Request for Additional Information

Docket No. 72-1032
Certificate of Compliance No. 1032
Amendment No. 5 to the HI-STORM Flood/Wind (FW) Multipurpose Canister Storage System

Chapter 1 – General Description

1-1 Clarify the change to the definition of repaired/reconstituted fuel assembly and provide the definition for damaged fuel isolator (DFI) and blended low enriched uranium (BLEU) in the final safety analysis report (FSAR) Glossary.

The Summary of Proposed Changes states that Certificate of Compliance (CoC) appendix A, definition of Repaired/Reconstituted Fuel Assembly has been modified. However, it does not seem that the definition has been changed in the application.

The Summary of Proposed Changes also states that the definition of DFI and BLEU are added to Appendix A and FSAR. Appendix A was updated with the two definitions; however, the FSAR Glossary does not have the definition of DFI and BLEU.

The staff needs this information to determine if the amendment application meets the regulatory requirements of 10 CFR 72.236.

Both Appendix A of the CoC and the FSAR Glossary were revised to update the definition of REparied/Reconstituted

Holtec Response:

Both Appendix A of the CoC and the FSAR Glossary were revised to update the definition of Repaired/ Reconstituted Fuel to include “If irradiated dummy stainless steel rods are present in the fuel assembly, the dummy/ replacement rods will be considered in the site specific dose calculations.”

The FSAR Glossary was revised to include the definitions of DFI and BLEU. The updated glossary pages are included in the attachments to this submittal.

Chapter 3 – Structural Evaluation

3-1

Provide the following information regarding the addition of the four new fuel types, 10x10I, 11x11A, 7x7C and 8x8G:

1) What is the weight of each new fuel type? Is the total weight of the storage system with the additional weight of new fuel type still bounded by the maximum allowable weight of the storage system?
2) Is the location of the center of gravity (CG) of the storage system changed by the addition of the new fuel type? If the location of the CG changed, provide the location of the CGs

before and after the addition of the new fuel type.

The applicant proposed to add four new fuel types to the approved contents in CoC No. 1032. However, no information (e.g., CG, weight, etc.) is presented in the application. The staff needs this information to determine compliance with the requirements of 10 CFR 72.236(g) and (l).

Holtec Response:

1) The total weight of the storage system with the new fuel types is bounded by the maximum allowable weight of the storage system, as evaluated in Chapter 3 of the FSAR. The new fuel types are bounded by the fuel assembly limits provided in Table 2.1-1 of Appendix A. No changes are being made to the maximum allowable fuel assembly weight limits defined in Table 2.1-1 of Appendix A. Note that if an assembly weight were to exceed the limits in Table 2.1-1, it would not meet the requirements for loading.
2) The proposed new fuel types are bounded by the fuel assembly limits provided in Table 2.1-1 of Appendix A. No changes are being made to the fuel assembly length, width and height limits provided in Table 2.1-1 of CoC Appendix A, and therefore no changes are made to the CG of the system based on the new fuel types.

3-2

Provide the following information regarding the addition of DFI:

1) What is the weight of the DFI? Is the total weight of the storage system with the additional weight of the DFI still bounded by the maximum allowable weight of the storage system?
2) Is the location of the CG of the storage system changed by the addition of the DFI? If the location of the CG is changed, provide the location of the CGs before and after the addition of the DFI.
3) Are there any interactions between the DFIs and the fuel assemblies during the postulated accident events? If there are interactions during the accident events, what are the maximum induced impact or contact stress between them and a factor of safety with respect to an appropriate code (e.g., ASME Code, Section III)?
4) Explain how the DFIs are installed and secured in a storage system to perform its intended functions during the accident events.

The applicant proposed to add DFIs in the multi-purpose dry storage canister (MPC) system. However, no analysis or information for the DFI is presented in the application. The staff needs this information to determine compliance with the requirements of 10 CFR 72.236(l).

Holtec Response:

1. The DFI assembly total weight is less than 30 pounds (including top and bottom caps). Nominally, each cap will individually weigh 15 pounds or less. This is less than the assumed weight of a Damaged Fuel container (DFC); therefore, the DFI is bounded by the maximum allowable weight of the storage system.

2. The location of the CG of the storage system is not changed by the addition of the DFI. The DFI adds essentially equal weight to the top and bottom of the fuel assembly it is paired with, which in combination with the low weight of the DFI assembly has essentially no effect on the vertical location of the CG of the system. DFI's are also loaded equally about the basket, ensuring that the CG remains unchanged.

3. The DFI and fuel assembly may interact during postulated accident events. The design of the DFI, however, is such that it does not act as a primary load bearing member. Since the DFI top and bottom cap assemblies are not fixed in place and are able to move with the damaged fuel assembly in the axial direction (relative to the fuel basket), the DFI top and bottom cap assemblies are not subject to significant loading since the fuel assembly can only make contact with the DFI top and bottom end plates, which in turn are backed by the MPC lid and base plate, respectively. In other words, if the stored fuel assembly were to shift inside the basket cell during an accident event, the DFI would move together with the fuel assembly until the DFI top plate bottomed out against the underside of the MPC lid. At that moment, the inertia from the fuel assembly would be fully resisted by the MPC lid with the DFI top plate merely acting as a shim plate. The behavior of the DFI bottom cap at the base of the cell is similar, with the DFI bottom plate acting as a thin shim plate between the stored fuel assembly and the MPC base plate. In summary, the DFI, by design, does not play a role in supporting the weight of the fuel assembly under normal conditions or during an accident event, and therefore a structural failure of the DFI as a result of fuel assembly interaction is not credible.

4. The basket cells and fuel assemblies with which the DFI(s) will be used are identified prior to loading. The bottom DFI cap is installed in the corresponding basket cells and placed at the bottom with the open end facing up. During loading operations, the damaged fuel assembly which can be handled by normal means is loaded into the basket cell containing the DFI bottom cap such that the bottom of the fuel assembly rests against the bottom face of the DFI. After the fuel assembly is loaded, the DFI top cap is installed manually using a long handle tool or similar means. The top cap is fully installed after it is pressed down into the basket cell firmly against the topmost part of the fuel assembly.

   One of the design features of the DFI top cap assembly is that when it is installed on top of the damaged fuel assembly and the MPC lid is welded in place, the insertion depth of the DFI top side walls inside the fuel basket cell is greater than the clearance gap between the DFI top cap assembly and the underside of the MPC lid. Thus, based on geometric considerations alone, the DFI top cap assembly cannot be ejected from the basket cell during a postulated accident event, since the MPC lid and its attachment weld have been demonstrated to remain structurally intact, physically in place, and fully functional under all loading conditions. Furthermore, since the DFI top cap assembly is not fixed in place and is able to move with the damaged fuel assembly in the axial direction (relative to the fuel basket), the DFI top cap assembly is not subject to significant loading since the fuel assembly can only make contact with the DFI top and bottom end plates, which in turn are backed by the MPC lid and base plate, respectively.

3-2

Provide the following analyses

1) Appendix E – Response of HI-TRAC VW Version V to Tornado Wind Load and Large Missile Impact
2) Appendix F – Missile Penetration Analysis for HI-TRAC VW Version V
3) Supplement No. 23 – HI-TRAC VW Version V Bottom Lid Analysis
4) Supplement No. 24 - HI-TRAC VW Version V Water Jacket Analysis

The applicant proposed to add two versions of the standard HI-TRAC, which are Version V and

Version V2. The applicant provided analyses for the HI-TRAC VW Version V2 in the application. However, no analyses for the HI-TRAC VW Version V are presented in the application. The staff needs this information to determine compliance with the requirements of 10 CFR 72.146(a) and 10CFR 72.236(b).

Holtec Response:

The requested analyses are provided as Attachments 7 through 10.

Chapter 6 – Shielding

6-1

Provide the fuel parameters that characterize the radiological source term for the fuel assemblies allowed for loading in the HI-STORM FW storage system to be included in appendix B of the CoC (Technical specifications).

To assure that the cask shielding design is adequate for the allowable contents, it is imperative to include fuel parameters, in the Technical Specifications, that can adequately define the source terms which include the strengths and spectra of the neutron and gamma emitted from the spent fuel. The applicant has developed a set of equations in Section 2.1.6.1 of the SAR to define the fuel assemblies allowable for loading based on the shielding design of the dry storage system. The staff requests that the applicant adds this set of equations (including necessary coefficients) to Technical specification, appendix B of the Certificate of Compliance, so that the source terms of the spent fuel is directly correlated to the characteristics of the allowable contents.

This information is needed for the staff to determine that the cask system is capable of meeting regulatory requirements of 10 CFR 72.234(a) and 72.236(d). Section 72.2349a) of 10 CFR requires that the cask design meets the requirements of 72.236, and 72.236(d) requires that cask design is capable of meeting the dose limits set forth in 72.104 and 72.106. In accordance with the regulatory requirements of 10 CFR 72.236(a), specifications must be given for the spent fuel to be stored in the cask.

Holtec Response:

The fuel qualification requirements for MPC-37 and MPC-89 have been included in Subsection 2.5 of Appendix B of the CoC. Figure 2.3-14 has been removed as no longer needed.

6-2

Provide the limiting loading pattern and source terms used for calculating limiting dose and dose rates for te HI-TRAC VW, HI-TRAC VW Version V2 and the overpack of the HI-STORM FW storage system. Also provide the burnup and cooling times used to determine these source terms for all locations for the MPC-37 and MPC-89.

Within the HI-STORM FW/HI-TRAC VW, there are multiple loading patterns and multiple regions within these loading patterns and multiple decay heat values allowed within each region, and multiple burnup/enrichment combinations that can be stored for each decay heat. The staff requests that the applicant provide the loading pattern, and source terms and burnup/enrichment combinations it used to determine the limiting dose and dose rate for the

MPC-37 and MPC-89 in Tables 5.1.1, 5.1.2a, 5.1.2b, 5.1.4b, 5.1.1 (5.1.7, 5.1.3), 5.1.6a (5.1.8a) and 5.1.6b(5.1.8b) of the SAR. The staff needs this information to verify source terms and dose and dose rates calculated by the applicant is reasonably bounding and appropriately reported within these tables. The staff requests that the applicant include this information for any new fuel tables that may be added in responding to other RAIs, such as RAI 6-8.

This information is needed for the staff to determine that the cask system is capable of meeting regulatory requirements of 10 CFR 72.236(d) which a dry storage system meets the dose limits as prescribed in 10 CFR.104 and 106.

Holtec Response:

Section 5.1 of the FSAR has been updated with the description of the methodology and specification of the analyzed limiting loading patterns and source terms used for shielding evaluation of HI-TRAC VW, HI-TRAC VW Version V2 and HI-STORM FW. For additional details about the bounding combination of the region-specific source terms that produces the maximum dose rates for each dose rate location around the cask, please see Supplement 2 of HI-2094431. Specifically, the calculated dose rates and the utilized burnup, enrichment, cooling time combinations are provided in the following tables of HI-2094431 (corresponding FSAR tables are provided in parentheses):

[Proprietary Information Withheld in Accordance with 10CFR2.390]

The source terms used in all those calculations, in the form of the neutron spectra, photon spectra, and ^{60}Co activities, are provided in data files “1032-5-src-terms-n.dat”, “1032-5-src-terms-p.dat” and “1032-5-src-terms-c.dat”, respectively, which are provided with this response.

6-4

Update Chapter 9 to describe the method for selecting allowable fuel assemblies.

Section 72.146(a) of 10 CFR states that the applicant must establish measures to correctly translate the design basis requirements into appropriate procedures.

The applicant provides a method for determining he required cooling times for a given burnup and initial enrichment for the allowable new spent fuel contents in the HI-STORM FW system. The staff requests that the applicant update Section 9.2.3 of the SAR to describe the method for the correlations from Section 2.1.6.1 of the SAR and the loading patterns from Section 1.2.3 of the SAR. The staff requests that the applicant specifically address the following concerns;

1) The referenced decay heat values for the minimum cooling time and enrichment correlations in Chapter 2 of the SAR does not match those in the loading patterns from Section 1.2.3 of the SAR.
2) Clarify the Minimum allowable cooling times as there are multiple minimum cooling times used throughout the SAR. Specifically, the staff observed that cooling time in Table 2.1-1 of CoC Appendix B (TS), the cooling time calculated from the correlation in Section 2.1.6.1 of the SAR, and the cooling times in Tables 5.0.3 and 5.0.4a, b and c of the SAR are different. For some burnup levels, the correlation in Section 2.1.6.1 of the SAR gives a minimum cooling time that is shorter than the cooling time used in

Tables in Chapter 5 of the SAR, which is shorter than the cooling time allowed by Table 2.1-1 of the TS. For example, at 10,000 MWd/MTU, the correlation in Section 2.1.6.1 of the SAR gives a minimum cooling time of 0.42 years, Table 5.0.3 of the SAR rounds this up to 1 year and Table 2.1-1 of the SAR has a minimum cooling time for the MPC-37 of 2 years. The applicant needs to clarify that the longest cooling time of the three (in this case 2 years) is what is allowed.

This information is needed for the staff to determine that the cask systems capable of meeting regulatory requirements of 10 CFR 72.236(d) which requires a dry storage system meets the dose limits as prescribed in 10 CFR 72.104 and 106.to determine if the amendment application meets the regulatory requirements of 10 CFR 72.236.

Holtec Response:

Section 9.2.3 has been revised to more clearly identify the actions needed to show the fuel selection is in accordance with the CoC requirements for Approved Content.
With respect to the 2 subitems in the RAI please note:

1) Table 2.1.10 is consistent with the loading patterns Figures 1.2.3 through 1.2.5 for MPC-37 and Figure 1.2.6 for MPC-89. The cell heat load limits ranges in Table 2.1.10 encompass the all of the cell heat load limits contained in Figures 1.2.3 through 1.2.6. Each cell heat load value is not listed individually; however, all of the allowable heat load limits fall within the ranges in the table.
2) Clarifications have been made to ensure that a consistent minimum cooling time is identified:
    a. CoC Appendix B Table 2.1-1 and FSAR Chapter 2 Tables 2.1.1a and 2.1.1b have been updated to give an absolute minimum cooling time value and reference the fuel qualification equation for additional restrictions.
    b. A note has been added to CoC Appendix B Section 2.5 to clearly state that if the cooling time value calculated by the equation is less than the cooling time limit in CoC Appendix B Table 2.1-1, the minimum cooling time in CoC Appendix B Table 2.1-1 is used. The same note was added to FSAR Chapter 2 Subsection 2.1.6.1.
    c. A note has been added to Tables 5.0.3 and 5.0.4a,b explaining that, to simplify the dose analyses in Chapter 5 that show bounding conditions, burnup and cooling time combinations are selected for the dose analyses that may correspond to a higher decay heat than is permitted for a cell. The note also states that the decay heat cell limits remain as provided in the referenced figures. Note that decay heat limits and burnup/cooling time limits remain independent of each other, so this does not impact the decay heat limit for a cell, but may just results in a higher, i.e. more conservative, dose rate is calculated in Chapter 5.

6-7

Clarify the additional fuel density for the BWR fuel region for the calculations involving the XL lid.

The applicant updated Table 5.3.2 of the SAR to include different BWR fuel region compositions for the calculations involving the XL or standard lid design. Although, the additional composition for the XL lid is lower in density, and may produce less self-shielding, the applicant did not state

the reason for this change in density. If it is because the applicant used a different design basis fuel assembly for these evaluations, a fuel assembly lower in mass would produce a lower source term. The applicant needs to explain why there are different BWR fuel region mixtures for calculations involving different lids as the allowable contents for these two lids are the same. If the designs with the different lids are meant to allow different fuel assembly types, this should be specified in the TS.

This information is needed for the staff to determine that the cask system is capable of meeting regulatory requirements of 10 CFR 72.236(d) which a dry storage meets the dose limits as prescribed in 10 CFR.104 and 106.

Holtec Response:

[Proprietary Information Withheld in Accordance with 10CFR2.390]

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6-11

[Proprietary Information Withheld in Accordance with 10CFR2.390]

Holtec Response:

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6-13

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Holtec Response:

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Chapter 8 – Material Evaluation

8-1

Provide the following additional information on the HI-TRAC Version V and Version V2 transfer casks described in FSAR section 1.2.1.3:

1) Licensing drawing of the components with dimensions and tolerances for the HI-TRAC Version V transfer cask.
2) Parts list with material specifications and quality category information for the HI-TRAC Version V transfer cask.
3) Material temperature limits (FSAR Table 2.2.3) for HI-TRAC Version V and Version V2 transfer cask components.

The applicant references the HI-TRAC Version V transfer cask Drawing 11006 in FSAR Section 1.5, but the drawing and the parts list with material specifications and quality category information were not provided in the amendment request. FSAR Table 2.2.3 contains information on component temperatures for normal conditions, short-term events, and off-normal and accident conditions; however, it is unclear if the existing entries for the HI-TRAC VW component temperature limits are applicable to the HI-TRAC Version V and Version V2.

The staff needs this information to proceed with its review to determine if the amendment application meets the regulatory requirements of 10 CFR 72.236(b).

Holtec Response:

1) The licensing drawing for the HI-TRAC VW Version V transfer cask, Drawing 11006R0, is included in the RAI response. The drawing includes the parts list, material specifications, dimensions and categorization.
2) The parts list, material specifications and quality categorization are included on Drawing 110006R0. Table 2.0.11 has been added to FSAR Chapter 2 to provide the ITS QA safety category of the HI-TRAC VW Version V components.
3) The specific material temperature limits have been included in in FSAR Table 2.2.3, which are applicable to the HI-TRAC Version V2. Note 2 has been added in FSAR Table 2.2.3 to clarify that unless otherwise specified the temperature limits listed for the HI-TRAC VW are also applicable to versions V and V2.

8-3

Provide the following information for the DFI described in FSAR Figure 1.2.9:

1) Licensing drawing with dimensions and tolerances in accordance with the guidance included in NUREG/CR-5502 (1998).
2) Material specifications and applicable design code for the component.
3) Allowable normal, off-normal, and accident temperature limits for the DFI consistent with the materials of construction and the applicable design code.

The applicant stated that the load bearing members of the DFI will be designed to satisfy Level D stress limits per ASME Section III, Appendix F and that the materials of construction would be stainless steel or nickel alloy and the safety class for the DFI is important to safety (ITS) Category C. The applicant did not provide a licensing drawing for the DFI, material specifications, or component temperature limits.

The staff needs this information to proceed with its review to determine if the amendment application meets the regulatory requirements of 10 CFR 72.236(b) and (g).

Holtec Response:

1) FSAR Figure 1.2.9 has been deleted. FSAR Figure 2.1.7 was revised to show the DFI nominal dimensions, including width, height of the top cap and welds used in fabrication for MPC-37 and MPC-89. The information provided for the DFI is to the same level of detail as provided for the DFI in the HI-STORM 100 amendment 14 and the previously approved Damaged Fuel Containers (DFCs).
2) FSAR Table 2.1.11 provides the material specification and design codes applicable to the DFI. [Proprietary Information Withheld in Accordance with 10CFR2.390]
3) Allowable normal, off-normal, and accident temperature limits for the DFI are equal to those of the MPC basket. Table 2.2.3 was revised to include the temperature limits for the DFIs.

8-4

Provide the material specifications for the HI-TRAC Version V2 transfer cask Item #3, I-Piece, in FSAR Drawing 11283, Sheet 1 of 3.

FSAR Drawing 11283, Sheet 1 of 3, Additional Note #3 indicates applicable codes and standards are in FSAR Tables 1.2.6 and 1.2.7. HI-STORM FW Revision 5, Table 1.2.6 (ML17179A444) states that the certification of material references the stipulations of NF-2130 (b) and (c) and explains that materials for ITS components shall be certified to the applicable Section II of the ASME Code or equivalent ASTM Specification. FSAR Table 1.2.7 indicates material specifications are ASME Section II. The bill of materials identifies the material as NITRONIC 60 which is not an ASME or ASTM specification; it is a trade name.

The staff needs this information to proceed with its review to determine if the amendment application meets the regulatory requirements of 10 CFR 72.236(b).

Holtec Response:

The FSAR drawing 11283R0 shall be revised and re-submitted with the identification of the ASME Section II material identified to comply with FSAR Table 1.2.7. The materials to replace the trade name NITRONIC 60, shall be SA-240 S21800, SA-479 S21800 OR SA-276 S21800. The multiple specifications provide alternate product forms for the same UNS21800 alloy.