June 15, 2007

Mr. Stefan Anton, 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 Mr. Anton:

By letter dated October 5, 2006, the U.S. Department of Energy (DOE) 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.

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 July 31, 2007. If you are unable to provide a response by that date, our review may be delayed.

I would like to stress that most of the requested information is clarifying in nature and should not require detailed technical responses. Accurate and complete responses to these questions should not require any further requests for information. 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, 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

Mr. Stefan Anton, Licensing Manager
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Docket No. 71-9261
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Enclosure: Request for Additional Information
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DATE	6/13/07		6/13/07		6/15/07	

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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 January 31, 2007, the U.S. Department of Energy (DOE or the applicant) requested an amendment to Certificate of Compliance 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 determine whether the applicant has demonstrated compliance with regulatory requirements.

Certificate of Compliance (CoC)

CoC-1 Delete the word "expected" and replace it with the word "possible" in the first sentence of the proposed definition of Damaged Fuel Assembly. Define those defects that are to be considered damaged and analyze them in the SAR.

Geometric rearrangement of the fuel needs to be prevented to assure the criticality safety of the package contents during all normal and hypothetical accident conditions. Furthermore, only pristine assemblies can be considered undamaged because the actual defects that might be considered damaged are not defined.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

CoC-2 Revise the entry under fuel type 7x7C in Table A.3 to specify an Initial Maximum Rod Enrichment for the majority of the fuel assemblies and, by exception, provide a footnote that only two fuel assemblies may have one rod each with an enrichment up to 5.5%.

This limitation on the number of fuel assemblies and fuel rods with uranium enrichments up to 5.5% is used by the applicant as a justification for not performing a separate criticality analysis for these two assemblies.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

Technical Specifications (TS)

TS-1 Remove paragraphs V.B ~ G of Table A.1 on page A-18 of the TS.

Paragraphs V.B ~ G of Table A.1 are also repeated on the succeeding page (page A-19) for the same MPC, the MPC-24EF, with the only modifications being the inclusion of other Trojan contents in the restriction to loading in damaged fuel canisters and specific basket cell locations. Thus, the listing of these paragraphs on page A-18 appears to be unnecessary.

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

TS-2 Verify the initial maximum rod enrichment for the 6x6D and 7x7C assembly arrays/classes listed in TS Table A.3.

Assembly arrays/classes 6x6D and 7x7C are the Humboldt Bay assemblies. The proposed TS indicate the initial maximum rod enrichments for these two assembly arrays/classes are 4.0 and 5.5 wt. % Uranium-235, respectively. However, the specifications given in Table 3.1-2 of the Humboldt Bay ISFSI FSAR indicate that there are some 6x6 assemblies that have rods with a maximum initial enrichment of 5.5 wt. % Uranium-235, which exceeds the limit in the proposed HI-STAR 100 TS. Thus it appears this limit for the 6x6D assembly array/class should be changed. Affected SAR analyses should also be adjusted to account for the correct maximum initial rod enrichments.

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

Chapter 1 General Information

1-1 On Drawing 5015-C1765, sheet 3, in Section 1.4, explain why the ten Type 2 and six Type 5 aluminum sections shown for the inner-layer honeycomb materials of the top impact limiter are not axisymmetrically proportioned.

The sixteen aluminum sections appear to have been assembled in an arbitrary manner, which could result in potentially biased impact limiter performance. This is contrary to the general practice of configuring impact limiters with axisymmetric material crush strength.

Complete and accurate information must be provided in the application in accordance with the 71.7(a) requirements.

1-2 Provide the correct summary table as reference in the next to last sentence in the first full paragraph on page 1.2-14.

The text cited makes reference to a table summarizing the target wt. % of boron in the poison absorbers but the table referenced does not contain this information.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

1-3 Provide note 1 for Table 1.I.6 of the proposed amended SAR.

The title of Table 1.I.6 includes a parenthetical reference to a note 1. However, there is no note 1 accompanying the table.

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

1-4 Clarify whether 24 or 28 damaged fuel assemblies may be loaded in the MPC-HB when loaded into the MPC using the peripheral loading pattern.

Table 1.I.1 states that up to 24 damaged fuel assemblies may be loaded in peripheral basket cells while the remaining basket cells are loaded with intact fuel. However, Table 1.I.7 indicates that up to 28 damaged fuel assemblies may be loaded in the peripheral cells with the remaining cells containing intact fuel. Thus, there is an inconsistency. TS Table A.1 also indicates the number is 28.

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

1-5 Update SAR Tables 1.2.23 and 1.2.24 to indicate the minimum initial enrichment for BWR assembly arrays/classes 6x6A, 6x6C, 7x7A, and 8x8A has been changed from 1.8 wt. % to 1.45 wt. % of Uranium-235.

SAR Tables 1.2.23 and 1.2.24, including the notes attached to the tables, continue to indicate that the minimum initial enrichment for the 6x6A, 6x6C, 7x7A, and 8x8A assembly arrays/classes is still 1.8 wt. %. However, the amendment proposes to change the minimum enrichment to 1.45 wt. % and provides analysis that supports this change. Thus, these tables should be consistent with the remainder of the SAR and the proposed amendment.

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

1-6 Specify in General note 6 to Drawing No. 4103, sheet 1 the 'applicable codes' that govern the NDE techniques and acceptance criteria.

General note 6 of proposed Drawing No. 4013 makes a statement that the NDE techniques and acceptance criteria for weld examinations on the MPC-HB basket are 'provided in the applicable codes.' This statement appears to be unnecessarily vague in reference to the governing codes for weld examinations. The staff notes that the drawings for the other MPC baskets specify that the NDE techniques and acceptance criteria are governed by ASME Sections V and III. Thus, it appears that the same statement should be included in the general notes for the MPC-HB basket.

This information is needed to confirm compliance with 10 CFR 71.31(c).

1-7 Specify the neutron absorber material for which the Boron-10 areal density is given in note 1 of Drawing No. 4103, sheet 2.

The proposed Drawing No. 4103, sheet 2 has a note, note 1, that states a Boron-10 areal density for the neutron absorber. However, the absorber material to which this applies is not specified. According to proposed change number 4, in the list of proposed amendment changes, the only absorber material used in the absorber plates in the

MPC-HB is Metamic. Thus, the drawing note should specify the neutron absorber as Metamic. The same change is necessary for Table 1.I.2 of the SAR as well.

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

1-8 Clarify whether Metamic may also be used as a neutron absorber in the MPC-68F.

Drawing No. 3928 describes the BWR MPCs, the MPC-68/68F/68FF. In addition to the minimum Boron-10 areal density for Boral, an areal density was added for Metamic; however, the Metamic specification is listed for only the MPC-68 (see note 6, Drawing No. 3928, sheet 2). Thus, it would seem that Metamic may only be used in the MPC-68. If Metamic is to be used in the MPC-68F, the minimum Boron-10 areal density for Metamic in this MPC basket should also be specified in the drawing. Note that, the poison plate specification must be consistent with the criticality analysis.

This information is needed to confirm compliance with 10 CFR 71.33(a), 71.55 and 71.59.

1-9 Justify the change in the annular seal given in SAR Section 1.2.2.1 in the description of loading operations.

The amendment proposes to change the description of the annular seal used to prevent contact of spent fuel pool water with the MPC shell during loading operations. The currently approved SAR states that an inflatable seal is used. However, the amendment proposes to remove the word 'inflatable' to describe the seal. The reason for this change is not explained and does not seem to be a part of any of the other changes proposed in the amendment. Staff also notes that there still remains some text in this section of the SAR that describes the seal as an inflatable seal.

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

1-10 Modify the proposed definition of 'critical characteristic' to include the following text: "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 function."

The term 'critical characteristic' was also added in License Amendment Request (LAR) 3 of the HI-STORM 100 cask system. The additional text requested in this RAI is the same as was found necessary for the definition of this term in the HI-STORM 100 LAR. Inclusion of this additional text will provide consistency between the HI-STORM 100 and HI-STAR 100 systems as well as ensure the ability of the HI-STAR component materials to perform their intended function as designed.

This information is needed to confirm compliance with 10 CFR 71.31(b).

1-11 Refer to Figure 1.I.1. Add a licensing drawing to the application depicting the damaged fuel container and the spacer, as appropriate, for the Humboldt Bay SNF.

Similar details of Figure 1.I.1 to those for the Trojan damaged fuel container, a licensing drawing for the Humboldt Bay damaged fuel container must be provided.

Complete and accurate information must be provided in the application in accordance with the 71.7(a) requirements.

Chapter 2 Structural Review

2 -1 Refer to page 2.I-9, first paragraph. Submit necessary information, including correlation of the test and analytical data, the test report with drawings of the tested impact limiter, and appropriate benchmarking LS-DYNA analysis files, to demonstrate that the LS-DYNA finite element model of the cask structure and impact limiters is properly benchmarked for calculating rigid-body impact response.

Reference 2.I.7.1 of the application cites only the general purpose computer code, LS-DYNA, and no details on the finite element model benchmarking is available for review.

Complete and accurate information must be provided in the application in accordance with the 71.7(a) requirements.

2-2 Refer to page 2.I-9, second paragraph. For both the 1/4-scale impact limiter drop test model and the corresponding HI-STAR 100 package, submit calculations to show that dimensions and material densities of the cylindric bodies, which are used to model the MPC and its contents, have adequately been considered in simulating the rotatory mass moment of inertia effects on the rigid-body response of the package.

Proper simulation of the rotatory mass moment of inertia of the package is essential in calculating rigid-body decelerations for the slap-down drop tests.

Complete and accurate information must be provided in the application in accordance with the 71.7(a) requirements.

2-3 Refer to page 2.I-10, last sentence, second paragraph. Provide appropriate time-history plots in the application, including those for different drop orientations, to demonstrate adequate correlation between the test and calculated dynamic responses of the HI-STAR 100 model.

Appropriate time-history comparisons must be captured in the application to support the statement, “...the comparison of results for all drop tests demonstrates that the HI-STAR 100 Package response is appropriately captured by the LS-DYNA simulations through the entire strong response duration of the event.”

Complete and accurate information must be provided in the application in accordance with the 71.7(a) requirements.

2-4 Refer to page 2.I-11, second sentence, second paragraph. Provide an evaluation in the application to demonstrate that the HI-STAR 100 HB fuel basket is structurally adequate to withstand the 30-ft free-drop accidents, including the impact deceleration g-loads exerted concurrently in the basket axial and transverse directions.

For the 30-ft free-drops, structural performance of the HI-STAR 100 HB overpack appears to have been bounded by that evaluated of the HI-STAR 100 overpack for the design basis impact of 60 g. However, there appears no evidence that the application has evaluated the HI-STAR 100 HB fuel basket other than the postulated side impact of 60 g.

Complete and accurate information must be provided in the application in accordance with the 71.7(a) requirements.

Chapter 3 Thermal Review

3-1 Provide details of the heat shield mentioned in Table 3.I.5 and explain its purpose compared to the generic HI-STAR 100, which apparently does not utilize this heat shield feature. Add this information to the SAR.

The application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a basis for evaluation.

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

3-2 Explain the impact of using the higher emissivity for stainless steel plates contained in Table 3.2.4 on the hypothetical accident conditions (HAC) cladding temperatures. This table notes that the stated value is a lower bound value which may not be conservative for HAC. Add this information to the SAR.

The application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a basis for evaluation.

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

3-3 Provide the bases for the thermal properties of Holtite-A, including any aging effects from thermal or radiation degradation. Explain how any changes in the properties and HI-STAR thermal performance are considered in the thermal analyses.

Holite-A is a polymer and may be subject to heat and radiation degradation, including weight loss. The application requests the acceptance and periodic thermal tests to be removed as requirements in the proposed SAR.

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

Chapter 4 Containment Review

4-1 Provide an explanation for calculating leakage rates based upon content source terms in Chapter 4 of the SAR. Chapter 7, Step 7.1.4.6, associated with closure of the HI-STAR 100, requires leak testing to leak tight criteria defined in ANSI 14.5.

Leakage rate calculations, based on source term release projections, aren't required if leak testing to the leak tight criteria is performed. Therefore, the source term release rate calculations seem unnecessary and could be removed.

This information is needed to confirm compliance with 10 CFR 71.31(b).

4-2 State explicitly in Chapter 4 and Chapter 7 the assembly leak test sensitivity of 10E-3 std cm^3/sec.

Clarify in the SAR what the assembly leak test sensitivity value is exactly. The sensitivity could be based upon the specific content type and apply the ANSI 14.5 method of determining by 4200 times the reference leakage rate from the 1987 version of ANSI 14.5. This value may be more than 10E-3 std cm^3/sec.

This information is needed to confirm compliance with 10 CFR 71.31(b).

4-3 Update Reference 7.1.5 to quote the 1997 version of ANSI 14.5.

This information is needed to confirm compliance with 10 CFR 71.31(b).

Chapter 5 Shielding Review

5-1 Provide justification for the loading of fuel debris that consists of stainless steel-clad pellets in the MPC-HB proposed in TS Table A.1, paragraph VI, note 3.

The shielding analysis in the proposed amendment only addresses loading fuel clad with a zirconium based alloy (ZR-clad). It is not clear how the current analysis considers, or is applicable to, stainless steel-clad fuel. The justification should be both quantitative and qualitative, addressing such items as any restrictions on amount and/or allowable locations of the material, impact on dose rates (and dose rate profile), effect on the source term comparison in the current shielding analysis for the Humboldt Bay assemblies, and differences in burnup versus design-basis Humboldt Bay assemblies. Restrictions on the allowable quantity and storage location(s) in the MPC basket should also be clearly described in the TS (e.g., in note 3 of Table A.1, Section VI, of Appendix A to the CoC).

This information is needed to confirm compliance with 10 CFR 71.33(b), 71.47, and 71.51.

5-2 Confirm that the 14x14E Indian Point Unit 1 (IP1) assembly array/class was properly considered in the determination of the design-basis stainless steel-clad PWR assembly and that this consideration included the contribution of the assembly shroud.

The amendment proposes to change, in TS Table A.2, the cladding from ZR to stainless steel for the 14x14E assembly array/class. This assembly array/class consists only of IP1 fuel, which uses stainless steel cladding. Sections 5.2, 5.2.3, and 5.2.5.1 discuss the design-basis stainless steel-clad PWR assembly determination. Section 5.2 and Table 5.2.18 include the IP1 assembly in the discussion of the stainless steel-clad PWR assemblies. However, Sections 5.2.3 and 5.2.5.1 do not contain references to the IP1 assembly. Thus, it is not clear that the IP1 fuel assembly was considered in the determination of the design-basis stainless steel-clad PWR assembly. Further, staff notes that the IP1 assembly has a stainless steel shroud, which also contributes to the assembly's gamma source term and should be accounted for in the determination.

This information is needed to confirm compliance with 10 CFR 71.33(b), 71.47, and 71.51.

5-3 Justify using only a source term comparison (between Humboldt Bay fuel and design-basis BWR fuel) when the neutron shield of the HB version of the HI-STAR 100 overpack has a smaller thickness than that of the standard HI-STAR 100 overpack.

A review of the overpack drawings, Drawing Nos. 3913 and 4082, indicates that the minimum neutron shield thickness in the HI-STAR 100 HB is 0.3 inches less than the thickness of this shield in the standard HI-STAR 100 overpack. Thus, the shielding configuration differs between the contents being compared in the shielding analysis of SAR Section 5.I.3, which would seem to require performance of a dose rate calculation for the loaded HI-STAR 100 HB. Justification of using only the source term comparison should be quantitative as well as qualitative and include an assessment of the impact on the dose rates of the difference in neutron shield thickness.

This information is needed to confirm compliance with 10 CFR 71.47 and 71.51.

5-4 Verify the maximum dose rate reported for the package's external side surface for the MPC-68 in SAR Table 5.5.3.

The amendment proposes to include BWR assemblies with additional maximum burnup and minimum cool time and enrichment parameter combinations to the allowed contents. Some of these contents result in higher dose rates than the maximum dose rates reported in SAR Table 5.5.3. While the table has been updated to list the now highest dose rate on the package bottom surface, the side surface dose rate remains unchanged. This appears to be inconsistent with the results reported in SAR Table 5.4.9. SAR Section 5.5 indicates that the side dose rate is the maximum from dose point locations 1 ~ 4. Looking at the dose rates for these locations in SAR Table 5.4.9, BWR fuel with the proposed 20,000 MWD/MTU burnup and 7-year cooling time results in the highest dose rate for any of these four dose point locations. Therefore, it would appear that the package's external side dose rate reported in Table 5.5.3 is no longer the maximum dose rate and should be changed.

It is also unclear what burnup and cooling time combination for BWR fuel results in the side surface dose rate currently reported for the MPC-68 in Table 5.5.3. All the dose rates for locations 1 ~ 4 in Table 5.4.9 are much less than the dose rate reported in Table 5.5.3. Even accounting for the azimuthal variation in the dose rate does not seem to indicate which burnup and cooling time combination results in the side dose rate reported in the table. The derivation of the side dose rate reported in Table 5.5.3 from the dose rates reported in Table 5.4.9 should also be explained.

This information is needed to confirm compliance with 10 CFR 71.47.

5-5 Confirm that the shielding analysis accounts for the assembly hardware of the Humboldt Bay fuel.

Table 5.I.1 of the amendment does not show any description of the assembly hardware

for the design-basis Humboldt Bay assembly. However, a similar table in the Humboldt Bay ISFSI FSAR, Table 7.2-1, indicates that the assemblies have various hardware components of stainless steel and inconel. Some of these components contain greater amounts of cobalt impurities (due to larger mass of material and/or material of higher impurity level) than the respective hardware component of the design-basis assembly. Further, the shielding analysis for other HI-STAR 100 contents indicates that the contribution from the assembly hardware in the assembly's active fuel region was included in the fuel source term (see SAR Section 5.2.1). With no description of the Humboldt Bay assembly hardware provided in the Section 5.I analysis, it is not clear that the analysis appropriately accounts for this hardware.

This information is needed to confirm compliance with 10 CFR 71.33(b), 71.47 and 71.51.

5-6 Clarify the statement regarding the equivalence of the Boron-10 areal density and thickness of Boral and Metamic given at the top of SAR page 5.3-5.

In the statement (the third sentence), thickness (of the Boral and Metamic) is mentioned twice, once as the same and once as essentially the same. The meaning of what is being described is, therefore, not clear.

This information is needed to confirm compliance with 10 CFR 71.47 and 71.51.

5-7 Provide further explanation of the determination of the height of a reconfigured damaged fuel assembly.

The SAR states that the assemblies in damaged fuel containers are compacted 50% and that the result is a rubble height of 55 inches, reduced from an active fuel length of 77.5 inches for Humboldt Bay fuel. It is not clear, however, how this 50% compaction occurs and results in a height reduction of only 22.5 inches. Further, there is no explanation of how this amount of compaction was determined, nor is there justification as to why it is bounding. Staff notes that, depending upon the assumptions used, calculations may result in a much smaller rubble height and thus a higher gamma and neutron source per inch.

This information is needed to confirm compliance with 10 CFR 71.51.

5-8 Explain whether the source term comparisons in SAR Section 5.I include consideration of the fuel configuration in the MPC basket and justify the basis for how the configuration was considered in the comparisons.

Fuel assemblies stored in the outer MPC basket locations dominate the radial dose rates. Thus it appears that a shielding analysis that compares source terms for different contents should also account for the effects of the basket configuration. For example, if a comparison of source terms is made for assemblies in the outer MPC-HB basket locations (about 48, considering how the HI-STORM 100 SAR defines the outer basket locations for the MPC-68) loaded with 28 damaged assemblies under accident conditions and assemblies in the outer region of the MPC-68 basket (36 in number), the damaged Humboldt Bay assemblies have a greater impact on the source term per inch than in a comparison that includes the loaded MPCs' entire contents.

This information is needed to confirm compliance with 10 CFR 71.47 and 71.51.

5-9 Verify the fuel pellet density of the design-basis Humboldt Bay assembly in the shielding analysis.

SAR Table 5.I.1 lists the pellet density as 10.412 g/cm^3; however, the Humboldt Bay ISFSI FSAR Table 7.2-1 states the density is 10.3 g/cm^3. The density of the fuel affects the source term; a lower density results in a higher source term. Therefore, the appropriate fuel density should be used for generating the source terms.

This information is necessary to confirm compliance with 10 CFR 71.47 and 71.51.

5-10 Provide additional justification/analysis of the acceptability of loading design-basis damaged BWR fuel with the proposed specifications.

The applicant compares the total gamma source per inch and the total neutron source per inch of the proposed design-basis damaged BWR fuel with the respective source terms of the design-basis intact BWR fuel. This comparison is used to demonstrate the design-basis damaged BWR fuel is acceptable for loading in the MPC-68F. The staff performed a similar comparison of the gamma and neutron source terms on a per inch basis; however, the comparison was also made for each energy group of the source terms. Staff's comparison indicates the gamma source for the design-basis damaged BWR fuel is significantly higher in the energy range of 1 ~ 1.5 MeV than the source for design-basis intact BWR fuel. Gammas in this energy range are significant contributors to the cask dose rates. Staff also notes that, for design-basis intact BWR fuel, fuel with burnup and cooling time limits that resulted in total source terms that were lower than for fuel at other burnup and cooling time limits yield higher dose rates than the fuel with the higher total source terms (e.g., 20,000 MWD/MTU and 7 year cooled BWR fuel versus 24,500 MWD/MTU and 8 year cooled BWR fuel). Therefore, it is not clear from the comparison made between the proposed design-basis damaged and intact BWR fuel that the design-basis damaged BWR intact fuel is acceptable for loading. Thus, the applicant should provide further justification/analysis (quantitative as well as qualitative) to demonstrate the acceptability of loading the proposed design-basis damaged BWR fuel.

This information is needed to confirm compliance with 10 CFR 71.51.

Chapter 6 Criticality Review

6-1 Describe and explain the changes that have occurred in Table 6.1.4 from the last time the SAR was submitted to the NRC for review.

The current version of Table 6.1.4 has change bars for almost all of the lines in the table; however, there is no indication of what entries were changed nor is there a clear indication in the text. This information will help identify the full scope of changes made since the last approval and will facilitate the review and evaluation of the application.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

6-2 Describe the differences in the computational models used to generate the data in Table 6.4-19 and justify the conclusion that the analytical results for the Metamic and Boral poison plates are the same.

It is not clear what detailed model parameters were changed to justify the conclusion that results for Boral are applicable to packages with Metamic poison plates.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

6-3 Show that the analysis of the MPC-HB has been performed at the optimum moderator density.

Compared to the other basket designs, the MPC-HB has a smaller pitch between the fuel cells which results in a higher fuel assembly density. The effectiveness of the poison plates is related to the degree of neutron moderation between fuel assemblies.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

6-4 Provide the computer code input files for the analyses used to show that a 1/4 inch gap between the two neutron absorber panels in the alternate poison plate design and for the analysis used to show that the reduced poison plate width is acceptable.

Representative input files are needed to determine how the analysis was performed and that the proposed conditions in the drawing notes are properly justified by the analysis.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

6-5 Describe and justify the physical constraints that will be employed to assure that the gap between the two neutron absorber panels will not be greater than 1/4 inch during all normal and accident conditions.

The criticality analysis assumes that the maximum gap width between the two neutron absorber panels in a single poison plate will not be greater than 1/4 inch. A positive means of control are needed to assure that this maximum gap width is not exceeded under all conditions. A structural analysis is needed to show that the proposed constraints will accomplish their intended purpose.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

Chapter 7 Package Operations

7-1 Revise step 2 in Sections 7.1.3.1 and 7.1.3.2 of the Operating Procedures to include the language in the condition 6(a)(11) of the current Certificate of Compliance, i.e., "Verify that the appropriate fuel spacers, as necessary, are used to position the active fuel zone within the neutron absorber plates of the MPC, and limit axial movement of the fuel assemblies in the MPC cavity."

It is important that the fuel spacers are sized and sufficiently strong to maintain the active fuel of the fuel assemblies within the region of the neutron absorber plates in the basket under all normal and accident conditions. This positioning has been assumed in the criticality safety analysis.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

7-2 Revise the procedures for loading fuel to include a caution to verify that all damaged fuel and fuel debris have been placed into a proper damaged fuel container before loading and that these containers occupy authorized locations in the MPC.

The criticality safety analysis relies on the assumption that all damaged fuel and fuel debris is placed in a damaged fuel container before being loaded into an MPC canister. Thus, the proper use of damaged fuel containers is part of the basis for assuring criticality safety.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

7-3 Revise the package operations section of the application to remove the last sentence of the first paragraph in SAR Section 7.0.

While similar wording was found in the previous revision of the SAR, under the current amendment request, SAR Section 7.0 is being incorporated by reference into the CoC. Thus, this section of the SAR will become a part of the conditions of the CoC. Note that shippers that are authorized to transport this package are required to comply with the conditions specified in the CoC. Thus, the text in Section 7 needs to be unambiguous in identifying and describing the essential operations and their proper sequence.

Also note that the NRC does allow for flexibility in package design changes, including package operations, within the constraints of the CoC. The NRC has issued Interim Staff Guidance (ISG) - 20, "Transportation Package Design Changes Authorized Under 10 CFR Part 71 Without Prior NRC Approval," which describes the flexibility that exists for making changes and how that flexibility can be built into NRC approval of the package. This ISG states that the information in Section 7 of the application, or SAR, is not intended to constitute the detailed package operating procedures; however, it is intended to provide the essential operations elements that must be included in the detailed operating procedures required by 10 CFR 71.87(f). Further, Regulatory Guide (RG) 7.9, Revision 2, states that "the operations should describe the fundamental steps needed to ensure that the package is properly prepared for transport, consistent with the package evaluation in Sections 2 - 6 of the application." RG 7.9 also states that the operations steps should be presented sequentially in the order they are actually performed. Staff recognizes that sequencing of steps should be flexible when performance of steps in a different order won't affect package preparation (see ISG-20); however, those steps which may be performed in a different order than presented in the SAR should be explicitly identified. Thus, the SAR text needs to be unambiguous regarding the necessary steps for package preparation. Text that introduces ambiguity should be removed.

This information is needed to confirm compliance with 10 CFR 71.87 and 71.111.

7-4 Justify removal of ALARA notes and warnings from SAR Section 7, "Operating Procedures."

In the currently approved revision of the SAR, package operations described in Section 7 include notes and warnings to alert package users to employ appropriate ALARA procedures for various operations. In the proposed amendment, these notes and warnings are removed without justification for their removal. Staff notes that package operations should be consistent with keeping occupational radiation exposures ALARA in accordance with 10 CFR 20.1101(b). Thus, the notes and warnings provided in the currently approved descriptions of package operations are important to retain in the proposed revision to SAR Section 7.

This information is needed to confirm compliance with 10 CFR 71.87 and to confirm that the product (the packaging and documentation) enables the user to comply with 10 CFR 20.1101(b).

7-5 Explain how seal welding the MPC lid by manual-only welding for dry loading operations will be performed in a manner that is consistent with the principle of ALARA.

Step 11 of proposed Section 7.1.3.2 indicates that seal welding of the MPC lid may be done completely by manual welding, similar to the seal welding step for wet loading. Yet, there is a significant difference in the shielding configurations for the two loading cases. For wet loading, a significant amount of water remains in the MPC during the loading operation. This water reduces the dose to personnel by shielding the spent fuel contents. In dry loading operations, however, there is no water in the MPC, resulting in a significantly higher radiation dose field. Thus, the welding operations described in the proposed Section 7.1.3.2, Step 11 should account for the reduced shielding (lack of water in the MPC) in dry loading operations and include appropriate operations descriptions to ensure that seal welding is performed in an ALARA manner.

This information is needed to confirm compliance with 10 CFR 71.87 and to confirm that the product (the packaging and documentation) enables the user to comply with 10 CFR 20.1101(b).

7-6 Include the following operations descriptions in Section 7 of the SAR.

In the review of the proposed Section 7, the staff noticed that there are several items that are not included but that appear to be essential elements in proper preparation of the package for shipment. These items should either be included in the proposed Section 7 package operations, or their lack of inclusion should be properly justified. These items include:

a. receipt inspection of the MPC physical condition to meet 10 CFR 71.87(b) and (g),

b. removal of road dirt/debris and any foreign objects from the overpack and MPC prior to placing in the spent fuel pool,

c. installation of annulus seal (proposed Section 7 already discusses removal of seal after removal of cask from the spent fuel pool),

d. installation of drain line in MPC lid, including necessary actions in case of drain line deformation when seating the lid on the MPC,

e. note stating the means for confirming proper seating of the lid on the loaded MPC,

f. radiation/contamination survey of the MPC lid and overpack upper surface when raising a loaded HI-STAR 100 out of the spent fuel pool,

g. decontamination of the upper MPC shell above the annulus seal in addition to the MPC lid and overpack upper flange in proposed Section 7.1.3.1, procedure No. 10,

h. plugging of pocket trunnions if present and not in use to meet 10 CFR 71.87(h),

i. decontamination of the base of the loaded overpack when removed from the spent fuel pool, and

j. verification of the condition of the overpack's neutron shield relief devices (installed and intact) upon receipt of package in proposed Section 7.2.1.

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

7-7 Provide the criteria that must be met for operational requirements to be fulfilled and the description of actions to be taken when those criteria are not met for package operations described in proposed SAR Section 7.

In its review of the proposed SAR Section 7, "Package Operations," staff noticed that there were several instances where surveys or checks were to be performed. However, the criteria against which surveyed/checked conditions were being compared were not described for a number of these operations. Also, actions taken when the package conditions do not meet the criteria were also not described for a number of these operations. Examples of these operations for which this information should be included in the operations descriptions are: Section 7.1.4, procedure No. 8; Section 7.1.5, procedure No. 5; Section 7.2.1, procedure Nos. 2 and 4; and Section 7.3, procedure No. 6.

This information is needed to confirm compliance with 10 CFR 71.87 and 10 CFR 20.1906.

7-8 Modify SAR Section 7.1.3.2 to describe the operations and condition limitations implementation of which is necessary to prevent oxidation of the fuel during dry cell loading.

Section 7.1.3.2 of the SAR proposes loading operations outside of a spent fuel pool (i.e., in a dry cell). The proposed operations descriptions are the same as for wet loading in a spent fuel pool except for the removal of operations involving filling and draining the MPC with water. However, the operations overlook the prevention of fuel oxidation, a critical issue when spent fuel is exposed to an oxidizing gaseous atmosphere. Interim Staff Guidance (ISG) No. 22, "Potential Rod Splitting Due To Exposure To An Oxidizing Atmosphere During Short-Term Loading Operations In LWR Or Other Uranium Oxide Based Fuel," discusses fuel oxidation, the conditions for which it can occur and means for its prevention. As stated in ISG-22, fuel oxidation can result in gross cladding breaches and create shielding, criticality and other concerns. The ISG further indicates that the oxidation concern extends to intact fuel as well, since intact fuel may have pinhole leaks and hairline cracks, which provide a path for the loading atmosphere to reach the fuel.

Thus, the applicant needs to provide a description of the essential operations and condition limitations through which fuel oxidation is prevented in Section 7.1.3.2 of the SAR. One way to prevent fuel oxidation is to limit dry cell loading to only that fuel which is known to have no breaches (including pinhole leaks and hairline cracks). This limitation will necessitate the use of an appropriate method to ensure to a high level of confidence that a fuel assembly does not have any cladding breaches. As stated in ISG-22, visual inspections are insufficient to provide the necessary confirmation. Methods such as sipping, ultrasonic testing, and a review of reactor records can provide the necessary level of confidence. For dry loading of fuel containing cladding breaches, ISG-22 provides possible options to control and/or prevent fuel oxidation. One of these is to maintain the fuel rods in an inert environment. In developing the necessary operations and limitations, the applicant will need to consider impacts on other areas such as contamination control and thermal issues.

This information is needed to confirm compliance with 10 CFR 71.33(b) and 71.87.

7-9 Modify SAR Section 7.1.3.2, No. 16, to include all the operation descriptions from SAR Section 7.1.3.1, No. 19.

Section 7.1.3.2, No. 16, as currently proposed only describes the examination of the root and final passes of some unidentified welds. Based upon the similarity of the operations descriptions of proposed Sections 7.1.3.1 and 7.1.3.2, it appears that the description in 7.1.3.2, No. 16, should be the same as 7.1.3.1, No. 19. Furthermore, it is not clear what welds are subject to the PT examination described in the currently proposed Section 7.1.3.2, No. 16.

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

Chapter 8 Acceptance Tests and Maintenance Program

8-1 Revise the visual inspections section to add a provision to ensure the presence of the neutron absorber plates during the acceptance process.

The neutron absorber plates are a vital part of the criticality control design features of the MPC canisters.

This information is needed to determine whether the package design and contents complies with 10 CFR 71.55 and 71.59.

8-2 Provide language in proposed SAR Section 8.1.1, No. 1, that clarifies that the drawings referred to in this item are the drawings referenced in the CoC.

It is not clear that the drawings discussed in the currently proposed language in Section 8.1.1, No. 1, refer to those referenced in the CoC. The proposed paragraph should reference these drawings explicitly. This can be done by referencing the drawings by their drawing numbers or by using the words "the applicable drawings referenced in the Certificate of Compliance," since the CoC requires the packaging to be constructed in accordance with the drawings it (the CoC) references by drawing numbers.

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

8-3 Provide language in proposed SAR Section 8.1.1 that clarifies that visual inspections will also verify that the packaging has the proper markings/labels, in compliance with 10 CFR 71.85(c).

10 CFR 71.85(c) requires that the package be conspicuously and durably marked with information that includes its model number, serial number, etc. It is not clear that the acceptance tests currently proposed in SAR Section 8.1.1 verify that the package has been so labeled.

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

8-4 Provide in the proposed SAR Section 8.1.5 the descriptions of the gamma shielding requirements and the general requirements for shield materials as well as acceptance tests and corrective actions described in the currently approved SAR Section 8.1.5.1.

Section 8.1.5.1 of the currently approved SAR includes a description of requirements, acceptance tests and criteria, and corrective actions (when acceptance criteria are not met) for HI-STAR 100 shielding materials in addition to the description provided for the Holtite-A. These additional descriptions are not currently included in the proposed revision to Section 8.1.5. However, the acceptance tests and criteria and corrective actions for all shielding materials should be described in Section 8.1.5 in order to show compliance with 10 CFR 71.85. Therefore, the applicant should continue to include the description of these tests, criteria, and actions for all shielding materials in this section of the SAR.

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

8-5 Demonstrate that sufficient ^{10}B content is present locally considering crack formation at edges of the plates. State and Justify the sample size to be used to measure the ^{10}B content.

For Metamic absorber plate materials demonstrate with 95% confidence that for a 1 cm region in production panels there shall be a 95% likelihood that any test sample will be at or above the required minimum ^{10}B content. Alternatively, propose acceptance tests that have the equivalent result or a result that is shown to be acceptable in criticality calculations for granting the requested 90% credit for the amount of ^{10}B shown to be present.

This information is needed to confirm compliance with 10 CFR 71.55 and 71.85.

8-6 Ensure that acceptance tests will be used to justify the uniformity of the Metamic product in all materials. Justify the statements on page 8.1-7: (a) that chemical analyses will be used to establish the uniformity of the ^{10}B in the absorber plate materials and (b) that neutron attenuation test samples may be performed to quantify the actual ^{10}B areal density.

For absorber materials that are given 90% credit (in calculations) for the amount of ^{10}B shown to be present, uniformity of ^{10}B has to be demonstrated using the 95/95 statistical criteria on a sample size of 1 cm in diameter.

This information is needed to confirm compliance with 10 CFR 71.55 and 71.85.