

October 12, 2010

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

SUBJECT: REVISION NO. 8 OF CERTIFICATE OF COMPLIANCE NO. 9261 FOR THE
MODEL NO. HI-STAR 100 PACKAGE

Dear Ms. Morin:

As requested by your application dated February 5, 2010, supplemented on August 11 and September 30, 2010, enclosed is Certificate of Compliance No. 9261, Revision No. 8, for the Model No. HI-STAR 100 package. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471. This approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471.

If you have any questions regarding this certificate, please contact me or Pierre Saverot of my staff at (301) 492-3408.

Sincerely

/RA/

Eric J. Benner, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9261
TAC No. L24418

Enclosures: 1. Certificate of Compliance
No. 9261, Rev. No. 8
2. Safety Evaluation Report
3. Registered Users

cc w/encls 1 & 2: R. Boyle, Department of Transportation
J. Shuler, Department of Energy
Registered Users

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SAFETY EVALUATION REPORT

Docket No. 71-9261
Model No. HI-STAR 100 Package
Certificate of Compliance No. 9261
Revision No. 8

SUMMARY

By letter dated February 5, 2010, supplemented on August 11 and September 30, 2010, the applicant submitted an amendment request to the U.S. Nuclear Regulatory Commission for Certificate of Compliance No. 9261. The applicant requested significant changes to the Model No. HI-STAR 100 package, namely the incorporation of Metamic as an approved neutron absorber material for all currently approved generic MPC models, and the redesign of the AL-STAR impact limiter non-backbone components.

NRC staff reviewed the application using the guidance in NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel." Based on the statements and representation in the application, as supplemented, the staff concludes that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

EVALUATION

The applicant updated licensing drawings with various proposed design changes and one-time manufacturing deviations for both generic and Humboldt Bay (HB) specific licensed equipment. The applicant incorporated Metamic® as an approved neutron absorber material option to Boral® for all currently approved generic Multi Purpose Canister (MPC) models and specified a minimum B-10 loading.

The applicant also redesigned the AL-STAR impact limiter non-backbone components and corrected an error in the call-out of the thread patterns for the impact limiter attachment bolt and the attachment holes in the HI-STAR 100 overpacks.

The applicant presented five proposed changes relevant to the structural performance of the Model No. HI-STAR 100 package and its variant the HI-STAR 100 HB. The five proposed changes are as follows:

- (1) Change the arrangement of the impact limiter crush material to support the use of a single type of aluminum honeycomb material rather than the currently licensed arrangement which requires four types of aluminum honeycomb.

This change, which does not apply to the HB variant, is summarized in (i) the licensing drawings by showing the new arrangement of crush material in the impact limiter (this change is not applicable to HI-STAR HB Impact Limiters), (ii) in Section No. 2.3.1.5 of the application which has been modified and Table 2.3.7 has been

added to reflect the revised minimum crush strengths for the HI-STAR 100 Impact Limiters (the minimum crush strength values for HB impact limiters remain unchanged but are also reflected in Table No. 2.3.7 of the application), and (iii) is evaluated in a new Appendix 2.C of the application which includes an LS-DYNA evaluation of the modified HI-STAR 100 impact limiter in accordance with previously approved USNRC methodology and approach (namely Model No. HI-STAR 60 package, Docket No. 71-9336 and Model No. HI-STAR 180 package, Docket No. 71-9325).

The reason for such changes is that using impact limiter sections made of materials with uniform crush strength removes complexity from the design and also allows for more flexibility during fabrication resulting in enhanced product quality. The required technical justifications and acceptance criteria are provided in the application.

Staff requested that the applicant clarify the licensing drawings which depict the layout and crush orientation for the single type of aluminum honeycomb (bi-directional). The applicant made the requested changes to the drawings to include both the HI-STAR 100 impact limiters as well as the HI-STAR HB impact limiters. Staff finds these clarifications adequate.

Staff also requested that the applicant provide (i) representative input and output files for the 9-meter end drop and the 9-meter slapdown, (ii) overlay plots of the deceleration time histories for the original impact limiter design and the updated impact limiter design, and (iii) additional justification that the change in impact limiter aluminum honeycomb will not adversely affect the performance of the impact limiter or ancillary structures.

Staff reviewed the representative input files as well as the deceleration time history overlay plots and found them credible. Specifically, the overlay plots showed that the revised impact limiter aluminum honeycomb arrangement reasonably predicted both the shape and the peak deceleration of the deceleration time history.

Staff also found that the additional justification for this change provided by the applicant reasonably demonstrated that this change will have no discernable effect on the ability of the impact limiter to perform its safety function. Specifically, the applicant demonstrated that the fundamental design, including the steel backbone, of the impact limiter is unchanged and the shimming requirements are the same as those for the previous version of the design.

The requirements of 10 CFR 71.33, and 10 CFR 71.73(c)(1) are satisfied.

(2) Addition of optional basket supports.

This change is evaluated in Section No. 2.6.1.3.1 of the application and is justified for fabrication flexibility for enhanced product quality. Optional basket supports and optional fuel spacers are added to the design of the MPC. These options are shown in more detail on the licensing drawings, are discussed in Section No. 2.6.1.3.1, and the evaluations summarized in Table No. 2.6.8 of the application show that the safety factors for the optional design of the basket supports are above 1.0 under normal conditions. Table No. 2.7.4 also shows the safety factors for the optional design of the basket supports are above 1.0 under accident conditions.

The optional fuel spacer design, using I-beam construction, is stronger than the tubing construction; therefore the safety factors for the tubing design bound the I-beam design.

Staff has reviewed this change, including verification of supplemental calculations, and finds the applicant's conclusions credible. The requirements of 10 CFR 71.71(c)(7) and 10 CFR 71.73(c)(1) are satisfied.

- (3) Removal of HB Damaged Fuel Can (DFC) lifting evaluation from Appendix 2.B (Table 2.B.1) and addition of a revised lifting evaluation of the HB DFC to Section No. 2.1.5.4 of the application. The reason for this change is that the DFC for Humboldt Bay is specifically designed for use at Humboldt Bay and is not the same as the DFC for Dresden. The lifting of the loaded DFC for Humboldt Bay is performed with a special tool that engages the slots on the top ring of the DFC (slots only accessible with DFC lid removed). Therefore the safety evaluation has been updated to support the actual operation/method implemented to lift the DFC for Humboldt Bay.

Staff has reviewed this change, including verification of supplemental calculations, and finds the applicant's conclusions credible. The requirements of 10 CFR 71.45(a) are satisfied.

- (4) Addition of Section 2.1.6.1.1 – Manufacturing Deviations.

The applicant added this section in Supplement 2.1 of the application to address manufacturing deviations with respect to 5 of a total of 54 closure bolt lids for the Model No. HI-STAR HB package. The applicant found that the usable thread length provided by these 5 bolts is less than the minimum specified length on the licensing drawing.

The applicant reanalyzed the in service condition limiting the torque values to a maximum of 750 ft-lbs on the 5 non-conforming bolts and torqued the remaining 49 bolts per the original design requirements (Table No. 7.1.1 of the application). The applicant concluded that:

- (i) The preload associated with the 49 conforming (fully threaded) bolt hole locations was sufficient to maintain the seal function for both Normal Conditions and Accident Conditions.
- (ii) The thread engagement for the 5 non-conforming hole locations is sufficient to meet ASME, Section III, Subsection NB stress limits for a torque of 750 ft-lbs.

Staff has reviewed this change, including verification of supplemental calculations, and finds the applicant's conclusions credible. The requirements of 10 CFR 71.71 and 10 CFR 71.73 are satisfied.

- (5) Addition of accident evaluation results from the analysis of the HB DFC when subjected to a 60 g loading.

The applicant performed an analysis of the HB DFC as summarized in Supplement 2.I of the application for a 60g end drop under accident conditions to demonstrate that the structural performance was consistent with that described in Appendix 2.B of the application.

Staff has reviewed this change, including verification of supplemental calculations, and finds the applicant's conclusions credible. The requirements of 10 CFR 71.73 are satisfied.

The applicant made a modification on the lid of the Multi-Purpose Canister (MPC). Note 1 on sheet 4 of licensing drawing No. 3923 states that the MPC lid may be fabricated from one or two pieces, where the bottom piece may be made either of stainless steel or carbon steel, where the carbon steel will be coated with stainless steel. A structural evaluation determined that this change to the MPC lid is acceptable and in compliance with the requirements of 10 CFR 71.73(c)(1).

The amendment permits the use of a cross core aluminum honeycomb, with no uni-directional material in the impact limiters. The cross core aluminum honeycomb is made of epoxy-bonded 5052 aluminum alloy. The highest temperature of the honeycomb material under normal conditions of transport is 179°F. Testing of the impact limiting materials was performed in 1998 by Holtec to verify the performance of the material up to 80°C (176°F). 179°F is the highest temperature of the honeycomb in the impact limiter, not the average temperature. In light of the marginal difference in peak temperatures indicated, the staff considered that a three-degree difference in Fahrenheit will have a negligible effect on the average properties of the epoxy-bonded aluminum honeycomb. The thermal properties of 5052 aluminum alloy used in the honeycomb were linearly extrapolated above 400°F. The thermal analysis, however assumes that under accident conditions the impact limiting honeycomb will have the thermal conductivity of 5052 alloy, with no void space, which is extremely conservative. Therefore the staff finds that the thermal properties of 5052 alloy above 400°F used in the application are acceptable and that the thermal analysis conducted to demonstrate compliance with 10 CFR 71.73(c)(1) will not be affected. No changes were made to the acceptance program listed in Section 8.1.5.3 for the honeycomb material. The acceptance program for the honeycomb was previously approved.

The applicant incorporated Metamic aluminum / boron carbide composites as neutron absorber material for all currently approved generic MPC models. The staff has previously approved the use of Metamic® in the Model No. HI-STAR 60 package described in the application, Revision 2, dated May 15, 2009. The qualification program for Metamic is detailed in EPRI Document 1003137, "Qualification of METAMIC® for Spent-Fuel Storage Application," and in Holtec Report, "HI-2043215, Revision 2, "Sourcebook for Metamic Performance." The staff considers that the acceptance program for the Metamic neutron absorbers was adequately described in Section 8 of the application, and is consistent with the acceptance program for the Model No. HI-STAR 60 package, with minor editorial changes. The licensing drawings permit minor deviations (1/32" over a length of no more than 12") from the design width of the panels. The criticality analysis provided to the staff demonstrates that these deviations will have a minimal affect on k_{eff} , therefore the staff finds there is no safety issue regarding these deviations with regards to 10 CFR 71.55(d)(1) and 71.55(e). The thermal conductivity of Metamic bounds that of Boral and will not have a significant effect on the overall thermal performance of the package.

The amendment clarifies the procedure steps to mitigate hydrogen burn/ignition during welding/cutting of the MPC lid to shell weld. Hydrogen monitoring of combustible gas prior to and during these operations is required.

The amendment specifies that the area beneath the MPC lid will be vented/exhausted or purged with inert gas prior to and during welding. This is to minimize the amount of combustible gas underneath the MPC lid before and during welding. The staff finds this clarification acceptable as required by 10 CFR 71.43(c).

The staff has reviewed the packaging materials and structural performance under the normal conditions of transport as well as hypothetical accident conditions, and concludes that there will be no substantial reduction in the effectiveness of the package. Specifically, the staff concludes that the packaging has adequate structural integrity to satisfy the subcriticality, containment, shielding, and temperature requirements of 10 CFR Part 71.

The staff reviewed the package application dated February 5, 2010, supplemented August 11 and September 30, 2010, in support of the amendment request and determined that the documentation was available and complete.

Changes to Certificate of Compliance

The following changes have been made to the Certificate:

Condition No. 5.(a)(3) was updated to include the latest revisions of all licensing drawings.

Condition No. 12 was revised to authorize use of the previous revision of the certificate for a period of approximately one year.

No new Condition was added to the Certificate. The expiration date of the Certificate was not changed. The consolidated application Revision No. 15, dated October 11, 2010, which consists of the February 5, 2010, application and its supplements, supersedes all previous revisions of the application and was included in the References Section.

CONCLUSION

Based on the statements and representations contained in the application, as supplemented, and the conditions listed above, the staff concludes that the design of the Model No. HI-STAR 100 package has been adequately described and evaluated. The staff concludes that the changes indicated do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9261, Revision No. 8,
on October 12, 2010.