RSI-1. Provide clarification on how incorporation of only the publicly available portions of the safety analysis report (SAR) for the 24PT1-DSC constitutes a complete and adequate licensing basis for the UMAX system.

The application incorporates by reference only the publicly available portions of the SAR for the 24PT1-DSC. Staff seeks to understand how the incorporation of only this partial information constitutes a complete application and how Holtec International (Holtec) will be able to demonstrate it can meet all the relevant regulatory requirements under Part 72. For example, 10 CFR 72.234 requires, in part, "The certificate holder and applicant for a CoC shall ensure that the design, fabrication, testing, and maintenance of a spent fuel storage cask comply with the requirements in §72.236." The application states: "Since the 24PT1-DSC canister has already been approved by the NRC for storage under Part 72, (and is presently in active use) under Docket No. 72-1029, much of the safety analysis information is incorporated herein by reference to the NUHOMS FSAR [I.1.2.1]." It is not clear how the applicant is able to ensure compliance with 10 CFR 72.236 based upon only the publicly available portions of the 24PT1-DSC. If the applicant is relying upon the NRC's findings in Docket No. 72-1029 to ensure compliance with 10 CFR 72.236, please explain how those findings address variations in the licensing bases between the 24PT1-DSC and the UMAX system.

This information is needed ensure the application complies with 10 CFR 72.230.

Holtec Response:

In order to ensure that the requirement of 10CFR72.234 is met, the proposed HI-STORM UMAX CoC includes a requirement (Appendix C, 5.4.1) that prior to storage a review of records is performed to ensure that the DSC meets the design and fabrication requirements. Throughout the HI-STORM UMAX FSAR, the use of the publically available SAR for the 24PT1-DSC is described and justified for individual disciplines, in Supplement I to each chapter. Additionally, the response to RSI-4 provides further discussion specifically on the use of this information for the criticality analysis. While the HI-STORM UMAX FSAR provides a full justification of the use of publically available information, the following summary provides a discussion of specifically how the requirements of 10CFR72.236 (as required by 10CFR72.234) are met using this information. Many of the requirements of 10CFR72.236 are met using the Standardized Advanced NUHOMS CoC (72-1029) which is fully publically available. Other items are met utilizing only publically available portions of the system FSAR.

72.236(a): *Specifications must be provided for the spent fuel to be stored in the spent fuel storage cask, such as, but not limited to, type of spent fuel (*i.e., *BWR, PWR, both), maximum allowable enrichment of the fuel prior to any irradiation, burn-up (*i.e., *megawatt-days/MTU), minimum acceptable cooling time of the spent fuel prior to storage in the spent fuel storage cask, maximum heat designed to be dissipated, maximum spent fuel loading limit, condition of the spent fuel (*i.e., *intact assembly or consolidated fuel rods), the inerting atmosphere requirements.*

As part of the amendment request submittal, Holtec submitted proposed revisions to the HI-STORM UMAX CoC, specifically the addition of appendices C and D. Appendix D contains the full specifications for approved contents for storage in the 24PT1-DSC within a HI-STORM UMAX overpack. This appendix includes the type of fuel (Table 2.1-1, item A.1), maximum initial enrichment (Table 2.1-2), burnup (Table 2.1-1), acceptable cooling time (Table 2.1-1), maximum heat load (Table 2.3-1), maximum spent fuel loading limit (Table 2.1-1), and condition of the spent fuel (Table 2.1-1, Item B). The

requirement for the inerting atmosphere is identical to that of the original NUHOMS CoC, and is made a requirement by the HI-STORM UMAX CoC, Appendix C, Section 5.4.1.

72.236(b): *Design bases and design criteria must be provided for structures, systems, and components important to safety.*
The important to safety classifications of SSCs important to safety involved in storage of 24PT1-DSC canisters in the HI-STORM UMAX system (including the 24PT1-DSC) are designated on the drawings in the HI-STORM UMAX FSAR Supplement I, Section 1.5. The principal design criteria for these SSCs are given in Supplement I.2.

72.236(c): *The spent fuel storage cask must be designed and fabricated so that the spent fuel is maintained in a subcritical condition under credible conditions.*
RSI-4 has a detailed discussion of the criticality evaluation of the 24PT1-DSC using publically available information. Additionally, the proposed CoC, Appendix D, Section 3.2.1 requires that the storage canister have certain design and fabrication requirements that are important to criticality control.

72.236(d): *Radiation shielding and confinement features must be provided sufficient to meet the requirements in §§ 72.104 and 72.106.*
The shielding evaluation of the 24PT1-DSC canister in the HI-STORM UMAX storage system is provided in Supplement I.5, which demonstrates that the system meets the dose requirements in 10CFR72.104 and 72.106. Additionally, the proposed HI-STORM UMAX CoC, Appendix C, Section 5.3 requires evaluations based on actual site conditions and configuration to ensure the dose limits are met. Dose rate measurements are also performed, per Section 5.3.5 to ensure limits are not exceeded.

72.236(e): *The spent fuel storage cask must be designed to provide redundant sealing of confinement systems.*
The confinement evaluation of the 24PT1-DSC canisters in the HI-STORM UMAX system is contained in Supplement I.7, based on the information in the Standardized Advanced NUHOMS FSAR. The 24PT1-DSC canisters have redundant sealing of the confinement boundary, as shown in the Standardized Advanced NUHOMS FSAR, Figure 7.1-1, which is incorporated by reference into the HI-STORM UMAX FSAR Supplement I.7. To ensure that only canisters that fully meet the requirements of the 24PT1-DSC are loaded in the HI-STORM UMAX System, the proposed HI-STORM UMAX CoC, Appendix C, Section 5.4.1 requires that the DSC has been loaded with the limits from CoC 72-1029. This statement is revised to include “fabricated and loaded,” for clarity that both loading and fabrication limits from CoC 72-1029 are required for storage under the HI-STORM UMAX CoC.

72.236(f): *The spent fuel storage cask must be designed to provide adequate heat removal capacity without active cooling systems.*
The storage of the 24PT1-DSC canister does not require any active cooling systems. Additionally, the transfer of a loaded 24PT1-DSC canister from a NUHOMS overpack to the HI-STORM UMAX VVM does not require any active cooling systems. A thermal evaluation of the 24PT1-DSC canister is presented in the HI-STORM UMAX FSAR Supplement I.4. This thermal evaluation relies on the temperature information in the from the Standardized Advanced NUHOMS FSAR to create a model of the 24PT1-DSC canister that can then be utilized in the HI-TRAC and HI-STORM UMAX thermal models. These evaluations show that adequate heat removal is provided during all phases of

transfer and storage. The 24PT1-DSC is not designed for wet loading or unloading within the HI-STORM UMAX system.

72.236(g): *The spent fuel storage cask must be designed to store the spent fuel safely for the term proposed in the application, and permit maintenance as required.*
Per the HI-STORM UMAX CoC, the license life of the system is 20 years. Additionally, the 24PT1-DSC canisters are limited to a license life of 20 years, even if previously stored within a different system, per CoC Appendix C, Section 5.4.2. Based on the NUHOMS FSAR the 24PT1-DSC has a design life of 50 years, which exceeds the license life. The HI-STORM UMAX system components that hold the 24PT1-DSC canister are also designed to a term that exceeds the requested license term. The maintenance program for the 24PT1-DSC canister within the HI-STORM UMAX system is described in Supplement I.10. The Standardized Advanced NUHOMS FSAR states that no maintenance is required for the initial 20 years of the canister, and this information has been incorporated by reference into the HI-STORM UMAX FSAR in Supplement I.10.4.

72.236(h): *The spent fuel storage cask must be compatible with wet or dry spent fuel loading and unloading facilities.*
The proposed HI-STORM UMAX CoC does not allow wet loading of the 24PT1-DSC canister within the HI-STORM UMAX docket. However, the canister itself is fully compatible with wet loading, following the requirements of the Standardized Advanced NUHOMS certificate (72-1029). As stated above, loading of the 24PT1-DSC in accordance with the 72-1029 certificate is a requirement of the proposed HI-STORM UMAX CoC, Appendix C, Section 5.4.1. Unloading of the canister may be performed at either a dry facility, or at a wet facility, following the 24PT1-DSC reflood requirements, and is incorporated by reference into the HI-STORM UMAX FSAR, Supplement I.12.3.2.

72.236(i): *The spent fuel storage cask must be designed to facilitate decontamination to the extent practicable.*
As stated above, the 24PT1-DSC canister is not wet loaded under the HI-STORM UMAX CoC, and is fully sealed. Therefore, decontamination is not expected to be required. However, the materials used in the canister are publically available and are chosen partly to facilitate any decontamination.

72.236(j) *The spent fuel storage cask must be inspected to ascertain that there are no cracks, pinholes, uncontrolled voids, or other defects that could significantly reduce its confinement effectiveness.*
As stated previously, the proposed HI-STORM UMAX CoC requires that the 24PT1-DSC canisters be fabricated and loaded in accordance with CoC 72-1029. One requirement in the 72-1029 CoC relates to pressure and leak testing of the DSC. The DSC shell and inner bottom plate, including longitudinal and circumferential welds are pressure tested and examined during fabrication. The field closure weld is pressure tested and examined for leakage. The siphon/vent cover welds are helium leak tested after the pressure test. Before storage in the HI-STORM UMAX, it is required by Appendix C, Section 5.4.1 that these tests have been performed and successfully passed to ensure no defects exist that would reduce the canister's confinement effectiveness.

72.236(k) *The spent fuel storage cask must be conspicuously and durably marked with--*
(1) A model number;

(2) A unique identification number; and
(3) An empty weight.
The DSC-24PT1 canisters are marked during initial fabrication, and the required review of records ensures that these markings exist prior to storage in the HI-STORM UMAX system.

72.236(l) *The spent fuel storage cask and its systems important to safety must be evaluated, by appropriate tests or by other means acceptable to the NRC, to demonstrate that they will reasonably maintain confinement of radioactive material under normal, off-normal, and credible accident conditions.*
As stated above, the confinement boundary is tested to ensure that confinement is maintained. Supplement I.7 demonstrates that there is no credible normal, off-normal, or accident condition that would change the ability of the system to maintain confinement, and relies on incorporating by reference the Standardized Advanced NUHOMS FSAR as described in Table I.7.0.1.

72.236(m) *To the extent practicable in the design of spent fuel storage casks, consideration should be given to compatibility with removal of the stored spent fuel from a reactor site, transportation, and ultimate disposition by the Department of Energy.*
No change has been made to the 24PT1-DSC canister which prevents its eventual removal from the HI-STORM UMAX and transportation off of a reactor site.

72.236(n) *Safeguards Information shall be protected against unauthorized disclosure in accordance with the requirements of § 73.21 and the requirements of § 73.22 or § 73.23 of this chapter, as applicable.*
There is no safeguards information connected with this application.

RSI-2. Provide licensing drawings and/or drawing details that, at a minimum, clearly identify materials joined, joining processes, and the level of NDE, symbols and dimensions.

Welding/fabrication/design details on the licensing drawings provided make the following statements, “Design of rail and supports is to be determined. Final design will be shown on fabrication drawing.” Staff require final design details to determine materials joined, joining processes, level of NDE, symbols, dimensions, etc. in order to evaluate safety.

This information is needed to evaluate compliance with 10 CFR 72.158.

Holtec Response:

The intended purpose of Flag Note 3 on Drawing 10488 was to provide flexibility in specifying the design of the rails and supports. Holtec recognizes the NRC concern with this approach and has deleted Flag Note 3 from the drawing. Any future improvement in rail/support designs will be considered under Holtec’s 10CFR72.48 change process, for determination if a license amendment is needed.

RSI-3. Provide a definition/identification of critical characteristics and an explanation of how critical characteristics are determined.

Text on the cask handling apparatus (CHA) licensing drawing 10488, CHA-90 ASSEMBLY, states the following: Equivalent materials that meet the required critical characteristics may be

used in lieu of the named material. Critical characteristics may be crosscutting depending on the staff's review discipline.

This information is needed to evaluate compliance with 10 CFR 72.156.

Holtec Response:

The intended purpose of Additional Note 3 on drawing 10488 was to provide flexibility in specifying materials during component manufacture that may not be directly identified on the licensing drawing, but will nonetheless provide an identical or better safety function in the design. Holtec recognizes the NRC concern that without specifically identifying and quantifying all critical material characteristics upfront, no assumptions can be made during evaluation of the design concerning the safety function (shielding, structural, thermal, etc.) of the material and, therefore, no assessment can be made of what material substitutions are allowable. Rather than specifically specify critical characteristics for all components on the licensing drawing and the FSAR (which would be cumbersome and largely unnecessary where material substitutions are not expected), Additional Note 3 has been deleted from drawings 10488 and 10576. If material changes are necessary in the future, the change will be considered under Holtec's 10CFR72.48 change process, for determination if a license amendment is needed.

Related to this change, General Note E on both drawings has been revised to eliminate the phrase "OR BETTER" from the statement concerning equivalence of material product forms. Like the issue with Additional Note 3, the inclusion of this phrase presents ambiguity about how the material's characteristics affect the component's safety function. General Note E is changed as follows (text with strikethrough deleted from note on drawing):

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]

RSI-4. Please provide a criticality safety analysis that demonstrates the safety of a 24PT1-DSC canister loaded into the UMAX system during storage and transfer. Supplement I.6 does not have any evaluation associated with the use of the UMAX system to store a 24PT1-DSC. The evaluation states that the results would be "practically identical" to the results in Chapter 6 of the Standardized Advanced NUHOMS FSAR ([I.1.2.1]), Tables 6.4-1 through 6.4-3, however no supporting information was provided in supplement I.6 to support this contention. In addition, the contention that the HI-TRAC is "similar" to the NUHOMS-MP187 transfer canister and is bounded by the calculations for the NUHOMS system is not justified by the information provided.

This information is required under 10 CFR 72.124 and 10 CFR 72.236.

Holtec Response:

Criticality safety calculations of the HI-STORM UMAX system with a model representing the 24PT1-DSC canister are performed and documented in Supplement I.6 of the HI-STORM UMAX FSAR (updated version included with these responses). Since there are no wet conditions during the operation of HI-STORM UMAX with the 24PT1-DSC canister (no canister loading / unloading), criticality safety is demonstrated in HI-TRAC VW and HI-STORM UMAX under dry conditions only. The results of the calculations confirm that the maximum k_{eff} values for the HI-STORM UMAX system with the 24PT1-DSC canister under storage conditions (dry inert environment) is substantially below the limiting design criteria ($k_{eff} < 0.95$).

RSI-5 Justify the use of the Holtec MPC-32 source term calculation to simulate the shielding evaluation for the 24PT1-DSC.

In SUPPLEMENT I.1: GENERAL DESCRIPTION OF 24PT1-DSC CANISTER, the applicant states: "

> The 24PT1-DSC has a smaller diameter than the MPC-37, resulting in a larger gap between the canister enclosure shell and CEC. However, the diameter of the 24PT1-DSC is similar to that of MPC-32 analyzed in the main section of this chapter.
>
> The 24PT1-DSC is shorter than the MPC-32 and the MPC-37."

The 24PT1-DSC has an outside diameter of 67.2 inches and height of 186.5 inches. The MPC-32 has an outside diameter of 75.5 inches and height of 213 inches according to USNRC Docket #72-1040 Holtec Project 5021 Holtec Report #HI-2115090 (ML14202A031). Considering 24 fuel assemblies for source term calculation and assuming smearing all fuel assemblies in the source term calculation, the dose rate on the surface of 24PT1-DSC basket should be higher than for the MPC-32 due to smaller diameter and shorter length of 24PT1-DSC. The applicant needs to justify the source term used in their evaluation.

This information is needed by the staff to determine compliance with 10 CFR 72.236(d) and 10 CFR 72.104(a) and 106(b).

Holtec Response

The MPC-37 has a larger diameter than the MPC-32. The MPC-32 is not specifically dimensioned in the HI-STORM UMAX FSAR, but is instead in the HI-STORM 100 FSAR (Docket Number 72-1014) drawing package, licensing drawing 3923R34 (sheet 3). The MPC-32 maximum outer diameter is 68 ½". This outer diameter is comparable to the 24PT1-DSC canister.

Specifically, the uranium weight of the Westinghouse 14x14 SC assembly allowed for storage in the 24PT1-DSC is 373 kg [Ref. 1], which is conservatively less than the modeled uranium weight of the design basis Westinghouse 17x17 fuel assembly of 469 kg (see Table 5.2.1). The uranium weight modeled along with the additional source from ^{60}Co gammas from the stainless steel cladding and guide tubes (in Section I.5.2) bounds the WE 14 x 14 SC assemblies.

Within Section I.5.2 Source Specification, the following text will be added,

"The source terms for the HI-STORM UMAX PWR design basis assemblies used in Section I.5.2 conservatively have more uranium mass than the actual shorter fuel stored in the 24PT1-DSC canister [I.5.0.1]."

Additional conservatisms in the model are listed in Section I.5.3 (2, 3, and 4).

References

[1] *Characteristics of Spent Fuel, High-Level Waste, and Other Radioactive Wastes which may Require Long-Term Isolation*. DOE/RW—0184-Vol.3. U.S. Department of Energy, Office of Civilian Radioactive Waste Management. Washington, D.C. December 1987. Appendix 2A, Page 2A-13.

RSI-6. Provide Chapter 7 (Confinement) change pages from Revisions 2 and 5 of the Standardized Advanced NUHOMS FSAR.

The confinement evaluation for the NUHOMS 24PT1-DSC is incorporated by reference into the HI-STORM UMAX application in reference I.1.2.1. Reference I.1.2.1 is identified as the Standardized Advanced NUHOMS FSAR, Revision 6. In a letter containing reference supplemental information dated November 4, 2016, the applicant states, “The "Final Safety Analysis Report for the Standardized Advanced NUHOMS Horizontal Modular Storage System for Irradiated Nuclear Fuel," Revision 6 was compiled from public documents available in ADAMS. Rev 0 of the FSAR is available in three pieces, with ADAMS accession numbers ML050410252, ML031040379, and ML031040312. This initial revision was then updated based on the publically available changed pages in ADAMS accession numbers ML040910311, ML082341022, ML102290084, ML12229A121, and ML14226A790, up to Revision 6.”

The Revision 6 FSAR should incorporate all changes made in the previous revisions. Since the Revision 6 change pages do not specify changes to the confinement chapter, it is assumed the confinement chapter is made up of Revision 0, Revision 2 and Revision 5 information per LOEP-5 in the Revision 5 change pages. Change pages for Revision 2 were not included in the reference supplemental information letter and although Revision 5 change pages were included in the reference supplemental information letter, specific Chapter 7 changes are not included or identified in those change pages. Chapter 7 changes from Revision 2 and Revision 5 should be provided so the staff has Revision 6 of the NUHOMS FSAR.

This information is needed to determine compliance with 10 CFR 72.236.

Holtec Response:

As stated by the staff in the RSI question, Holtec has compiled the Standardized NUHOMS FSAR from the various submittals of changed pages, and has based the HI-STORM UMAX application on only the publically available information. Through both searches of the NRC’s ADAMS database, and communication with the NRC document control staff, it has been determined that no version of the Standardized Advanced NUHOMS FSAR Revision 2 is publically available. Therefore, Holtec has not utilized any Revision 2 information to support the conclusions made in the HI-STORM UMAX application.

The Standardized Advanced NUHOMS FSAR Revision 5 changed pages were submitted to the NRC under the package with ADAMS Number ML12229A121. While the list of effective pages in the beginning of that package identifies that pages 7.1-1 and 7.1-2 were updated as part of Revision 5, those pages are not included in the public information in the ADAMS package. Therefore, it is assumed that those pages are proprietary information.

Although certain information is not publically available, Holtec believes that the information provided in Supplement I.7 of the HI-STORM UMAX FSAR provides

reasonable assurance that the 24PT1-DSC canister maintains its confinement integrity. Additional information on use of the NUHOMS FSAR is provided in the response to RSI-1, under the discussion of compliance with 10CFR72.236(e).

RSI-7. Please provide calculations and drawing details supporting the design of the sliding rail used in the cask handling apparatus, CHA-90 assembly. Bill of materials item 1 (sliding rail) described in licensing drawing 10488 sheet 1 and 2 states that the design of the sliding rail and its supports are to "be determined" at a later time according to flag note 1. This important to safety item appears to affect lifting operations and could affect retrievability. A safety finding cannot be made without drawing details and supporting calculations of this item.

This information is needed to determine compliance with 10 CFR 72.124(a) and 10 CFR 72.236(m).

Holtec Response:

Drawing 10488 has been updated to remove flag note 1 and eliminate any uncertainty regarding the design of the sliding rail. The details of the sliding rail (item 1) and rail rib (item 5) are as shown on sheets 1 and 2 of updated licensing drawing. The sliding rails are not in the load path when the CHA-90 assembly is being used to lift a loaded 24PT1 DSC canister, and therefore they are not credited in the structural analysis of the CHA-90 assembly, which is documented in Calculation 3 of Holtec Calculation Package HI-2167337. During vertical lifting, the weight of the 24PT1 DSC bears against the eight (8) foot plates (item 11) near the base of the CHA-90 assembly, and the load then travels upwards through the lifting legs (items 10 and 13) to the top support ring (item 2). The sliding rails are only used when 24PT1 DSC is being inserted into (or withdrawn from) the CHA-90 assembly inside a horizontally oriented HI-TRAC VW transfer cask. As configured, the rail ribs provide continuous support to the sliding rails along their entire length, and they also provide a direct pathway for the weight of the 24PT1 DSC to be transferred to HI-TRAC inner shell through radial compression and bearing contact. Based on the bounding weight of the 24PT1 DSC (82,000 lb) and its overall height (186.5 in), the average compressive stress in the pair of ½" thick rail ribs is less than 1,000 psi. Therefore, the sliding rail design as shown in the updated licensing drawing is more than adequate for its intended purpose.

RSI-8. Please provide calculations and/or description for lifting lugs depicted on sheet 1 of drawing 10576.

Flag note 1 on sheet 1 of drawing 10576 indicates that "lugs may vary in location size and quantity". It is unclear if these ITS lugs are used to support and/or lift the 24PT1 DSC in any fashion by way of the seismic restrain assembly. If so, provide calculations backing their design as a safety finding cannot be made for these important to safety items without knowing their size and location.

This information is needed to determine compliance with 10 CFR 72.124(a).

Holtec Response:

The lugs depicted on sheet 1 of drawing 10576 are not used in any fashion to support or lift the 24PT1 DSC. The sole purpose of the lugs, which are welded to the divider shell, is to provide a resting surface for the shield ring (item 1 on drawing 10574) when the Top Seismic Restraint Assembly (TSRA) is lowered into position. It is further noted that when

the TSRA is installed in place the DSC spacer blocks (consisting of items 2, 4, 5, and 6 on drawing 10574) are self-supporting, and they do not transfer any load to the shield ring during normal storage conditions or during a seismic event. Thus, the welded lugs are only required to support the weight of the shield ring (1,300 lb approx.). The attachment welds between the lugs and the divider shell are evaluated in Calculation 2 of Holtec Calculation Package HI-2167337. The analysis shows that the welds have a safety factor of 4 against failure when the weight of the shield ring is amplified by a 1g vertical earthquake. Flag note 1 on sheet 1 of drawing 10576 allows the location, size and/or number of lugs to vary from what is depicted on the drawing provided that the lugs and their attachments welds continue to meet the applicable ASME NF stress limits.

RSI-9. Please provide structural calculations for the pedestal shown on sheet 1 of drawing 10576.

Flag note 7 on Sheet 1 of drawing 10576 indicates that pedestal joints are to be determined at the fabrication level. A finding for this important to safety item used for structural support, lifting operations, seismic analysis, and retrievability cannot be made without structural calculations, nor can it be fabricated as depicted without out pertinent weld information such as size, filler material, weld process etc. Provide calculations in the SAR and place weld size, filler material, and process on the licensing drawings.

This information is needed to determine compliance with 10 CFR 72.124(a) and 10 CFR 72.236(m).

Holtec Response:

The structural calculations for the pedestal are documented in Calculation 2 of Holtec Calculation Package HI-2167337. The calculations do not take any credit for the vertical welds between the center support and the eight pedestal legs (see sheet 2 of drawing 10576). Therefore, these welds are not structurally significant and need not be specified on the licensing drawing. On the other hand, the horizontal welds between the underside of the pedestal top plate and all eight pedestal legs are relied upon to transfer the horizontal load acting on the top plate. Therefore, drawing 10576 has been updated to indicate the size and type of these welds.

RSI-10. Please provide LS-DYNA input and output files used to characterize the seismic response of the 24PT1-DSC within the UMAX VVM.

Section I.3.1.3 describes the stress analysis and computer codes used to determine the seismic response of the 24PT1-DSC canister within the UMAX VVM. However, the input/output files have not been provided.

This information is needed to determine compliance with 10 CFR 72.24(d)(2).

Holtec Response:

The requested input/output files are provided as an attachment to this RSI response.

RSI-11. Please provide the following references:

a) Reference [I.1.2.3] HI-STORM FW FSAR, HI-2114830, latest revision along and licensing drawings
b) Reference 3.1.3 as cited in Table I.3.1.1 of the FSAR as part of the acceptance criteria for the 24PT1-DSC.
c) Structural Calculation Package For the HI-STORM UMAX System, HI-2125228, Revision 5
d) HI-STORM UMAX FSAR, HI-2115090, Proposed Rev. 3D (LAR 1040-3)

This information is needed to determine compliance with 10 CFR 72.230(a).

Holtec Response:

a) The latest version of the HI-STORM FW FSAR is Revision 4, which was submitted on June 24, 2015 to the NRC, ML15177A246. The references in the HI-STORM UMAX FSAR have been updated to refer exclusively to Revision 4 of the HI-STORM FW.

b) Reference [3.1.3] is from the main body of the HI-STORM UMAX FSAR: Doug Ammerman and Gordon Bjorkman, "Strain-Based Acceptance Criteria for Section III of the ASME Boiler and Pressure Vessel Code", Proceedings of the 15th International Symposium on the Packaging and Transportation of Radioactive Materials, PATRAM 2007, October 21-26, 2007, Miami, Florida, USA.

For convenience, a copy of this document is attached to this letter

c) HI-2125228 Revision 5 is attached to this letter.

d) The HI-STORM UMAX FSAR Proposed Rev 3D was submitted with the original amendment request submittal (Holtec Letter 5021033, dated August 30, 2016). That FSAR is now superseded by Proposed Rev 3E, which is attached to this letter.

RSI-12. Please describe the condition of the fuel within the 24PT1 DSC canister when subjected to seismic loading.

While an analysis has been provided for the canister under seismic conditions, it is unclear what the structural integrity of the fuel will be after being subjected to seismic loading. Note that canister rated g-loads are dependent on canister drop orientations and boundary conditions which are not shared by the seismic analysis. Note that the 24PT1 DSC canister stored in the UMAX is supported and oriented in a manner unlike its original NUHOMS configuration, and is supported in a manner that is unlike other canisters in the UMAX. Please place the supporting analysis into the SAR.

This information is needed to determine compliance with 10 CFR 72.24(d)(2)

Holtec Response:

As explained in Section 3.5 of the FSAR (which is also referenced in Section I.3.5), the fuel rod cladding is not credited as a confinement barrier, and therefore a structural integrity analysis of the fuel rods is not necessary to demonstrate compliance with 10CFR72 requirements. Nonetheless, Supplement I.3 of the HI-STORM UMAX FSAR has been updated to incorporate by reference the permissible

fuel rod decelerations established in Section 3.5.3 of the Advanced NUHOMS FSAR. The structural integrity evaluations of the fuel rods performed in the NUHOMS FSAR are equally valid when the 24PT1 DSC is stored in the UMAX since the referenced evaluations are based solely on the material properties and dimensions of the fuel rods themselves, with no dependence on the canister support configuration. The fuel rod integrity evaluation and the permissible fuel rod decelerations are now incorporated by reference in Tables I.3.0.1 and I.3.1.1 of the HI-STORM UMAX FSAR.

From Table I.3.4.3, the maximum horizontal (lateral) acceleration acting on the 24PT1 DSC when stored in the UMAX, during a design basis earthquake, is 6.93g, which is less than the permissible lateral deceleration for the fuel rods in Table I.3.1.1 by more than a factor of 3. Likewise, the maximum vertical acceleration acting on the 24PT1 DSC when stored in the UMAX is 311.48 kip / 82 kip = 3.80g (derived from maximum vertical force on DSC pedestal divided by the DSC weight from Table I.3.4.3 and I.3.2.1), which is less than the permissible axial deceleration for the fuel rods in Table I.3.1.1 by more than a factor of 5.

In summary, the fuel rods within the 24PT1 DSC canister will remain structurally intact if a design basis seismic event occurs while the 24PT1 DSC is stored in the UMAX. However, the fuel rods are not credited in the confinement analysis as discussed in Section 3.5 of the FSAR.

RSI-13. Provide detailed drawings that support the thermal model.

Section I.4.4 of the SAR states "*24PT1-DSC storage in the UMAX VVM is evaluated using a suitably calibrated thermal model of the canister that conservatively represents the temperatures in its licensed configuration as articulated in the NUHOMS FSAR.*" However, the application did not provide detailed drawings of the module. Section 4.5.1 of NUREG-1536 states that in addition to the material compositions, the dimensions of the cask components and SNF assemblies are to be clearly indicated. All drawings, figures, and tables should be sufficiently detailed to support in-depth staff evaluation. The drawings need to provide sufficient detail to support the applicant's statement that the thermal model is suitably calibrated, representative, and conservative. The staff needs this information to ensure its proper use in the thermal calculations and to verify that the dimensions and materials are consistent with those in the drawings of the actual cask.

This information is necessary to verify the requirements of 10 CFR 72.230(a) and 10CFR 72.236.

Holtec Response:

Detailed drawings of the NUHOMS module not relied in the thermal analysis as this material is withheld by the license holder from public disclosure in the supporting NUHOMS FSAR. To support thermal modeling the principal characteristics of the NUHOMS module is constructed by review of information from multiple sources as cited in the supporting calculation package "Thermal Evaluation of HI-STORM UMAX System Loaded with 24PT1-DSC", HI-2167272, Rev. 1. This information and citation is incorporated in the revised Section I.4.4 included with these responses.

RSI-14. Provide a detailed description of the NUHOMS 24PT1 DSC thermal model.

Section I.4.4 of the SAR states "*24PT1-DSC storage in the UMAX VVM is evaluated using a suitably calibrated thermal model of the canister that conservatively represents the temperatures in its licensed configuration as articulated in the NUHOMS FSAR.*" However, the application did not provide a detailed description of the model configuration. Section 4.5.4.1 of NUREG-1536 states that any model used in the thermal evaluation should be clearly described. The staff needs this information to determine the adequacy of the developed thermal models to predict applicable thermal limits.

This information is necessary to verify the requirements of 10 CFR 72.230(a) and 10CFR 72.236.

Holtec Response:

A more detailed thermal model description is incorporated in the revised Section I.4.4 included with these responses.

O-1. The information contained in previous applications, statements, or reports filed with the Commission may be incorporated by reference provided that these references are clear and specific. Provide in the appropriate sections of the SAR, a summary of all documents submitted to the Commission in other applications that are incorporated in whole or in part that support this requested licensing action (RLA).

For example, in the General Information section of "Supplement I.1: General Description of 24PT1-DSC Canister," it is stated: "Since the 24PT1-DSC canister has already been approved by the NRC for storage under Part 72, (and is presently in active use) under Docket No. 72-1029, much of the safety analysis information is incorporated herein by reference to the NUHOMS FSAR." This statement is not specific and not exactly clear.

This information is needed to evaluate compliance with 10 CFR 72.230(a).

Holtec Response:

Amendment 3 to the HI-STORM UMAX CoC includes material incorporated by reference as appropriate in the supporting proposed Safety Analysis Report (Supplement I to UMAX FSAR Report No. HI-2115090). Proposed Supplement I for each UMAX FSAR chapter contains as applicable, a table that summarizes the material incorporated by reference into that chapter supplement, typically in the first section of the chapter. The table below, repeated from Supplement I.1, displays material incorporated by reference into Supplement I.1. Incorporation by reference is only utilized where information is not repeated in Supplement I. Passing references may be made to other documents, but these are not considered to be incorporation by reference. As conveyed in the sample table, materials incorporated for this licensing action includes docketed information from the HI-STORM FW (NRC Docket no. 72-1032) and TN NUHOMs (NRC Docket no. 72-1029). The statement identified in the RSI response will be revised to reference the specific information in each chapter. Where analysis is performed in support of Amendment 3, the safety case is documented in the supplement and incorporation by reference is not utilized.

Table I.1.0.1: Material Incorporated by Reference

Information Incorporated by Reference	Source of the Information	NRC Approval of Material Incorporated by Reference	Location in this FSAR where Material is Incorporated	Technical Justification of Applicability to HI-STORM UMAX
Canister Description	Section 1.2.1.1 Reference [I.1.2.1]	SER Advanced NUHOMS Amendment 0, Reference [I.1.2.2]	I.1.2.1.1	The canister is the same as the one described in the FSAR and originally approved in the referenced SER.
HI-TRAC VW design	Section 1.2.1.3 Reference [I.1.2.3]	SER HI-STORM FW Amendment 0, Reference [I.1.2.3]	I.1.2.1.3	The HI-TRAC VW used with the 24PT1-DSC is the same as the one originally approved in the referenced SER. The Cask Handling Apparatus (CHA) is fully evaluated in this supplement.
Criticality Safety	Section 1.2.2.3.1 Reference [I.1.2.1]	SER Advanced NUHOMS Amendment 0, Reference [I.1.2.2]	I.1.2.2.3.1	Criticality is controlled by geometry and neutron absorbing materials in the fuel basket. The basket is made from stainless steel, with a fixed borated neutron absorbing material known as Boral™, which ensures criticality control of the fuel. The canister is maintained in a sealed, dried condition, so the criticality evaluations are unchanged.

O-2: Format citations in the reference sections according to a style rule consistent with either "The Elements of Style" by Strunk & White, the Modern Language Association's (MLA) Style Manual and Guide to Scholarly Publishing, the publicly available, NUREG-1379, "NRC Editorial Style Guide" (ML093280744), or equivalent.

Citations directs the reader to the source the writer(s) used. So, the reference list should have reference entries that allows the reader to find the original source a writer used. No specific style rule has been adhered to throughout the entire RLA submittal. For example, in the "Reference" section of "Supplement I.1: General Description of 24PT1-DSC Canister," the following citation is both incomplete and incorrectly formatted.

"[I.1.2.3] HI-STORM FW FSAR, HI-2114830, latest revision"

This information is needed to evaluate compliance with 10 CFR 72.230(a).

Holtec Response:

Supplement I has been revised based on the citation format in NUREG-1379 (Revision 2). The references section for each chapter supplement has been revised accordingly.

O-3. Certain or specific portions of the engineering drawings may be categorized as proprietary. However, should any drawings be relied on as the technical basis for adding the dry storage system (DSS) design to the list of approved DSSs contained in Subpart K of 10 CFR Part 72, those drawings become part of the public record. Such drawings will not be treated as proprietary and will be made available to the public.

Currently, the amendment request includes proprietary drawings and descriptions that will remain proprietary upon approval of the certificate, the sketches, drawings, and diagrams that provide the general description and operational features need not show the proprietary features. This may be achieved by depicting less detail or by illustrating generic components that fulfill the design function. However, these representations should show the operational concept and features important to safety in sufficient detail to form an acceptable basis for public review and comment.

This information is needed to evaluate compliance with 10 CFR 72.230(a).

Holtec Response

Licensing Drawings in Section I.1.5 of the proposed Proprietary UMAX FSAR Supplement I (Report No. 2115090 Proposed Rev. 3.E) are deemed proprietary in accordance with 10 CFR 2.390 because they contain patentable subject matter, disclose processes, apparatuses and information, which, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product. Historically Holtec and other stakeholders in the spent nuclear fuel dry storage and transportation industry have withheld licensing drawings submitted with licensing actions or updated Final Safety Analysis Reports from public disclosure. This process is the same for USNRC dockets for the HI-STORM UMAX System (72-1040), HI-STORM FW System (72-1032), TN Standardized Advanced NUHOMS System (72-1029) and TN/AREVA NUHOMS EOS System (72-1042) among others.

In lieu of licensing drawings, the updated or proposed FSARs may contain non-proprietary figures, illustrations or diagrams, which provide general description and operational features with less detail and are therefore not considered proprietary. Holtec

agrees that those figures and diagrams not displaying proprietary features should be made available to the public and show operational concepts and features in sufficient detail to form an acceptable basis for public review and comment. The non-proprietary version of proposed Supplement I of the HI-STORM UMAX FSAR submitted in support of this licensing action has been revised (particularly in Chapters 3 and 9) to display figures and diagrams where proprietary licensing basis details of operational concepts and features are not included.

O-4. Please provide the steps to unload a 24PT1-DSC that have been provided in the applicable NUHOMS FSAR rather than the HI-STORM FW FSAR.

Page 9-18 of the SAR states that "[t]he regulatory compliance justifications and conclusions described in Section 9.5 apply to this Supplement, with the following exception: The steps to unload a 24PT1-DSC have been provided in the NUHOMS FSAR rather than the HI-STORM FW FSAR." However, a specific NUHOMS FSAR reference was not provided so that this information is clearly incorporated by reference into the licensing basis.

This information is needed to determine compliance with 10 CFR 72.236(h).

Holtec Response

To clarify the unloading of fuel in the NUHOMS FSAR, Chapter I.9 is revised to provide a specific reference to the NUHOMS FSAR.

O-5. Please provide Section 8.2.1 of the Standardized Advanced NUHOMS FSAR which states the steps necessary to remove the DSC from the AHSM.

Page 9-6 of the SAR states in Step 5 to "[r]etrieve the 24PT1-DSC canister from the AHSM into the NUHOMS transfer cask per Section 8.2.1 of the Standardized Advanced NUHOMS FSAR." However, a specific reference to the Standardized Advanced NUHOMS FSAR was not provided so that the staff can verify the adequacy and compatibility of the operating procedures of the two SARs being used together.

This information is needed to determine compliance with 10 CFR 72.236(h).

Holtec Response

Holtec concurs. Step 5 is revised as attached to these responses to provide a specific reference to the NUHOMS FSAR:

O-6. Clarify (provide) the basis and evaluation as to why the requirement for and of a fuel removal procedure are not provided in the HI-STORM UMAX Technical Specifications (TS) as they are in Section 5.1 of the Standardized Advanced NUHOMS Technical Specifications.

Page 5-1 of the Standardized Advanced NUHOMS TS states the requirement for a fuel removal procedure and then lists, at a minimum, what it shall include. However, the HI-STORM UMAX TS provided in this application do not contain similar requirements to ensure the same level of rigor and protection of personnel is provided in the fuel removal procedure.

This information is needed to determine compliance with 10 CFR 72.234(f).

Holtec Response

HI-STORM UMAX CoC Condition 8 of proposed Amendment 3 has been revised to require a procedure for fuel unloading from the welded TN NUHOMS 24PT1-DSCs

(canisters) following storage in a HI-STORM UMAX System. DSCs fuel unloading operations and procedure, as described on Page 5-1 of the Standardized Advanced NUHOMS TS (Amendment No. 3), has been incorporated by reference Subsection I.9.4.4, and shall be performed in accordance with the Standardized Advanced NUHOMS TS and FSAR procedures. Additionally, the requirement for DSC fuel unloading training has been added to Subsections I.13.2.1 and I.13.2.2 (Supplement I.13(Proposed Rev. 3.E)).

O-7. Clarify (provide) the basis as to why the requirement for inspection of the DSC after any transfer cask drop of 15 inches or greater is not provided in the HI-STORM UMAX TS as it is in Section 5.3.2 of the Standardized Advanced NUHOMS TS.

Pages 5-8 and 5-9 of the Standardized Advanced NUHOMS TS state the requirement for DSC inspection after a transfer cask drop of 15 inches or greater to ensure it will continue to provide confinement and the transfer cask can continue to perform its design function. However, the HI-STORM UMAX TS provided in this application does not contain a similar requirement to ensure the DSC can continue to perform its safety function in the unlikely case it is dropped during Transport Operations.

This information is needed to determine compliance with 10 CFR 72.236(j).

Holtec Response

Section 5.2 of proposed Appendix C of the HI-STORM UMAX CoC (proposed Amendment 3) states that the Transfer Cask may be lifted and carried at any height necessary during Transport Operations and Canister Transfer, provided lifting equipment are designed in accordance with NUREG-0612 with redundant drop protection features. The vertical column and lifting equipment shall be designed to comply with stress limits of ASME Section III, Subsection NF, Class 3 for linear structures.

Therefore lifting and handling devices such as the HI-TRAC Transfer Cask, Top Seismic Restraint Assembly (TSRA) and Canister Handling Assembly (CHA) are designed as lifting and handling devices with redundant drop protection features in accordance with NUREG-0612 and other standards in Section 5.2 of proposed Appendix C of the HI-STORM UMAX CoC (proposed Amendment 3). As such, drops of the HI-TRAC, TSRA and CHA are not credible and therefore inspection of canisters post-drop not applicable under the HI-STORM UMAX CoC.

Analysis of the drop protection features on the HI-TRAC Transfer Cask is in Section 2.4.4 of main body of the UMAX FSAR, and analyses of drop protection features on the CHA and TSRA is in proposed Supplement I (Section I.3.4) of the safety analysis report submitted with this licensing action.

It is understood that the licensing basis for the DSC in the NUHOMS license includes the possibility of drops and requires an inspection of any DSCs that undergo a drop. The proposed HI-STORM UMAX CoC, Appendix C, Section 5.4 includes a condition that the DSC be verified to meet all the requirements of CoC 72-1029. This verification will include a review that an inspection of the DSC has been performed if it has been dropped from a height of 15 inches or greater, in accordance with CoC 72-1029.**O-8.** Please clarify the number of hours cited in the TS for the Completion Time of LCO 3.1.1.C.2.2.

O-8. The TS LCO states 64 hours for the completion time, however, page I.13.A-15 of the SAR states, in part, for Required Action C.2.2, "[t]he Completion Time of 24 hours reflects the Completion Time from Required Action C.2.1 to ensure component temperatures remain below their short-term temperature limits for the respective decay heat loads." Please clarify/verify this value throughout the SAR and TS.

This information is needed to determine compliance with 10 CFR 72.236(l).

Holtec Response

The completion time for Required Action C.2.2 was an editorial error and has been corrected to 64 hours on page I.13.A-15 to align with TS Appendix C LCO 3.1.2.

O-9. Provide a standalone licensing drawing that incorporates UMAX drawing 10017 along with the items referenced in Note 1 of Sheet 1 of drawing 10576.

Note 1 of the Additional notes section on Sheet 1 of drawing 10576 indicates that UMAX drawing 10017 should be coordinated with certain features specific to the 24PT1 DSC shown on Sheet 1 of drawing 10576. To eliminate confusion in the review by technical staff and inspectors, a separate licensing drawing or detail should be provided incorporating the two drawings rather than having to guess at what Sheet 1 of drawing 10576 should be like with a different pedestal, closure lid restrain block assembly, shield ring, upper MPC guides etc.

This information is needed to determine compliance with 10 CFR 72.146(a) and 10CFR 72.160.

Holtec Response

The intent of incorporating the basic design features of the HI-STORE UMAX design (CEC shell, closure lid configuration, shielding thicknesses, air flow gaps, etc.) from the UMAX drawing 10017 is to maintain the documentation of these key features in a single design document (drawing 10017), while highlighting only site-specific design needs in drawing 10576. While it is understood that this creates difficulty in cross-referencing the drawings, it was considered a reasonable approach to help avoid mistakes in transposing features and dimensions from one drawing to another, which has historically been a potential source of error and inconsistency between what are expected to be identical drawings. To aid in cross-referencing between drawings, Note 1 has been revised, as shown below, to provide more details and clearer explanation of the drawing intent:

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]

[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

]

O-10. State the reasons why the k-ω turbulent model adequately captures the heat transfer and flow characteristics of the VVM cooling passages.

Section I.4.4.2 of the SAR states that "*the airflow through the cooling passages of the VVM is modeled as turbulent, using the k-ω model with transitional option.*" The applicant needs to clearly state the reasons why the selected turbulence model adequately capture the heat transfer and flow characteristics for such low decay heat and air flow velocities. The staff needs this information to verify heat transfer and air flow characteristics are realistic or conservative.

This information is necessary to verify the requirements of 10 CFR 72.230(a) and 10 CFR 72.236.

Holtec Response

The k-ω turbulent model with transitional option is the same as Holtec bench marked turbulent model [O-10.1] supporting the thermal modeling of HI-STORM UMAX (Docket No: 72-1040), HI-STORM FW (Docket No: 72-1032) and HI-STORM 100 systems (Docket No: 72-1014). The verification of model is documented in Section 4.4.3 of HI-STORM UMAX FSAR.

This is further supported by the Reynolds number for the annular gap between DSC and divider shell. The Reynolds number is calculated for air in the annular gap at approximately mid-height of the DSC and reported in the following table. The results indicate that the flow in the annular gap is in transitional regime. Therefore, it is appropriate to use k-ω turbulent model with transitional option enabled. The above justification is added to the thermal calculation package, HI-2167272 Rev 1.

Table O-10.1: Reynolds Number in Annular gap between DSC and Divider Shell

Average Air Temperature (K)	Average Velocity (m/s)	Reynolds Number
319	0.318	8700

[O-10.1] "Identifying the Appropriate Convection Correlation in FLUENT for Ventilation Air Flow in the HI-STORM System", Revision 1, Holtec Report HI-2043258, Holtec International, Marlton, NJ, 08053.