain port, or the vent port plug to be consistent with the conditions for which testing is required in Step #6 of Section 7.1.4.
c. Change the ALARA note on page 7.2-1 to discuss the HI-STAR 100 and not the HI-STAR 60.
d. Remove Section 7.I.1.1.2 from the SAR. This section for operations with the HI-STAR HB refers to Section 7.1.3.2 (dry loading), which the applicant deleted in response to the staff's previous RAI.
e. Add the description that pocket trunnions, if present and not in use, are plugged to meet 10 CFR 71.87(h) in Section 7.1.5.

This information is needed to confirm compliance with 10 CFR 71.87.

Chapter 8 Acceptance Tests and Maintenance Program

8-1 Revise the acceptance tests for the neutron shielding in Section 8.1.5.4 of the proposed amendment to include the shielding effectiveness tests in Section 8.1.5.2 of the currently approved SAR.

The current amendment proposes to use the radiological surveys performed in Chapter 7, "Operating Procedures" prior to transport to constitute acceptance tests for the neutron shielding material. This proposal does not meet the purpose of acceptance tests, as the pre-shipment radiological surveys only ensure that the Part 71 dose rate limits are met for a particular shipment. Acceptance tests verify that the as fabricated neutron shielding performs, for approved contents, as designed. This verification involves comparison of dose rate measurements for a given contents with the values calculated for the same contents and would be performed prior to the first shipment. The shielding effectiveness tests described in Section 8.1.5.2 of the currently approved SAR fulfill the purpose of acceptance tests. Further guidance regarding shielding acceptance tests is contained in NUREG/CR-3854, "Fabrication Criteria for Shipping Containers."

This information is needed to confirm compliance with 10 CFR 71.85(c).

8-2 Revise Section 8.2.4 of the “Maintenance Program” for shielding to include Condition 6.(b)(6) of the currently approved CoC for periodic verification of the neutron shield integrity.

The current amendment proposes to use the pre- and post-transport radiological surveys, conducted as part of Chapter 7, “Package Operations,” to demonstrate continued shield integrity and efficacy. However, these Chapter 7 radiological surveys only ensure the package meets the Part 71 dose rate limits for a particular shipment. The maintenance tests should verify that the neutron shield performs as designed for approved contents, which verification involves comparison of dose rate measurements for given contents with values calculated for the same contents. This verification also accounts for potential degradation of the Holtite-A neutron shield during the service life of the package. The tests in the currently approved CoC Condition 6.(b)(6) fulfill the purpose of maintenance tests for shielding.

This information is needed to confirm that the maintenance program is adequate to assure that packaging effectiveness is maintained throughout the packaging’s service life to ensure continuing compliance with 10 CFR Part 71, Subpart E.