UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 10, 2020

Ms. Kim Manzione, Licensing Manager
Holtec International
Holtec Technology Campus
One Holtec Boulevard
Camden, NJ 08104

SUBJECT: HOLTEC INTERNATIONAL'S APPLICATION FOR SPECIFIC INDEPENDENT SPENT FUEL STORAGE INSTALLATION LICENSE FOR THE HI-STORE CONSOLIDATED INTERIM STORAGE FACILITY FOR SPENT NUCLEAR FUEL – FIRST REQUEST FOR ADDITIONAL INFORMATION, PART 6

Dear Ms. Manzione:

By letter dated March 30, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17115A431), as supplemented on April 13, October 6, December 21, and 22, 2017; and February 23, 2018 (ADAMS Accession Nos. ML17109A386, ML17310A218, ML17362A097, ML18011A158, and ML18058A617, respectively), Holtec International submitted to the U.S. Nuclear Regulatory Commission (NRC) an application for a specific independent spent fuel storage installation license to construct and operate the HI-STORE Consolidated Interim Storage Facility, in Lea County, New Mexico, in accordance with the requirements of Part 72 of Title 10 of the *Code of Federal Regulations*, "*Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste and Reactor-Related Greater than Class C Waste.*" The license application seeks NRC approval to store up to 8,680 metric tons of commercial spent nuclear fuel in the HI-STORM UMAX Canister Storage System for a 40-year license term.

The NRC staff is conducting a detailed technical review of your application and has determined that additional information is necessary in connection with its review. The information needed by the staff is discussed in the enclosed request for additional information (RAI). We request that you provide responses within 60 days from the date of this letter. If you are unable to meet these deadlines, please notify NRC staff in writing, within two weeks of receipt of this letter, of your new submittal date and the reasons for the delay.

As discussed in our February 28, 2018, letter notifying you of our decision to docket the application and begin a detailed technical review, the NRC staff expects to issue its first round RAIs in several parts. The enclosed RAIs address the remaining portions of the NRC staff review completed to date and complete the staff's first round RAIs.

Upon removal of Enclosure 2, this document is uncontrolled

Please reference Docket No. 72-1051 and CAC/EPID No. 001028/07201051/L-2018-NEW-0001 in future correspondence related to the technical review for this licensing action. If you have any questions, please contact me at (301) 415-0606.

Sincerely,

/RA/

Jose R. Cuadrado, Project Manager
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No.: 72-1051
CAC/EPID Nos.: 001028/07201051/
L-2018-NEW-0001

Enclosures:
1. RAI – Part 6 (Non-Proprietary)
2. RAI – Part 6 (Proprietary)

SUBJECT: HOLTEC INTERNATIONAL'S APPLICATION FOR SPECIFIC INDEPENDENT SPENT FUEL STORAGE INSTALLATION LICENSE FOR THE HI-STORE CONSOLIDATED INTERIM STORAGE FACILITY FOR SPENT NUCLEAR FUEL – FIRST REQUEST FOR ADDITIONAL INFORMATION, PART 6

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First Request for Additional Information, Part 6

Docket No. 72-1051
Application for specific independent spent fuel storage installation license for the HI-STORE Consolidated Interim Storage (CIS) Facility in Lea County, New Mexico

By letter dated March 30, 2017 (ADAMS Accession No. ML17115A431), as supplemented on April 13, October 6, December 21, and 22, 2017; and February 23, 2018 (ADAMS Accession Nos. ML17109A386, ML17310A218, ML17362A097, ML18011A158, and ML18058A617, respectively), Holtec International submitted to the U.S. Nuclear Regulatory Commission (NRC) an application for a specific independent spent fuel storage installation license to construct and operate the HI-STORE Consolidated Interim Storage (CIS) Facility, in Lea County, New Mexico, in accordance with the requirements of Part 72 of Title 10 of the *Code of Federal Regulations* (10 CFR 72), "*Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste and Reactor-Related Greater than Class C Waste.*" The license application seeks NRC approval to store up to 8,680 metric tons of commercial spent nuclear fuel in the HI-STORM UMAX Canister Storage System for a 40-year license term.

This request for additional information (RAI) identifies additional information needed by the NRC staff in connection with its safety and environmental review of the HI-STORE CIS facility license application. The requested information is sorted by the specific part of the license application, or the specific chapter or section number in the safety analysis report, environmental report, or their respective supporting analyses. The staff used the guidance in NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," for its review of the application.

License Application (LA)

[Note: RAI LA-1 thru LA-4 were issued on September 13, 2018 (ML18257A240)]

RAI LA-4: Provide a justification why a Technical Specification limiting condition for operation (LCO) for transfer cask and canister contamination limits during transport operations was not included in the application.

The HI-STORM UMAX Technical Specifications include LCO 3.2.1 for transfer cask and canister contamination limits, but the proposed Technical Specifications for the HI-STORE CISF do not include a similar LCO. The canisters being sent to the HI-STORE CISF are surveyed for contamination once the transportation overpack is opened, but no limits have been established to ensure the minimization of the potential spread of contamination to the environment during subsequent transport operations to the storage pad.

This information is needed to determine compliance with 10 CFR 72.24(g) and 72.104.

Financial Qualification and Decommissioning Funding Assurance

RAI FQA-1: Provide detailed financial statements for Holtec International for the last three complete accounting years. Specifically, provide balance sheet, statement of income (statement of profit or loss), and statement of cash flow, and certification by a public accountant. Additionally, clarify "sponsoring party" and the applicant's reliance on funding for operations as being "[…] *tied to the sponsoring party's agreement*" with the applicant, as stated in the application; and provide more detail as to the intent of proposed License Conditions 17 and 18

used to address financial qualification, decommissioning funding assurance, and other legal, financial, and liability qualifications and requirements.

The provisions of 10 CFR 72.22(e) state that the applicant must show that it either possesses the necessary funds, or that the applicant has reasonable assurance of obtaining the necessary funds; or that by a combination of the two, the applicant will have the necessary funds to construct, operate, and decommission the facility. As discussed below, it is not clear to staff whether the applicant intends to demonstrate its financial qualifications based on a demonstration that it possesses sufficient assets and funds, or whether it will show reasonable assurance of obtaining those funds through the referenced service contracts and/or user agreements with its customers.

In Section 1.0 of Holtec Report HI-2177593, "HI-STORE CISF Financial Assurance and Project Life Cycle Cost Estimate", the applicant states that it *"[…] is well positioned to provide the financial assurance for the construction and oversight of Phase 1 of the CISF facility to include 500 HI-STORM UMAX canisters for the storage of Spent Nuclear Fuel (SNF) and Greater-than-Class C (GTCC) waste from commercial reactors. Our commitment is based on the willingness and capability of Holtec to fund the construction efforts of the CISF estimated to be in the range of ~$180 million."* In proprietary information provided in the application, the applicant provides net asset data as of end of year 2016, earnings before interest, taxes, depreciation, and amortization (EBITDA) data for fiscal year 2016, and projected cumulative EBITDA data for years 2016 through 2020. However, the financial information provided in the application does not provide sufficient detail to establish whether the reported earnings include any non-recurring items, such as extraordinary gains or losses, charges from discontinued operations, or accounting changes.

Additionally, Section 1.0, "Financial Profile of Holtec International," states that *"[…] as a matter of financial prudence, Holtec will require the necessary user agreements in place (from the USDOE and/or the nuclear plant owners) that will justify the required capital expenditures by the Company."* Section 2.1, "Annual Operating Costs," states that *"[…] [a]ll financial commitments related to annual operations will be tied to the sponsoring party's agreement with Holtec (viz., DOE settlement agreement)."* To record these commitments, the applicant proposes License Conditions No. 17 and No. 18, which refer to and condition the license to "definitive agreement[s]" with prospective users/payers, and "service contracts" and "service contract provisions" between itself and customers.

This information is needed to determine compliance with the financial qualification requirements of 10 CFR 72.22(e).

RAI FQA-2: Provide a description of onsite and offsite insurance coverage.

The application does not identify plans for obtaining onsite or offsite nuclear insurance. While NRC regulations do not identify financial protection requirements for applicants for a specific license under 10 CFR Part 72, such insurance and indemnity coverage is required of NRC power reactor licensees transitioning to decommissioning. Moreover, the NRC has previously exercised its discretion on a case-specific basis to condition the approval of a license for an away from reactor site spent fuel storage facility on provision of offsite and onsite financial protection. The staff notes that Materials License No. SNM-2513, issued to Private Fuel Storage, LLC, for an away-from-reactor independent spent fuel storage installation (ADAMS Accession No. ML060450438), included License Condition 21.(4), addressing onsite and offsite

insurance coverage. The NRC staff could not find a description of onsite and offsite insurance coverage in the license application.

This information is needed to determine compliance with the financial qualification requirements of 10 CFR 72.22(e).

RAI FQA-3: Provide additional clarification regarding statements in Section 2.2, "Decommissioning Funding Assurance," of Holtec Report HI-2177593, "HI-STORE CISF Financial Assurance and Project Life Cycle Cost Estimate," regarding the method of decommissioning funding assurance.

Section 2.2 of Holtec Report HI-2177593, "HI-STORE CISF Financial Assurance and Project Life Cycle Cost Estimate," states that *"[t]he method of financial assurance as specified in 10 CFR 72.30(e)(3) will be met by Holtec International,"* and *"[a] decommissioning fund will be established by setting aside $840 per MTU stored at the HI-STORE facility. These funds, plus earnings on such funds calculated at not greater than a 3 percent real rate of return over the 40-year license life of the facility, will cover the estimated cost to complete decommissioning.*"

NRC guidance in NUREG-1757, Volume 3, "Consolidated Decommissioning Guidance; Financial Assurance, Recordkeeping, and Timeliness," provides further information about the use of external sinking funds for decommissioning funding assurance. Specifically, Appendix A, Section A.10, "External Sinking Funds" indicates that use of this method, *"[…]allows a licensee to gradually prepay for decommissioning by combining the use of a partially funded prepayment instrument (i.e., a trust fund) with a surety bond, letter of credit, or insurance covering the unfunded balance. As the licensee gradually funds the prepayment instrument over time, the licensee can reduce by a corresponding amount the coverage provided by the surety bond, letter of credit, or insurance."*

[…] Licensees that recover, either directly or indirectly, the estimated total cost of decommissioning through rates established by "cost of service" or similar ratemaking regulation, or (2) have a source of revenues for its external sinking fund that is a "non-bypassable charge"... may use an external sinking fund without having to couple it without a surety method or insurance."

As presented, the applicant does not describe how the sinking fund will be coupled with another decommissioning funding method, nor does the applicant indicate whether it will provide full funding of the sinking fund to address total decommissioning funding requirements. Further, the applicant does not justify how it is a licensee that falls into the category above that need not couple the sinking fund with another method. Finally, the information in Section 2.2 of the HI-STORE CISF Financial Assurance and Project Life Cycle Cost Estimate states that it will rely on a *"[…] 3 percent real rate of return over the 40-year license life of the facility to cover the estimated cost to complete decommissioning."* The application should justify how Holtec qualifies as a licensee that does not need another method of insurance, further justify how Holtec qualifies to use a real rate of return, and further justify how 3 percent is appropriate.

This information is needed to determine compliance with the financial qualification requirements of 10 CFR 72.30(e).

Safety Analysis Report (SAR), Chapter 1, "General Information"

RAI 1-1: Revise the definition of the controlled area boundary to state that the control access to the controlled area is applicable to the entire duration of the HI-STORE CISF operation.

The definitions in Page ii of the HI-STORE SAR state that the: "*Controlled Area means that area immediately surrounding the ISFSI over which the HI-STORE Facility owner (Holtec) exercises authority over its use and within which all Short Term Operations are performed*." This definition is not consistent with 10 CFR 72.3, which states: "Controlled area means that area immediately surrounding an ISFSI or MRS for which the licensee exercises authority over its use and within which ISFSI or MRS operations are performed." In accordance with the regulation, the controlled area is applicable to the entire period of operation of the ISFSI, rather than the duration in which short term operations are performed.

This information is needed to determine compliance with 10 CFR 72.104 and 72.106.

RAI 1-2: Revise Licensing Drawing No. 10940 (3 sheets) to provide clear demarcation of the controlled area boundary and the distance from the ISFSI pad to the controlled area boundary.

The applicant provided the layout of the HI-STORE CIS facility in Drawing No. 10940. However, the drawing does not include specific demarcation of the controlled area boundary. Although the applicant states on Table 1.0.1 of the SAR that the distance from the nearest loaded UMAX VVM to the controlled area boundary is 400 meters, the controlled area boundary is not clearly marked on the drawing.

This information is needed to determine compliance with 10 CFR 72.104 and 72.106.

RAI 1-3: Provide additional details about the measures to be implemented for controlling access to the area inside the controlled area boundary of the ISFSI.

The applicant provided a general description of the ISFSI installation in Section 1.1 of the SAR. However, the application does not state what specific physical measure(s) the applicant will implement to effect control access to the ISFSI when necessary.

This information is needed to determine compliance with 10 CFR 72.104 and 72.106.

RAI 1-4: [Contains Proprietary Information, see Enclosure 2]

RAI 1-5: [Contains Proprietary Information, see Enclosure 2]

RAI 1-6: Provide a justification why the air outlet vents are identified as Not Important to Safety (NITS) items or revise the drawings to label them as important to safety.

Sheet 6-6 of Drawing 10875 of the HI-STORE SAR identifies Items 304 (AIR OUTLET, INNER SHIELD CONE, 305 (AIR OUTLET, UPPER SHIELD CONE), and 306 (AIR OUTLET, LOWER SHIELD CONE) as NITS. The staff does not understand why these air outlets are classified as NITS, since the geometry and dimensions of these air outlets are important to shielding and provide streaming paths for radiations. The staff also notes that Drawing 8446, Sheet 7 for the UMAX FSAR marks the similar items as ITS.

This information is needed to determine compliance with 10 CFR 72.128(a)(4), 72.104 and 72.106.

RAI 1-7: Clarify the distance between the ISFSI and the controlled area boundary and revise the calculation for the dose at the controlled area boundary and the dose rate versus distance, as necessary.

Table 1.0.1 of the HI-STORE SAR states that the distance from the nearest loaded UMAX VVM to the controlled area boundary is 400 meters. However, Section 7.4.2.1 of the SAR also states that: "[…]*The nearest residence is 1.5 miles from the HI-STORE CIS Facility. The dose calculations conservatively assume a full-time resident (8760 hours/year) is only 1000 meters from the nearest loaded HI-STORM UMAX VVM. In the case of this nearest residence, the dose is calculated to be below the 25 mrem annual dose limit prescribed in 10 CFR 72.104*." From these statements, the staff is unable to verify the calculated controlled area boundary dose as presented in Table 7.4.3 of the SAR because it is not clear whether the controlled area boundary is 400 meters or 1000 meters.

This information is needed to determine compliance with 10 CFR 20.1301(a)(1), 10 CFR 72.104 and 72.106.

RAI 1-8: Provide the exact dimensions of the path and the distance from the unloading point of the transportation cask to the UMAX ISFSI pad.

Table 1.1.1 of the HI-STORE SAR provides some general arrangement data of the HI-STORE CISF ISFSI. However, it does not provide a detailed description for the dimensions of the site to include the specific path and distance from the point of transferring the canister from the transportation package to the ISFSI pad to facilitate radiation protection design and calculations.

This information is needed to determine compliance with 10 CFR 20.1201, 20.1202, 20.1203, 10 CFR 72.104 and 72.106.

RAI 1-9: Clarify the statements in Section 1.0.1 of the HI-STORE SAR regarding the treatment of 10 CFR 72.48 Evaluations for the HI-STORE CISF.

On Section 1.0.1 of the HI-STORE SAR, the applicant states: "*It is noted that the information incorporated herein by reference is based on the docketed, NRC – approved licensing basis. If any change is made to a canister under the original licensing basis using 10 CFR 72.48, such change will need to be evaluated against the HI-STORM UMAX FSAR before the canister can be stored in a HI-STORM UMAX system*." However, it is not clear from these statements what changes to the canister design have been made under 10 CFR 72.48 since the approval of Amendment 1 to Certificate of Compliance No. 1040 for the HI-STORM UMAX System, how the evaluations were performed, what acceptance criteria were used, and its impacts on shielding design for these canisters.

Because this application is for a specific license, evaluations of all changes made under 10 CFR 72.48 should be related to the specific characteristics of the HI-STORE CISF ISFSI design and operation.

This information is needed to determine compliance with 10 CFR 72.104, 72.106 and 72.124.

Safety Analysis Report (SAR), Chapter 3, "Operations at the HI-STORE CIS Facility"

RAI 3-1: Clarify (provide) the basis for how the HI-STORE CISF will be designed to receive fuel from any licensed canister-based transportation cask (or modify or remove that statement).

Section 3.1 of the HI-STORE SAR states that "[t]he HI-STORE facility will be designed to receive fuel from any licensed canister-based transportation cask." However, the analyses and operating procedures in the application only considers the use of the HI-STAR 190 transportation cask at the HI-STORE CISF. A basis or evaluation is not provided for the use of other licensed transportation cask designs or how HI-STORE is generically designed to accommodate a range of licensed transportation cask designs.

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

RAI 3-2: Provide the contamination limits (both removable and fixed) for the site including the surface of the spent fuel storage canister and the basis for those values.

Section 3.1.4.6 of the HI-STORE SAR states, in part, that personnel ensure that contamination levels on the canisters of incoming shipments meet site requirements, and canisters exceeding the limits will be returned to the originating power plant for dispositioning. However, no site limits have been established nor an associated basis or evaluation performed in the application.

This information is needed to determine compliance with 10 CFR 72.24(e), 72.122(h), and 72.126(a)(4).

RAI 3-3: Clarify if decontamination of the interior surfaces of transportation packages and transfer casks will be conducted after canisters are removed from both during canister transfer operations.

Section 3.1.4.6 of the HI-STORE SAR states that contamination surveys will be conducted on accessible surfaces of the canister after removal of the transportation cask lid. However, the SAR does not discuss whether decontamination of the interior surfaces of transportation packages or transfer casks after removing spent fuel canisters will be conducted if contamination is found on the accessible surfaces of the canister. If necessary, these decontamination activities could contribute to the generation of solid decontamination wastes and should be discussed in the SAR.

This information is needed to determine compliance with 10 CFR 72.126(a).

RAI 3-4: Revise Section 3.1.4 and/or Section 10.3.3 of the HI-STORE SAR to address the actions that will take place if the dose rates from the cask surface (or one meter from cask) exceed those specified transportation regulations upon receipt at the CISF.

Section 3.1.4 and 3.1.5 of the HI-STORE SAR discusses the operation at HI-STORE CISF. However, these sections of the SAR do not discuss any contingencies that will take place if the radiation dose rates from the cask exceed those specified in transportation regulations when received at the site.

This information is needed to determine compliance with 10 CFR 72.126.

RAI 3-5: Revise the operating procedures to include the requirement for a surface contamination survey and define the criterion for the acceptable surface contamination level.

Page 3-5 of the SAR states: "*After initial receipt approval, the cask is moved into the security vehicle trap for physical inspection by security personnel to ensure no unauthorized devices or materials enter the PA [protected area]. When security clearance is complete, the shipment proceeds into the PA and into the CTB (Figure 3.1.2) where the personnel barrier and tie-down are removed. The transportation cask, in accordance with the Part 71 requirements, is surveyed for dose rates and contamination levels. The dose rate from the cask on arrival at the HI-STORE CIS facility must be in reasonable accord with the measured dose rate at the originating plant. An excessive discrepancy would warrant a root cause evaluation under Holtec's quality program and appropriate notification to the USNRC*."

Chapter 10 of the SAR provides operating procedures (OP) for unloading the canister to be stored in the HI-STORE CIS ISFSI. Specifically, Chapter 10 includes the following operational requirements:

> Step 1 of the OP requires: "The HI-STAR packaging is visually receipt inspected to verify that there are no outward visual indications of impaired physical conditions except for superficial marks and dents. Any issues are identified to site management. Any road dirt is washed off and any foreign material is removed."
>
> Step 6 of the OP requires: "*Radiological surveys are performed in accordance with 49 CFR 173.443 [10.3.1] and10 CFR 20.1906 [7.4.1]. Any issues are identified to site management. If necessary, the overpack is decontaminated as directed by site radiation protection.*"

The requirements set forth in different parts of the SAR appear to be inconsistent with respect to surface contamination survey and necessary decontamination. The applicant needs to revise the operating procedures to move the surface contamination survey before washing off the package. Also, the SAR does not include specific acceptance criterion for the canister radiological surveys.

This information is needed to determine compliance with 10 CFR 72.104(a), (b), and (c).

Safety Analysis Report (SAR), Chapter 4, "Design Criteria for the HI-STORE CIS Structures, Systems, and Components"

RAI 4-1: Clarify the safety classification of the ISFSI subgrade in Table 4.2.1 of the HI-STORE SAR and, as appropriate, update the aging management evaluation of this component in SAR Chapter 18, and revise any applicable shielding and structural analyses accordingly.

Table 4.2.1 of the HI-STORE SAR, "ITS Classification of SSCs that Comprise the HI-STORE CIS Facility," states that the controlled low strength material (CLSM) within the space between the cavity enclosure containers (CECs) is not important to safety. However, the HI-STORE SAR includes minimum density requirements for this subgrade to support shielding and structural analyses. Also, Table 2.6.2 of the HI-STORM UMAX FSAR, "Principal Materials, Their Function, and ITS Categories for VVM," states that the subgrade between the CECs is important to safety and has primary functions of shielding and physical protection.

In SAR Chapter 18, "Aging Management Program," the subject subgrade is not evaluated for potential aging mechanisms because it is stated as not performing, or affecting, a safety function. However, if the designation of the subgrade is revised to be important to safety, then potential aging mechanisms for lean concrete or CLSM subgrades should be evaluated to ensure that the subgrade will be capable of performing its functions during long-term exposure to radiation and elevated temperatures.

In addition, HI-STORE CIS SAR Section 17.2.1.2 states that the subgrade is constructed of "lean concrete or CLSM"; however, the SAR frequently refers to the subgrade only as "CLSM" (e.g., SAR Tables 4.2.1 and 18.1.1). The staff notes that the terms "lean concrete" and "CLSM" are often loosely defined in the construction industry. The SAR should consistently clarify the usage of either of the two materials, and the evaluation of aging mechanisms should consider the wide range of possible subgrade compositions. If potential degradation, such as loss of material, shrinking, cracking, are plausible, then the SAR should discuss how these aging mechanisms affect the performance of the identified safety functions and revise the shielding and structural analyses accordingly.

This information is required to determine compliance with 10 CFR 72.104, 72.106, and 72.120(a).

<u>Safety Analysis Report (SAR), Chapter 5, "Structural and Installation Evaluation"</u>

RAI 5-1: Provide a basis for how the seismic analysis for stack-up, with respect to the UMAX location, is the bounding case as compared to the cask transfer facility (CTF) location. Include a response spectrum and/or supporting calculations demonstrating that the dynamic behavior of the UMAX is bounding for both forces and displacements and update any results/tables as necessary.

Section 2.0 of Supplement 5 to Holtec Report No. HI-2177585, "Structural Calculation Package for HI-STORE CIS Facility," states:

> *"[…] Therefore, the only differences between stack-up at the CTF and UMAX locations is the free length (i.e. unthreaded length) of the anchor bolts (approximately 4.5 inches and 13.5 inches, respectively). The longer free length of the bolts will introduce more flexibility into the system and potentially larger rocking displacements and loads in the stack. Hence, stack-up at the UMAX location is considered bounding and the bolted connection points between the CEC and HT are included in the model […]"*

It is not clear how a more flexible system due to longer bolts would be bounding in terms of loading or displacements, since the response of the structure is dependent on the response spectrum of the site. That is, a stiffer structure may observe larger demands on certain components than a flexible system and vice-versa, given the characteristics of the site described by the response spectrum, which has not been provided.

This information is necessary to determine compliance with 10 CFR 72.92, and 72.103(a)(2).

RAI 5-2: Verify the density values for the materials used in the LS-DYNA model, used for stack up to simulate the Design Extended Condition Earthquake (DECE) event. Update and submit any results/calculations as necessary.

According to the licensing drawings (DWG 10865), BOM 9 is made of ASTM A516 Grade 70, which typically has a mass density of around 7.280e-004 slugs/in^3, but is reported as 9.330e-004 slugs/in^3 in LS-DYNA simulations. Higher density values for materials could lead to erroneous results, as the response of the structure may be significantly altered.

This information is necessary to determine compliance with 10 CFR 72.92 and 72.122(b)(2)(i).

RAI 5-3: Justify the claim that the weight used to model the HI-TRAC CS in LS-DYNA is conservative with respect to seismic demands. Include a discussion of when the HI-TRAC CS is fully loaded versus partially loaded. Update, as needed, any seismic calculations related to the simulation of the HI-TRAC CS using LS-DYNA.

Page 117 of Holtec Report No. HI-2177585, "Structural Calculation Package for HI-STORE CIS Facility" claims that a weight of 380,000 lbs for the HI-TRAC CS is conservative with respect to seismic analysis. However, this claim is not justified given that a higher weight may not necessarily indicate a more severe seismic response depending on the response spectrum that typifies the site, which has not been provided. That is, a partially loaded MPC may produce higher demands on certain components of the HI-TRAC CS depending on the response spectrum of the site and dynamic behavior of the HI-TRAC CS.

This information is necessary to determine compliance with 10 CFR 72.92 and 72.122(b)(2)(i).

RAI 5-4: Define the duration of a work shift as it pertains to seismic qualification.

Section 4.3.6 of the HI-STORE SAR states, in part:

> *"Following the universally practiced "lift and set" rule at nuclear power plants, transient activities such as upending of a cask, attaching of slings or installation of fasteners, are treated as transient activities that are not subject to a seismic qualification. For clarity of application, any activity that spans less than a work shift is deemed to be seismic-exempt."*

Since seismic qualification of important handling operations, such as cask upending, attaching of slings, or installation of fasteners, which may include important to safety components, is not performed based on a work shift, a work shift should be clearly defined.

This information is necessary to determine compliance with 10 CFR 72.122(b)(2)(i).

RAI 5-5: Describe the condition of the loaded HI-TRAC CS when carried by the vertical cask transporter and transiting or performing downloading operations from the cask transfer building to a designated ventilated vertical module while subjected to a tornado or lightning strike.

Section 5.5.2 of the SAR describes the scenario where the vertical cask transporter and related equipment is carrying the HI-TRAC CS under seismic loading. However, it is unclear how the same system responds to a lightning strike or tornado while traveling to the ventilated vertical module and performing downloading operations. Provide justification and/or supplemental calculations and update the SAR, as necessary, showing that the transported canister will not be breached by a missile strike or a tip over of the vertical cask transporter. If the tip over scenario is credible, the structural, shielding, thermal, and confinement analyses should be updated to consider the damage from that event.

This information is necessary to determine compliance with 10 CFR 72.92 and 72.106.

RAI 5-6: Confirm the values provided in Table 5.4.8 of the HI-STORE SAR, as needed, for the type of material used in the lifting trunnions of the HI-TRAC CS.

Table 5.4.8 of the HI-STORE SAR indicates that the maximum number of fatigue cycles for the lifting trunnions is 7,500 for SB-637 N07718 material. It appears that SA-564 Gr. 630 H1100 material was intended to be described instead.

This information is necessary to determine compliance with 10 CFR 72.122(b).

RAI 5-7: Confirm the weight of the HI-STAR 190 transportation package to be lifted by the horizontal lift beam.

According to Supplement 9 to Holtec Report No. HI-2177585, the maximum weight of the MPC to be lifted by the horizontal lift beam is 110 kips; however, the HI-STAR 190 FSAR, Revision 0C (Document No. HI-2146214) indicates that the maximum weight of the MPC is 116,400 lbs Confirm the actual weight to be lifted, and revise any calculations related to the design of the horizontal lift beam.

This information is necessary to determine compliance with 10 CFR 72.122(b).

RAI 5-8: Provide a basis for the assumption that the vertical cask transporter (VCT) is essentially a rigid body when transporting a loaded HI-TRAC CS and how the use of the peak ground acceleration (PGA) alone, for calculations involving tipping and sliding, is conservative. Confirm the rigid body nature of the system, incorporate the response spectrum of the site based on the actual dynamic behavior of the system, and update the calculations used to determine tipping and sliding.

Attachment 11 to Report No. HI-2177585, Rev. 0, details the calculations used to determine the amount of sliding and tipping that the loaded VCT may experience. The methodology used from ASCE Standard 43-05 assumes that while carrying the HI-TRAC CS, the VCT is a rigid body. Two concerns related to the assumption that the system is a rigid body are:

1. The fundamental period of the VCT has not been provided. When empty, the VCT weighs approximately 210,000 lbs and weighs an additional 375,000 lbs when carrying a fully loaded HI-TRAC CS. The loaded VCT is expected to have a fundamental period that is 67% larger relative to the unloaded VCT, which could allow the fully loaded VCT to experience larger seismic demands. The demand is unclear as the response spectrum of the site has not been provided.

2. The VCT, while carrying the HI-TRAC CS, appears to have at least 2 dominant periods given that the MPC can sway independently from VCT during an earthquake. This would violate the rigid body assumption of ASCE Standard 43-05.

Accordingly, the use of the PGA for sliding and tip over calculations is questionable since its use was intended for rigid bodies. In addition, clarify how the use of the PGA is conservative for calculation purposes since its magnitude relative to the response spectrum of the site is unclear.

This information is necessary to determine compliance with 10 CFR 72.122(b)(2)(i).

RAI 5-9: Justify the impact loads on the HI-TRAC CS transfer cask due to collapse of the cask transfer building (CTB) and/or provide additional justification that the scenario where the impact from the W40 x 324 beam is the bounding accident scenario for a building collapse.

The cask transfer building (CTB) has been classified as not important to safety. Its collapse onto the HI-TRAC CS transfer cask and HI-STAR 190 transportation package has been postulated as an accident scenario and detailed in Report No. HI-2177585 R0. In the structural calculation package, it is assumed that a W40 x 324 beam from the building strikes either the HI-STAR 190 package or the HI-TRAC CS transfer cask, which was simulated using LS-DYNA. However, the application does not provide detailed drawings or details of the CTB, so it is not possible to confirm if the loading that the HI-TRAC CS transfer cask or HI-STAR 190 transportation package would experience as a result of building collapse is bounding. It's possible that a smaller object, such as a pipe driven by heavy load behind it or some other object, may be a more damaging scenario than the collapse of a beam onto the system.

This information is necessary to determine compliance with 10 CFR 72.122(b)(2)(ii).

RAI 5-10: Confirm the fatigue life of the HI-TRAC CS, vertical cask transporter (VCT), and associated lifting ancillaries and relate it to anticipated canister deployments. Update fatigue calculations with both high and low stress cycle information and relate it to canister deployments so that the VCT, HI-TRAC CS, and lifting ancillaries can be adequately maintained and operated in a safe manner.

Holtec Report No. HI-2177585 R0, "Structural Calculation Package," provides calculated estimates of fatigue life for the HI-TRAC CS and associated lifting ancillaries, referred to as "components" for the purposes of this RAI. The report estimates the number of fatigue cycles a component of the HI-TRAC CS and associated lifting ancillaries may observe based on the maximum bounding allowable stress the component may experience during its lifetime. While fatigue cycles based on maximum stress of this nature are useful, they don't capture the complete fatigue life of the component since low stress, high cycles observed during handling and movement by the VCT have been ignored. In addition, calculated fatigue cycles have not been linked to a periodic inspection, maintenance, repair, or replacement of the VCT, HI-TRAC CS, lifting ancillaries etc. Fatigue life should relate to the number of "canister deployments" or some other measure, where a canister deployment is defined for purposes of discussion as the movement of a canister upon initial receipt from rail car to its ventilated vertical module (VVM) location, or from the VVM back to the rail car.

For a given canister deployment, the HI-TRAC CS, VCT, and associated lifting ancillaries will observe a combination of high stress and low stress cycles, which should be combined to calculate the fatigue life of the component via a cumulative damage model such as Miner's rule. High stress cycles are expected during lifting operations while low stress cycles are expected when being handled by the VCT as it travels from the rail car to the VVM. The number of low stress cycles and stress itself will depend on the vibrational characteristics of the VCT while carrying the HI-TRAC CS, the weight of the canister being moved, the distance the HI-TRAC CS is carried (which depends on the VVM location), etc.

This information is necessary to determine compliance with 10 CFR 72.122(b).

RAI 5-11: Clarify how the fabricator will be able to replace fillet welds with groove welds of equal or greater strength.

Note 2 on Sheet 1 of 5, of Drawing No. 10868, indicates that the fabricator is able to replace all fillet welds with groove welds of equal or greater strength, as do other licensing drawings. It is unclear how the fabricator will determine that a given groove weld will have equal or greater strength to a fillet weld since supporting design documentation has not been provided for both NITS and ITS components.

This information is necessary to determine compliance with 10 CFR 72.122(a).

RAI 5-12: Clarify how items labeled as "not important to safety" will vary and how these variations will not impact important to safety items.

Several of the licensing drawings indicate the following:

> *"NOT IMPORTANT TO SAFETY (NITS) COMPONENTS MAY BE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY AND MAY VARY. ADDITIONAL NITS FEATURES AND DETAILS MAY BE SHOWN ON THE MANUFACTURING DRAWINGS THAT ARE NOT SHOWN ON THE LICENSING DRAWINGS."*

It is not clear how NITS items will vary, especially those that will not be depicted on the licensing drawings (or fabrication drawings). NITS items that are not depicted could potentially impact important to safety items (ITSs) by introducing unforeseen/undesirable material, structural, thermal, and shielding effects or deficiencies to ITS items. The application should provide additional information or descriptions of NITS items (function, materials of construction etc.) in the licensing drawings because those items could affect ITS components.

This information is necessary to determine compliance with 10 CFR 72.24(b) and 72.24(c).

RAI 5-13: Clarify the note on Drawing No. 10895 indicating that an unspecified item will be welded from multiple pieces.

Note 3 on Sheet 1 of 4, Drawing No. 10895, states:

> *"SHELL MAY BE WELDED FROM MULTIPLE PIECES, TYPE OF WELD, NUMBER AND LOCATIONS OF WELDS TO BE DETERMINED BY FABRICATOR."*

It is not clear which item will be welded in this fashion as it does not appear that any item in Drawing No. 10895 references this note. In addition, if the item is ITS, it is not clear how the item will be able to perform its intended safety function with varying weld size and location as supporting calculations demonstrating structural integrity of the component have not been submitted.

This information is necessary to determine compliance with 10 CFR 72.24(b) and 72.24(c).

RAI 5-14: Clarify if the pedestal to be used with the HI-STAR 190SL is ITS and if so, provide supporting drawings and calculations for a pedestal to be used in tandem with the HI-STAR 190SL canister and canister transfer facility.

Note 5 on Sheet 1 of 4, Drawing No. 10895, states:

"A PEDESTAL OF HEIGHT 22 1/2" SHALL BE USED TO SUPPORT HI-STAR 190SL IN THE CTF CAVITY. THE PEDESTAL SHALL BE MADE TO MEET THE REQUIRED HEAT TRANSFER REQUIREMENTS IN THE CTF."

However, this item has not been detailed on the licensing drawings, nor have supporting calculations been provided to show that this item can perform its structural and thermal functions. If the pedestal is considered an important to safety component, provide supporting calculations and drawings. If not, the application should justify its NITS designation by discussing scenarios where the pedestal fails or cannot perform its intended function and assessing the corresponding effects.

This information is necessary to determine compliance with 10 CFR 72.24(b).

RAI 5-15: Provide an explanation and justification for the excessive amounts of hour glassing energy observed during seismic simulations during stack-up analysis. Update the model and any results in the HI-STORE SAR, as necessary.

Comparison of hour glassing energy to internal energy for the "Design Extend Condition Earthquake" (DECE) seismic simulation of the CS Stack-up analysis at the CTF and UMAX (via LS-DYNA) reaches 16% during the simulation, indicating that the model is potentially exhibiting unrealistic behavior and likely leading to erroneous stress and strain output of the analyzed components. Similar behavior was also noted for the "Safe Shutdown Earthquake" (SSE) scenario.

This information is necessary to determine compliance with 10 CFR 72.24(c)(2) and 72.122(b).

RAI 5-16: Clarify how closure lid handling holes are designed. Provide supporting calculations and update the licensing drawings and HI-STORE SAR, as necessary.

Note 7 on Sheet 1 of 6, Drawing No. 10875, states:

"THE BOUNDING CLOSURE LID WEIGHT IS DEFINED IN TABLE 3.2.1 OF THE FSAR. CLOSURE LID HANDLING HOLES ARE DESIGNED TO MEET THE REQUIREMENTS OF TABLE 2.4.1 OF THE FSAR."

However, supporting calculations do not appear to have been provided for this ITS component.

This information is necessary to determine compliance with 10 CFR 72.24(c)(3) and 72.120(b).

RAI 5-17: Clarify detail AD on Sheet 3 of 6, Drawing No. 10875 of the Vertical Ventilated Module, Version C.

Sheet 3 of 6 of Drawing No. 10875, depicts detail AB and AD, which are called out in section A-A on the same sheet. It appears that detail AB and AD as drawn, do not correspond to the details on Section A-A. Confirm that details AB and AD as depicted correctly and update the licensing drawings as necessary.

This information is necessary to determine compliance with 10 CFR 72.24(c)(3).

RAI 5-18: Clarify the drawing details of the cask transfer building (CTB) floor slab relative to the cask transfer facility (CTF) building and describe the structural stability of the shell liner of the

CTF during stack-up as depicted in that view. Interaction of lateral loads due to the vertical cask transporter and earth pressure in conjunction with the vertical loads from the loaded transfer cask and mating device should be considered simultaneously in the buckling analysis of the shell and the SAR should be updated, as needed.

Sheet 1 of 4, of Drawing No. 10895, depicts an isometric view of the CTF that does not appear to include the details of the cask transfer building floor slab shown on Sheet 2 of 2 of Drawing No. 10912. Additionally, it is unclear if the fill surrounding ITS BOM part 1 (shell) on Sheet 1 of 4, of Drawing No. 10895 is earth or concrete as drawn.

Also, it appears that the shell (BOM 1) was not analyzed for the case that includes the lateral earth pressure exerted by the vertical cask transporter (VCT), which weighs 180,000 lbs (Table 3.2.1 of Chapter 3 of the UMAX FSAR) during stack up operations. It was noted that Calculation 8 for the CEC of the UMAX system (Attachment 12 to Holtec Letter 5025012) appears to be applicable to the shell; however, buckling of the shell is most likely to occur in the direction of the surrounding earth pressure, where the shell may buckle inwards in the ventilated vertical module cavity rather than outwards as assumed in Attachment 12.

This information is necessary to determine compliance with 10 CFR 72.24(c)(3) and 72.120(b).

RAI 5-19: Clarify the material properties and their temperature dependency used for the lifting trunnions of the HI-TRAC CS, HI-TRAC CS lift links, and the MPC lift attachment.

Lifting trunnions (BOM 4) on Licensing Drawing 10868 are identified as being made of either SB637-N07718 or SA 564 H1100 Gr. 630. However, calculations in Holtec Report No. HI-2177585 assume that the trunnions are only made of SA-564 Gr. 630 H1100. The trunnions are assumed to sustain a temperature of 350°F, although in Holtec Report No. HI-2177553 the concrete in which the trunnions are embedded is reported to sustain 642 deg. F, while Table 4.4.1 of the HI-STORE SAR reports a concrete temperature of 572 deg. F for the HI-TRAC CS. According to Holtec Report No. HI-2177585, the HI-TRAC CS lift links, which are in direct contact with the trunnions, are assumed to only reach 300 deg. F and the MPC lift attachment is only assumed to observe 500 deg. F.

The SAR should verify that the most limiting material properties for the lifting trunnions has been used, that the correct temperature is being used for the lifting trunnions of the HI-TRAC CS, HI-TRAC CS lift links, and the MPC lift attachment, and that the calculations as updated or revised as necessary.

This information is necessary to determine compliance with 10 CFR 72.122(b).

RAI 5-20: Specify the size of weld(s) 5-1, 5-2, 5-3, 5-4, 5-5, and 5-6 shown on Sheet 5 of Licensing Drawing 10868 used to construct the shield gate of the HI-TRAC CS.

The shield gate, identified as ITS, is made of multiple plates which supports the MPC during transfer operations. Calculations in Holtec Report No. HI-2177585 assume these plates act in unison (composite action) with respect to bending thanks to these welds (5-1, 5-2, 5-3, 5-4, 5-5, and 5-6), which help ensure composite action when supporting the MPC as shown on Section 5A-5A, Section 5B-5B, and Detail 5D of Licensing Drawing 10868. However, the size of these welds is unspecified, and are expected to carry significant transverse shear stress, particularly at the neutral axis of the composite section. The SAR should clarify the size of these welds to

ensure that composite action is ensured, or re-evaluate the section as non-composite, and the licensing drawings and calculations should be updated, as necessary.

This information is necessary to determine compliance with 10 CFR 72.24(c)(3) and 72.120(b).

RAI 5-21: Provide stress-strain curves based on material testing for SA-516 Gr. 70 at 400 degrees F.

Supplement 5 to Report No. HI-2177585 provides stress-strain curves with guessed material properties (n and k coefficients) for SA-516 Gr. 70 at 400 deg. F, which is used in seismic simulations of the HI-TRAC CS. Material properties used in ITS equipment should be well defined and based on physical testing as seismic evaluations of ITS equipment cannot be verified otherwise. Seismic evaluations are only as good as the material properties that go into them, and the seismic response may be very different than observed when material properties are assumed arbitrarily.

This information is necessary to determine compliance with 10 CFR 72.24(c)(3) and 72.122(b)(2)(i)

RAI 5-22: Describe the margins of safety for the tilt frame and saddle with respect to buckling while supporting a transportation cask.

Calculations have been provided for the tilt frame and saddle, however, margins of safety that describe the buckling of web plates and beams (BOM 2, 7, 12) of the tilt frame and saddle have not been provided. Update the calculations as necessary.

This information is needed to ensure compliance with 10 CFR 72.122(b).

RAI 5-23: Clarify the margins of safety for members of the Transport Cask Horizontal Lift Beam with respect to buckling when lifting a transportation cask, and how it will behave and interact with its surroundings during a seismic event.

Figure 3.1.1 of the HI-STORE SAR depicts the Transport Cask Horizontal Lift Beam handling a transportation cask. From this depiction, and the calculations in Holtec Report No. HI-2177585, it is unclear what the margins of safety are for BOM members 1-3, which are subjected to buckling loads due to the slings applying compressive loads. The SAR references an ANSYS evaluation that was provided in the application, but buckling checks have not been performed.

The orientation of the slings (cable pitch) can greatly influence the buckling load on these members and should be placed on the licensing drawings or technical specifications to avoid overloading these members and should correspond to what has been provided in the calculations.

In addition, it is unclear how the slings while attached to the Transport Cask Horizontal Lift Beam will behave when subjected to seismic loads and how the Transport Cask Horizontal Lift Beam will avoid hitting the crane and or building while in such a scenario. The SAR's calculations and licensing drawings should be updated, as necessary.

This information is necessary to determine compliance with 10 CFR 72.24(c)(3) and 72.122(b)(2)(i).

RAI 5-24: Justify the how the title frame, saddle, Transport Cask Horizontal Lift Beam, slings, and other lifting equipment used to lift a transportation cask are seismically exempt.

Supplement 13 to Holtec Report No. HI-2177585R0 states that seismic analysis of these components is not performed because they are seismic exempt as per the document "Licensing report on the HI-STORE CIS Facility, HI-2167374, Revision 0" (i.e., the HI-STORE SAR). The SAR states, in part, that: *"[f]ollowing the universally practiced "lift and set" rule at nuclear power plants, transient activities such as upending of a cask, attaching of slings or installation of fasteners, are treated as transient activities that are not subject to a seismic qualification. For clarity of application, any activity that spans less than a work shift is deemed to be seismic-exempt."*

There is no reference where the "lift and set" rule is stated and approved by the NRC for use. In addition, as written, it appears as if only one handling operation will ever occur at the facility. However, an undetermined number of operations (work shifts) are expected to occur at the facility, and the duration of a shift is not specified. These should be considered in a duration approach argument and should be documented clearly in the technical specifications. Nonetheless, the regulations do not exempt a seismic evaluation of these components. Specifically, 10 CFR 72.122(a)(2)(i) states:

> *(i) Structures, systems, and components **important to safety must be designed** to withstand the effects of natural phenomena such as **earthquakes**, tornadoes, lightning, hurricanes, floods, tsunami, and seiches, without impairing their capability to perform their intended design functions. The design bases for these structures, systems, and components must reflect:*
>
> *(A) Appropriate consideration of the most severe of the natural phenomena reported for the site and surrounding area, with appropriate margins to take into account the limitations of the data and the period of time in which the data have accumulated, and*
>
> *(B) Appropriate combinations of the effects of normal and accident conditions and the effects of natural phenomena.*

The provisions of 10 CFR Part 72 do not exempt this equipment from being seismically qualified. Thus, ITS equipment such as the title frame, saddle, Transport Cask Horizontal Lift Beam, slings, and other lifting equipment used to lift, and transport spent nuclear fuel have to be designed with seismic loading.

This information is necessary to determine compliance with 10 CFR 72.122(b)(2)(i)

RAI 5-25: Clarify the margin of safety of the lift yoke with respect to lateral torsional buckling when lifting a fully loaded MPC.

Licensing Drawing 10900 depicts two strong back plates (BOM 1) which act in unison when performing lifting operations. During lifting operations, these two plates will be subjected to bending moments with unbraced compression flanges, which could undergo lateral torsional buckling. It is noted that thin rods (spacers) that link these two plates are depicted on the licensing drawings, but their ability to brace these two components is unknown, and their dimensions and material properties have not been provided. An evaluation of lateral torsional buckling for the lift yoke was not provided. The calculations and licensing drawings should be updated, as necessary.

This information is necessary to determine compliance with 10 CFR 72.92 and 72.122(b)(2)(i).

RAI 5-26: Demonstrate that the proposed UMAX ISFSI storage pad design at the proposed CIS Facility would not fail due to sliding under dynamic loading.

The UMAX ISFSI pad design creates a new interface between Space A and Space C in the subgrade material (Figure 4.3.1 of the HI-STORE SAR). Due to significant differences in material stiffnesses (Controlled Low Strength material in Space A is stiffer than the materials in Space B or C, which are native soil), a seismic event may cause a failure due to slippage or sliding along this interface and/or along a critical failure surface within the material in Space B or Space C. The assessment should establish that the shear resistance provided by the interface and the materials in Space B would be able to resist such sliding of the pads. Therefore, an analysis is needed to ensure that the proposed storage pads would not fail by sliding under the anticipated dynamic loads. Alternatively, the applicant may provide a reference to specific bounding analyses from the HI-STORM UMAX FSAR, if any, that consider and analyze this scenario or bounds it.

This information is necessary to determine compliance with 10 CFR 72.24(a), 72.103, and 72.122.

<u>Safety Analysis Report (SAR), Chapter 6, "Thermal Evaluation"</u>

[Note: RAI 6-1 thru 6-5 were issued on September 13, 2018 (ML18257A240)]

RAI 6-6: Clarify how long an MPC will remain within the HI-TRAC CS transfer cask if the UMAX heat removal system is declared inoperable.

Technical Specification Bases B.3.1.1 C.2.2 (Page 16.A-12 of HI-STORE SAR) indicates that a MPC can be stored within a HI-TRAC CS, but does not specify a time period within which it would be required to return the MPC back to a storage condition. There was no corresponding time period specified for the MPC to remain within the HI-TRAC CS, recognizing that a number of analyses (e.g., thermal, structural) are typically performed to ensure safe operation during long-term storage. The SAR should provide an analysis to specify a time limit that the MPC can remain within the transfer cask.

This information is needed to determine compliance with 10 CFR 72.26 and 72.122(b).

RAI 6-7: Update the draft Design Feature Technical Specification to indicate the minimum HI-STORM UMAX module pitch justified by the thermal analysis.

The minimum HI-STORM UMAX pitch spacing, which is an important parameter for thermal performance and safe operation of the system, was not included in the proposed Technical Specifications.

This information is needed to determine compliance with 10 CFR 72.26 and 72.122(b).

RAI 6-8: Update the Technical Specification Surveillance requirement SR 3.1.2 so that it considers the 32 hour time period to reach allowable limits, as stated in Section B 3.1 C.2.1 (HI-STORE SAR Chapter 16, page 16.A-11).

The proposed Technical Specifications (SR 3.1.2) suggests that a vent could be blocked for 54 hours, based on the 24 hour LCO 3.1.1 to restore the system to operable status and the 24 hour (plus 25% factor, per SR 3.0.2) SR 3.1.2, 24-hour surveillance frequency.

This information is needed to determine compliance with 10 CFR 72.26 and 72.122(b).

RAI 6-9: Clarify that installed temperature monitoring equipment is to be designated as Important to Safety if it is used as part of surveillance requirements to fulfill Technical Specifications.

The proposed Technical Specification SR 3.1.2 indicates that VVMs installed with temperature monitoring equipment can be used as part of the surveillance requirements to ensure SFSC integrity, rather than periodic visual surveillance. However, Section 3.4 of the HI-STORE SAR indicates that temperature monitoring equipment is not important to safety.

This information is needed to determine compliance with 10 CFR 72.26 and 72.128(a)(1).

RAI 6-10: Specify and provide the basis for the criteria associated with the proposed Technical Specification SR 3.1.2.

There is no clear basis provided in the SAR for the 91 deg F temperature difference between the average VVM air outlet duct temperature and the ISFSI ambient temperature mentioned in the proposed Technical Specification SR 3.1.2. In addition, a “LCO criteria” was not specified in the proposed Technical Specification Basis SR 3.1.2 in Chapter 16 of the HI-STORE SAR.

This information is needed to determine compliance with 10 CFR 72.26 and 72.122(b).

RAI 6-11: Update the proposed Technical Specification LCO 3.1.1 to state that operability is defined as 50% or more of the inlet vent duct areas and 100% of the outlet vent areas are unblocked and available for flow.

Currently, proposed Technical Specification LCO 3.1.1 states that the SFSC Heat Removal System is operable when 50% or more of the inlet vent duct areas are unblocked and available for flow. However, Section 4.6.1.2 of the HI-STORM UMAX FSAR, which is incorporated by reference, only indicated the results for thermal performance when the HI-STORM UMAX air inlet vents were 50% blocked (no mention of outlet vents).

This information is needed to determine compliance with 10 CFR 72.26 and 72.122(b).

RAI 6-12: Provide the maximum ambient temperature limit for conducting short term operations in the Technical Specifications.

Proposed Technical Specification 4.2.4 indicates that operations should not be performed if ambient temperatures are below 0 deg F. There was no corresponding maximum temperature limit for conducting short term operations and no transfer analyses, for example, at accident-level ambient temperatures. The maximum ambient temperature analyzed for short term operations was reported as 91 deg F in Table 6.4.1 of the HI-STORE SAR and Table 1.1 of Holtec Report No. HI-2177553, “Thermal Analysis of HI-TRAC CS Transfer Cask.” However, the HI-STORE SAR, including in Table 2.7.1, indicates that ambient temperatures could be above that value (e.g., 108+ deg F).

This information is needed to determine compliance with 10 CFR 72.26 and 72.122(b).

RAI 6-13: Update the proposed Technical Specification Design Feature 4.2.1 to indicate that the design of the HI-STORM UMAX modules are limited to Type SL and Type XL of the UMAX Version C module.

Holtec Report No. HI-2177591, "Thermal Evaluation of HI-STORM UMAX at HI-STORE CIS Facility," states that MPCs of certain heights are to be installed in Type SL or Type XL UMAX Version C modules with storage cavity depths made at two discrete dimensions. The thermal analyses and performance of the system are based on these design aspects, but they were not included in the Technical Specifications.

This information is needed to determine compliance with 10 CFR 72.26 and 72.122(b).

RAI 6-14: Provide the Holtec Engineering Change Order (ECO) 5021-24, Revision 0, and its corresponding 10 CFR 72.48 evaluation.

Section 2 of Holtec Report No. HI-2177591, "Thermal Evaluation of HI-STORM UMAX at HI-STORE CIS Facility," states that the thermal model is based on ECO 5021-24, but this was not provided in the application.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-15: Provide additional discussion that explicitly describes the analysis principles and methodology for the thermal analyses found in Holtec Report No. HI-2177553.

Section 2 of Holtec Report No. HI-2177553, "Thermal Analysis of HI-TRAC CS Transfer Cask," broadly states that the analysis principles and methodology for the calculations are adopted from the HI-STORM FW FSAR and HI-STORM UMAX FSAR. The principles and methodology relevant to the HI-TRAC CS should be described or specific sections/paragraphs of the HI-STORM FW FSAR and HI-STORM UMAX FSAR should be referenced for staff to evaluate the thermal analyses of the HI-TRAC CS.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-16: Provide the mass and energy residuals, mass and energy balances, DO balances, and justification of grid convergence for the thermal analyses mentioned in Section 6 of the HI-STORE SAR and those provided in Holtec Report No. HI-2177553, "Thermal Analysis of HI-TRAC CS Transfer Cask;" Holtec Report No. HI-2177591, "Thermal Evaluations of HI-STORM UMAX at HISTORE CIS Facility;" and Holtec Report No. HI-2177597, "HI-STORE CTF Thermal Evaluation."

The above-mentioned numerical criteria, which are part of computational best practices (e.g. NUREG-2152) are needed to confirm that the results provided in the referenced thermal analyses are relevant to the review.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-17: Provide additional information about the air pathway geometry through the bottom of the HI-TRAC CS shield gates while the HI-TRAC CS and HI-STAR 190 are within the Canister

Transfer Building and clarify how the air pathway area is correctly represented in the thermal models.

Holtec HI-TRAC CS Licensing Drawing 10868, Revision 0 (referenced in Section 7.0 of Holtec Report No. HI-2177553, "Thermal Analysis of HI-TRAC CS Transfer Cask") does not clearly call out the air pathway or its dimensions. This information is needed to determine the appropriateness of the thermal model during canister transfer described in Holtec Report No. HI-2177553.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-18: Clarify the relation between the MPC shell's inner and outer diameters and the width of the gap between the MPC shell and HI-TRAC CS cask (Item 5 in Section A.3 of Holtec Report No. HI-2177553, "Thermal Analysis of HI-TRAC CS Transfer Cask").

Holtec Report No. HI-2177553 does not provide the actual gap and modeled gap between the MPC shell and HI-TRAC CS cask. Staff needs this information to determine if the thermal model conservatively estimates the temperature limits.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-19: Justify the heat transfer boundary conditions that are used during the Canister Transfer Building (CTF) collapse accident scenario.

Many of the details, assumptions, and justifications for the heat transfer boundary conditions described in Section B.2.2 of Holtec Report No. HI-2177553, "Thermal Analysis of HI-TRAC CS Transfer Cask," and Section 1.0 of Holtec Report No. HI-2177597, "HI-STORE CTF Thermal Evaluation" were not provided. The response should address the following:

a) the basis for only a 25% penalty on the heat transfer coefficient, recognizing that a typical buoyant flow pattern around a vertical cylinder would be disturbed by a collapsed structure;
b) the basis of certain radiation heat transfer parameters, such as the reported 30% penalty of surface emissivity, the external "ambient" temperature from a locally close structure (used for radiation heat transfer calculations), view factor, solar flux on the building;
c) confirmation that the shield gate inlets are the only air inlet to the HI-TRAC CS ventilated flow and that those are 100% blocked;
d) the basis for 10% of the exit air area remains unblocked and clarify the exit areas (HI-TRAC CS, CTF pipe vents, CTF cavity top) of HI-TRAC CS and CTF (refer to HI-STORE SAR Figure 6.4.3);
e) explanation of how the 10% exit area remaining unblocked, whereas page B-7 of HI-2177553 states that "100% of the top opening of the HI-TRAC CS cavity is assumed to be blocked in the thermal model;"
f) the justification for the assumption (Holtec Report No. HI-2177597) that excluding the HI-TRAC CS from being placed in the stack-up position is bounding, considering that Section 6.1 of the HI-STORE SAR states that the limiting thermal condition occurs when the canister is loaded in the transfer cask and its shield gate is closed.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-20: Clarify whether Equation B.2.1 (Section B.2.1.2 of Holtec Report No. HI-2177553, "Thermal Analysis of HI-TRAC CS Transfer Cask") is meant to provide the temperature rise due to the solid phase fire or the total temperature rise. In addition, provide the temperature rise and thermal load due to the solid phase fire and the temperature rise and thermal load due to the liquid phase fire and explain how the "ΔT" was applied to the model to determine the values reported in Table B.6.1.1.

The text preceding Equation B.2.1 states that the equation is to provide the temperature rise due to the solid phase fire; however, the equation uses the subscript "total", rather than "solid," which is then used in the subsequent terminology section (possibly there is a typographical error in the equation). Based on the above, the staff does not understand the intent of the equation as written and, therefore, how its results factor in the values reported in Table B.6.1.1.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-21: Clarify the 640 deg F HI-TRAC CS concrete temperature during the CTB collapse accident scenario, reported in Holtec Report No. HI-2177553, "Thermal Analysis of HI-TRAC CS Transfer Cask", considering that HI-STORE SAR Table 4.4.1 has a 572 deg F allowable local maximum temperature limit under accident conditions.

In the response to RAI 17-10, the allowable accident temperature of the shielding concrete in HI-STORE SAR Table 4.4.1 was revised to align with the Holtec Position Paper DS-289. However, the HI-TRAC CS concrete temperature during the CTB collapse accident scenario was calculated to be significantly above the revised limit for accident conditions.

The inconsistency between the calculated concrete temperature and the allowable temperature limit should be addressed. If the allowable temperature will be exceeded, provide a technical basis that demonstrates that the temperature exposure will not degrade the concrete to an extent that could prevent it from fulfilling its intended functions.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-22: Confirm that the thermal analyses presented in Chapter 6 of HI-STORE SAR; Holtec Report No. HI-2177597, "HI-STORE CTF Thermal Evaluation;" Holtec Report No. HI-2177553, "Thermal Analysis of HI-TRAC CS Transfer Cask;" and Holtec Report No. HI-2177591, "Thermal Evaluations of HI-STORM UMAX at HISTORE CIS Facility," are based on the bounding content to be stored at the HI-STORE CISF.

Several references in the license application provide differing descriptions of the bounding content assumed in the thermal analyses. For example, Calculation Package HI-2177597 refers to Fort Calhoun fuel (Page 9 of 26) as bounding content. Section 6 of the HI-STORE SAR states that the heat load in any canister cannot exceed that in the transport cask (i.e., HI-STAR 190), and Page 1 (4 of 31) of Calculation Package HI-2177591 states that the content at the site is for those approved in HI-STORM FW FSAR and HI-STORM UMAX FSAR. Likewise, Section 6.4.2.3 of the HI-STORE SAR refers to Section 4.4 of the HI-STORM UMAX FSAR as providing bounding content but Note 5 of Table 6.4.1 of HI-STORE SAR refers to Appendix 7.C of the HI-STAR 190 SAR as the bounding heat load. Bounding content should be analyzed in order to determine bounding temperature and pressure conditions.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-23: Provide details of the pedestal and corresponding "cut-outs" to ensure an appropriate design is modeled within the CTF thermal analyses.

Licensing Drawing 10895 does not provide design details of the pedestal, but rather notes that "*[t]he pedestal shall be made to meet the required heat transfer requirements in the CTF.*" In addition, there are no bases for certain aspects of the pedestal that are briefly mentioned in Section 2.0 of Holtec Report No. HI-2177597, "HI-STORE CTF Thermal Evaluation." For example, there is no basis for the bounding nature of the 1 W/m-K thermal conductivity, no description of the relative sizes between the pedestal and "cut-outs", which would affect heat transfer, and no discussion to indicate how the thermal models correctly represent the pedestal design.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-24: Clarify that the maximum pressures for the short term CTF normal operation (e.g., Table 6.3 of Holtec Report No. "HI-STORE CTF Thermal Evaluation") and the CTB collapse accident scenario are based on having the maximum initial backfill pressure for the pressure range reported in Section 2.0 of HI-2177597, "Methodology and Assumptions."

The calculation package states that the minimum backfill pressure is used in the thermal analyses to understate the thermo-siphon effect within the MPC. However, the determination of maximum pressure, which should be reported, is based on the maximum backfill pressure for normal, off-normal, and accident conditions.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-25: Confirm that the component temperatures in the HI-STORE SAR and Holtec Report No. HI-2177597, "HI-STORE CTF Thermal Evaluation;" Holtec Report No. HI-2177553, "Thermal Analysis of HI-TRAC CS Transfer Cask;" and Holtec Report No. HI-2177591, "Thermal Evaluations of HI-STORM UMAX at HISTORE CIS Facility," satisfy the unconditionally safe threshold (UST) after considering the effects due to modeling uncertainties (e.g., grid convergence uncertainty).

The acceptability of component temperatures should be reviewed considering that the HI-TRAC CS concrete after the CTB collapse accident scenario appears to indicate that the 640 deg F temperature may not satisfy the unconditionally safe threshold (UST) defined in Section 6.0 of the HI-STORE SAR, which did not address the effects due to grid convergence uncertainty.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-26: Provide the HI-STAR 190 O-ring minimum and maximum temperature limits and its temperature for the building collapse scenario.

The application did not include the allowable temperature limits for the O-rings. In addition, Table 6.2 of Holtec Report No. HI-2177597, "HI-STORE CTF Thermal Evaluation," listed HI-STAR 190 component temperatures but did not include the O-ring.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-27: Clarify in Chapter 3 of the HI-STORE SAR that the HI-STAR 190 is the only transportation package that is used to ship content to the HI-STORE CISF.

Chapter 3 (Page 3-3) of the HI-STORE SAR states that transportation packages other than the HI-STAR 190 would be used to transport content. However, the thermal analyses that are provided to demonstrate compliance with site specific parameters and design features are based only on the HI-STAR 190 package.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-28: Specify the time limits associated with the corrective actions associated with the blockage of air flow malfunction specified in Item 8 of Section 10.3.3.5 of the HI-STORE SAR.

The operations procedure mentions the need to perform a corrective action associated with blockage of air flow, but a transient HI-TRAC thermal analysis with blocked airflow and a time limit to perform the corrective action were neither listed nor provided.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-29: Specify the changes introduced in HI-STORM UMAX Version C system that are noted in Table 15.0.1 of HI-STORE CIS SAR Chapter 15 and confirm there are no impacts to the thermal model or performance.

The HI-STORE SAR states there are changes in the UMAX system from that previously analyzed. However, descriptions of those changes were not provided such that assessments by technical disciplines could not be performed.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-30: Clarify the applicability of the reference to Paragraph 4.6.2.3 of the HI-STORM UMAX FSAR for the 100% blockage of air inlets and outlet HI-STORE UMAX scenario.

Table 6.0.1 of HI-STORE SAR indicates that Paragraph 4.6.2.3 of the HI-STORM UMAX FSAR provides information that applies for the scenario of 100% blockage of air inlets and outlet. However, Paragraph 4.6.2.3 discusses the scenario of 100% blockage of air inlets only.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-31: Clarify the definition of “maximum section average temperature” and “bulk average temperature” denoted in the notes to Table 6.4.3 and Table 6.4.5 of the HI-STORE SAR.

The definitions are required for staff to have a clear understanding of the temperatures reported in the tables.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-32: Clarify the effects of thermal stresses on the site’s SSCs (including UMAX module/VVM, HI-TRAC CS, and CTF) due to the temperature gradients from the heat generated by the content’s decay heat.

There was no mention of thermal stresses in Chapter 5 of the HI-STORE SAR, even though many of the SSCs are new (e.g., HI-TRAC CS, CTF) or have new designs (e.g., module). Thermal stresses are expected to impact safety margins already calculated (e.g., seismic and

tornadic wind effects) since they exist in the analysis of the SSCs a priori. That is, they should be considered concurrently with both seismic and tornadic effects. Update any relevant calculations as necessary.

This information is needed to determine compliance with 10 CFR 72.24(d) and 72.128(a).

RAI 6-33: Identify the potential onsite sources of fire or explosion events in SAR Chapter 6, Thermal Evaluation.

The SAR does not describe the source(s) of different fuels needed for operating onsite vehicles, such as the Vertical Cask Transporters and heavy haul tractor/trailers (SAR Section 3.1.4.7, Maintenance Operations), or those used for heating and other operational purposes. Existence or presence of large fuel source(s) (e.g., a fuel storage tank or a tanker truck) near important to safety structures could be a potential hazard that needs to be assessed.

The information should, at a minimum, include the following:

a) Confirm whether the proposed CISF would have any onsite storage tanks for gasoline, diesel, natural gas, or other combustible materials needed for operation;
b) Describe how the storage tanks will be replenished periodically, including the frequency, and the routes within the facility that would be taken by the supply vehicle(s) to reach the storage tanks;
c) Specify the nearest distance to the important to safety structures and systems from the storage tanks and supply vehicles' routes; and,
d) Confirm that the storage tanks and the supply vehicles would not pose any safety hazards to the important to safety structures and systems and a loaded cask transporter enroute to the cask storage pad area.

This information is necessary to determine compliance with 10 CFR 72.24, 72.90(a) through (d), 72.94, and 72.122.

<u>Safety Analysis Report (SAR), Chapter 7, "Shielding Evaluation"</u>

RAI 7-1: Justify how the shielding performance of the ISFSI will be improved under earthquake events or revise the shielding calculation and the SAR to make the shielding calculation consistent with the result of the structural analyses for design basis accident conditions of the system.

Section 1.2.1 of the SAR states that: "*[t]he height of the lateral seismic restraint at the top of the canister is adjusted to accord with the height of the canister that will be stored in the cavity, and a second set of seismic restraints are situated between the Divider Shell and Cavity Enclosure Container (CEC) at the same height and location as the lateral seismic restraint. As a result, the structural performance of the system remains unaffected and other safety metrics such as shielding and thermal (heat rejection) are either unaffected or improved (depending on the height of the canister being stored)*." However, the staff notes that these statements seem to show a discrepancy. If the design basis earthquake will not affect the structural performance of the Vertical Ventilated Module (VVM), there should not be any impact on the performance of the thermal and shielding functions of the system. More importantly, the staff does not understand how the shielding function can be improved by the damages resulting from an earthquake event either. The analysis should discuss how the shielding function will not be affected or improved if the canister ends up leaning to one side of the VVM and forms a bigger gap between the

canister and the VVM wall that results in a bigger streaming path for radiation. The staff's understanding is that the dose rate at the top of the VVM may increase because the increased streaming path on one side of the canister and the VVM. The analysis should provide additional discussion of how design basis earthquakes will not affect the shielding performance or revise the analyses to make models for shielding analyses consistent with the results of the structural analyses for the system under design basis accident conditions.

This information is necessary to determine compliance with 10 CFR 72.106.

RAI 7-2: Clarify if any high burnup fuel will be authorized for storage at the HI-STORE CISF.

Section 7.1.2 of the HI-STORE SAR states that: "*Assemblies with higher burnups[:] Those would also have correspondingly higher cooling times to meet transport requirements*." However, Table 7.1.1 of the HI-STORE SAR states that the maximum burnup is 45 GWd/MTU. It is not clear if this statement implies that spent fuel with burnups higher than 45 GWd/MTU will be stored at the CISF. Since the UMAX design allows for storage of fuel with a maximum burnup of 68.2 GWd/MTU for PWR fuel assemblies and 65 GWd/MTU for BWR assemblies(ML14202A032, UMAX FSAR), the applicant should clarify this discrepancy between the burnup limit used in the shielding analysis and these SAR statements.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), (c) and 72.106(b).

RAI 7-3: Provide specific minimum cooling time for higher burnup fuel to demonstrate that fuel with higher burnup will meet the design basis source terms limit of the HI-STORE CISF.

Section 7.1.2 of the HI-STORE SAR, states that: "*Assemblies with higher burnups[:] Those would also have correspondingly higher cooling times to meet transport requirements*." However, the applicant did not provide specific minimum cooling time requirement for each fuel burnup and enrichment limit. Without specific minimum cooling times for burnup and enrichment combination, the staff cannot verify if the higher burnup fuel meets the design basis source terms used in the HI-STORE CISF dose analyses.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), (c) and 72.106(b).

RAI 7-4: Justify that the calculated source terms considered in the HI-STORM UMAX FSAR are applicable to the HI-STORE CISF design or revise the shielding analyses accordingly.

Table 7.1.1 of the HI-STORE SAR provides the parameters for the design basis (DB) fuel assembly used to perform the shielding evaluation for the HI-STORE CISF. Specifically, Table 7.1.1 states that the DB fuel has a burnup of 45 GWd/MTU, 8 years of cooling time, and an initial U-235 enrichment of 3.2 weight percent (wt%). Section 7.1.2 of HI-STORE SAR further states that the DB source terms for the HI-STORM UMAX System were used in the site-specific shielding analyses for the HI-STORE CISF. However, Table 5.2.2 of the UMAX FSAR shows that the DB source terms for the MPC-37 canister were calculated based on 45 GWd/MTU burnup and 4.5 year cooling time, but does not state the minimal initial enrichment. Instead, the UMAX FSAR states that its design basis source terms are the same as those from the HI-STORM FW FSAR. The HI-STORM FW FSAR referenced in the HI-STORM UMAX FSAR states that the source terms calculated for the design basis PWR fuel are based on a WE 17x17 fuel, with 45 GWd/MTU burnup, 4.5 years of cooling time, and an initial enrichment of 3.6 wt%.

These parameters do not match the design basis fuel parameters presented in Table 7.1.1 of the SAR for the HI-STORE CISF.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), (c) and 72.106(b).

RAI 7-5: Justify the adequacy of the 2000 hours occupancy assumption in the calculation of the annual dose at the controlled area boundary.

Section 7.4.2.1 of the HI-STORE SAR states that: *"[t]he maximum controlled area boundary dose rate (assuming an occupancy of 2,000 hours per year) is below the 25 mrem annual dose limit of 10 CFR 72.104.*" However, the SAR does not provide the basis for assuming 2000 hours occupancy of a real individual at the controlled area boundary.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), (c).

RAI 7-6: Justify that the calculated annual dose at 1000 meter is appropriate for demonstrating compliance with the requirements of 10 CFR 72.104 and 72.106.

Section 7.4.2.1 of the HI-STORE SAR states that: "*[t]he nearest residence is 1.5 miles from the HI-STORE CIS Facility. The dose calculations conservatively assume a full-time resident (8760 hours/year) is only 1000 meters from the nearest loaded HI-STORM UMAX VVM*." However, Table 1.0.1 of the SAR, "Overview of the HI-STORE Facility," states that the distance from nearest loaded UMAX VVM to Site Boundary (Controlled Area Boundary) is 400 meters. These statements suggest that there is a discrepancy in the assumptions used to calculate the annual dose for a real individual at the controlled area boundary.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), (c) and 72.106(a), (b) and (c).

RAI 7-7: Demonstrate that the HI-STORE CIS storage system design is sufficiently similar to that of the HI-STORM UMAX design so that the analyses for HI-STORM UMAX are applicable to the HI-STORE CIS system.

Section 7.2.2.1 of the HI-STORE SAR states that: "[t]he *version of the HI-STORM UMAX storage system used here is slightly different from that described in [1.0.6]. However, the differences are minor, and do not affect the principal design features of the system. A discussion of the shielding design features of the storage system see Subsection 5.1.1 in [1.0.6]. This Subsection is incorporated here by reference*." However, there is no detailed comparison between design features of these two systems with respect to shielding design, particularly with respect to: (1) the authorized contents (e.g., PWR fuel burnup of 68.2 GWd/MTU for UMAX vs 45 GWd/MTU for HI-STORE CIS), (2) the VVM design dimensions, (3) the materials used in the backfill materials (Controlled Low-Strength Material (CLSM) in HI-STORE CIS vs concrete and soil for UMAX (Table 5.3.2 of UMAX FSAR (ML14202A029)), and top cover shielding design, including the streaming paths formed by inlet and outlet vents.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), (c) and 72.106(a) and (b).

RAI 7-8: Justify that the dose rate calculations under accident conditions for the HI-STORM FW HI-TRAC under accident conditions are applicable to the site-specific HI-TRAC CS to be used at the HI-STORE CISF.

Section 7.4.2.2 of the HI-STORE SAR states that: "*[t]he only off-normal or accident condition applicable to the HI-STORM UMAX storage system is the missile impact during construction next to a loaded canister. This condition is analyzed and modeled in Section 5.1 and 5.3 of the HI-STORM UMAX FSAR*." However, the HI-TRAC CS for the HI-STORE CIS uses concrete-filled steel annular shells structure, whereas the shielding design of the HI-TRAC transfer cask described in the HI-STORM UMAX System FSAR, referenced from the HI-STORM FW FSAR, is comprised of a lead, water jacket, and steel shell structure. Therefore, the same accident may result in different damage modes and hence different dose rates for these two transfer cask designs. .

The staff also notes that Section 7.4.2.2 states that a separate shielding calculation for the HI-TRAC CS with assumption of substantially degraded concrete was performed. However, the SAR does not discuss the amount of concrete degradation assumed. The SAR should explicitly discuss and justify the amount of concrete degradation assumed in the shielding calculations for the HI-TRAC CS to demonstrate compliance with the regulatory requirements of 10 CFR 72.106.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), (c) and 72.106(a) and (b).

RAI 7-9: Provide an assessment of the amount of Carbon-14 that can be generated by neutron radiation of the air passing through the annular space between the canister and the VVM and an estimate of its contribution to the controlled area boundary dose.

Carbon-14 (C-14) is a radioactive material that can be produced by neutron irradiation of Nitrogen-14, Oxygen-16, and Oxygen-17 that exists in the atmospheric air. For small ISFSIs, the generation of C-14 is generally insignificant and, accordingly, the staff has not been concerned with its potential contribution to the dose to the general public and occupational workers inside or outside the controlled area boundary. However, larger spent fuel storage facilities, such as that proposed for the HI-STORE CISF, could generate higher amounts of C-14 during its operation. Accordingly, the SAR should provide an assessment or estimate of the amount of C-14 that can be generated during its operation to determine its contribution to the total dose to workers and the general public.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), and (c).

RAI 7-10: Provide justification for excluding the manufacturing tolerances for important to safety structures and components in the shielding analyses for the HI-STORE CISF.

The HI-STORE CISF incorporates by reference the shielding analyses from the HI-STORM UMAX System, specifically those in Chapter 5 of HI-STORM UMAX FSAR, Rev. 1 (Holtec Report HI-2115090). Section 5.3 of the HI-STORM UMAX FSAR states that, "*[t]he nominal dimensions in these drawings were used to create the MCNP models used in the radiation transport calculations*." However, the HI-STORE SAR does not provide a justification for why this assumption is acceptable. More importantly, the HI-STORE CISF VVMs and the HI-TRAC CS transfer cask (TC) have different geometries and dimensions than those assumed in the HI-STORM UMAX FSAR. Specifically, the VVM storage module has different top lid design and

the HI-TRAC CS TC is a new concrete shield design instead of a lead and water layer shield design of the HI-TRAC TC for the UMAX system.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), (c) and 72.106(a) and (b).

RAI 7-11: Justify neglecting the contribution to the controlled area boundary dose from ISFSI loading and unloading operations or revise the estimated annual dose that includes the contribution from these operations.

The HI-STORE SAR provides an estimate of the annual dose from the ISFSI loaded with 500 design basis casks. However, it is not clear why the dose estimates at the controlled area boundary do not consider the contribution to dose of ISFSI loading and unloading operations. Because the HI-STORE CISF is designed to store up to 500 canisters in the initial phase, the SAR should provide a justification for why the doses from ISFSI loading operations, including loading of the canister into the transfer cask, moving the loaded transfer cask to the VVM, and unloading the canister into the VVM, do not make a substantial contribution to the dose at the controlled area boundary.

This information is necessary to determine compliance with 10 CFR 72.104(a), (b), (c) and 72.106(a) and (b).

RAI 7-12: Clarify the statement in Section 7.4.2.2 of the HI-STORE SAR regarding the off-normal and accident condition scenarios considered in the shielding analyses for the HI-STORE CISF.

Section 7.4.2.2 of the HI-STORE SAR states that: "*[t]he only off-normal or accident condition applicable to the HI-STORM UMAX storage system is the missile impact during construction next to a loaded canister. This condition is analyzed and modeled in Section 5.1 and 5.3 of the HI-STORM UMAX FSAR*." However, Section 15.2 and 15.3 of the HI-STORE SAR lists all of the off-normal and accident scenarios that were considered and analyzed for the HI-STORE CISF. The statement should be revised to either clarify that the scenario of missile impact during construction next to a loaded canister was the bounding scenario considered in the shielding analyses, or to otherwise reference that all other off-normal and accident scenarios listed in Section 15.2 and 15.3 were bounded by it.

This information is necessary to determine compliance with 10 CFR 72.106(b).

Safety Analysis Report (SAR), Chapter 8, "Criticality Evaluation"

RAI 8-1: Provide the licensing bases which ensure that, before a nuclear criticality accident is possible, at least two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to nuclear criticality safety.

The HI-STORE CISF SAR does not identify the cask design or site features that ensure that accidental criticality is not caused by two unlikely, independent, and concurrent or sequential events. The SAR should include such a discussion, which should consider the likelihood of possible events (e.g., canister failure, flooding) over the 40-year license period.

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

Safety Analysis Report (SAR), Chapter 10, "Conduct of Operations Evaluation"

[Note: RAI 10-1 thru 10-9 were issued on September 13, 2018 (ML18257A240)]

RAI 10-10: State whether radiation protection program, radiation monitor readings or results, and copies of the updated SAR or FSAR records will be maintained in Section 10.3.2 of the HI-STORE SAR as appropriate.

SAR Section 10.3.2 discusses what records are required to be maintained as quality records. However, the radiation protection program, radiation monitor readings or results, and copies of the updated SAR or FSAR are not referenced in this section as records that will be maintained as required.

This information is needed to determine compliance with 10 CFR 72.70 and 10 CFR Part 20, Subpart L.

RAI 10-11: Explain how canister transfer operations are terminated to ensure the canister is in a safe condition following identification of Krypton-85 concentration above the acceptance criteria or detection of a canister leak.

Steps 10 and 12 in Section 10.3.3.1 of the HI-STORE SAR state, respectively, to terminate canister transfer operations if Krypton-85 is identified above the acceptance criteria or a canister leak is detected. However, no operational steps are provided as to how termination of canister transfer operations would be performed at each stage in the process to put the canister in a safe condition. If the canister is considered in a safe condition after completing the applicable test, no basis is provided in the application.

This information is needed to determine compliance with 10 CFR 72.24(h) and 72.104(a).

RAI 10-12: Identify and describe the projected contingency operations following identification of Krypton-85 concentration above the acceptance criteria or detection of a canister leak.

Steps 10 and 12 of Section 10.3.3.1 of the HI-STORE SAR state that site management is informed for disposition following identification of Krypton-85 concentration above the acceptance criteria or detection of a canister leak. However, no contingency operations are identified or described to explain the potential disposition pathways for the canister and their safety basis.

This information is needed to determine compliance with 10 CFR 72.24(h) and 72.104(a).

RAI 10-13: State whether a canister contamination survey, including the applicable site contamination limit(s) and applicable actions post survey, will be performed and how.

Section 3.1.4.2 of the HI-STORE SAR states that *"[w]ith the canister lid exposed, a contamination survey is taken on the accessible areas of the canister lid to verify that the canister is free of removable contamination.*" However, SAR Section 10.3.3.2 does not discuss that after the transportation cask closure lid is removed, a contamination survey is performed on the canister. In addition, the SAR does not discuss site contamination limit(s), nor the actions to be performed based on the results of the survey.

This information is needed to determine compliance with 10 CFR 72.24(e) and 72.104(a).

RAI 10-14: Provide the location of Quality Assurance in the organization charts in Figures 10.4.1 and 10.4.2 of the HI-STORE SAR.

Quality Assurance is discussed in SAR Chapter 10, Section 10.1.2, as part of the organization's support staff (ISFSI specialists) but is not depicted in the corporate or the on-site organization charts in SAR Figures 10.4.1 and 10.4.2.

This information is needed to determine compliance with 10 CFR 72.28(c) and 72.142.

RAI 10-15: Clarify if the training described in the second paragraph of SAR Section 10.4.2 is only for Operating Personnel or all employees at the facility that have unescorted access. Describe if any general employee training will be provided to all personnel.

SAR Section 10.4.2 is titled, in part, training for Operating Personnel. The first sentence of the second paragraph states that individuals requiring unescorted access to the site will receive training in several programmatic areas. However, it is not clear if this training requirement is only applicable to Operating Personnel who need unescorted access or to all personnel who need unescorted access. If it is only for Operating Personnel, describe how other facility staff, such as administrative and corporate support that have unescorted access, will be adequately trained to perform work safely at the facility.

This information is needed to determine compliance with 10 CFR 72.28(d) and 72.192.

RAI 10-16: Provide the standard to which Radiation Protection Technicians will be trained and certified, and the basis for the selection.

Table 10.1.1 of SAR Chapter 10 describes the training and certification requirements for HI-STORE organization staff. Under Specialists/Radiation Protection Technicians, it states that Radiation Protection Technicians are trained to the Holtec Radiation Protection Technician Training Program. However, no details of the training program are described in the application, including the standard it was written to and the basis.

This information is needed to determine compliance with 10 CFR 72.28(c) and 72.192.

RAI 10-17: Provide the procedures, guidance, or criteria that site personnel will use to review records related to canister design and contents to verify that spent fuel received at the HI-STORE CISF will meet the descriptions and parameters analyzed in the SAR, and specified in the license and Technical Specifications.

SAR Chapter 3 lays out general procedures for loading the spent fuel canisters into the VVM for storage, which are supplemented in SAR Chapter 10 with more detailed descriptions of the operations of the ISFSI. Although Section 10.3.2 specifies that administrative procedures will be established and maintained for records, including canister receipt, inventory, transfer, among others, Chapter 10 does not provide detailed procedures, guidance, or criteria that site personnel will use in reviewing these records. The SAR should provide detailed procedures and/or guidance to site personnel for their review of these records to confirm that spent fuel canisters received at the site are bounded by the CISF site-specific shielding and criticality safety analyses in the SAR and meet the conditions of the license and Technical Specifications.

This information is needed to determine compliance with 10 CFR 72.104, 72.106, and 72.124.

RAI 10-18: Clarify whether the VVM temperature monitoring elements discussed in Section 10.3.3.5 of the HI-STORE SAR are necessary or optional.

Step 13 of Section 10.3.3.5 of the HI-STORE SAR states: *"13. Install the VVM temperature monitoring elements (if used)."* The SAR does not provide any specific information on whether the VVM temperature monitoring elements are necessary or optional. If necessary, the SAR should discuss whether the expected dose received by the operator(s) during this operation are expected to be significant and account for these in the worker dose estimate.

This information is needed to determine compliance with 10 CFR 72.126

Safety Analysis Report (SAR), Chapter 11, "Radiation Protection Evaluation"

RAI 11-1: Justify the exclusion of a site-specific dose estimate for ISFSI excavation activities at the CISF.

Table 11.0.1 of the HI-STORE SAR references the specific aspects of the HI-STORM UMAX FSAR Radiation Protection evaluations that are incorporated by reference, as well as those that require additional site-specific evaluations. Specifically, Table 11.0.1 states that *"[i]n the event, it is desired to expand the HI-STORE CIS Facility's HI-STORM UMAX VVM ISFSI, radiation protection of the excavation activities is achieved on a site-specific level using the same prescription as in the generic case (i.e. prescribing a minimum distance between the excavation area and the loaded VVMs, as well as radiological monitoring of the excavation area. The shielding design basis accident dose presented in the HI-STORM UMAX FSAR for the HI-STORM UMAX system demonstrates compliance with 10 CFR 72.106 [1.0.5] for the HI-STORE CIS Facility".* However, the staff could not find a site-specific radiation protection evaluation and dose assessment for this type of site operation, especially with respect to a minimum distance between the excavation area, distance between pads and the loaded VVMs, as well as radiological monitoring of the excavation area, including whether the design basis accident dose presented in the HI-STORM UMAX FSAR is still applicable to the HI-STORE CISF.

This information is needed to determine compliance with 10 CFR 72.104(a), (b), (c), and 72.106(a) and (b).

RAI 11-2: Provide additional details and clear markings on the site map for the boundary of the Restricted Area, Radiation Areas, and High Radiation Areas and discuss specific access controls to these areas with radiation protection requirements.

Section 11.2.1 of the SAR states that, *"[c]ertain areas within the Restricted Area are designated as Radiation Areas, and specific locations within the Radiation Area share the potential to be High Radiation Areas and are posted and controlled in accordance with applicable requirements of 10 CFR 20."* The applicant needs to clearly delineate the designated Radiation Areas, the boundary of Restricted Area, and the specific location for the High Radiation Areas in the site map.

This information is needed to determine compliance with 10 CFR 20.1302, 10 CFR 72.122(h), and 10 CFR 72.104.

<u>Safety Analysis Report (SAR), Chapter 14, "Waste Confinement and Management Evaluation"</u>

RAI 14-1: Justify the assumption that no low-level radioactive wastes will be produced during site operations.

Section 14.1 of the HI-STORE SAR states that: *"[r]adioactive wastes typically generated during operations at an ISFSI fall into the categories below. However, as discussed in Sections 14.3, 14.4, and 14.5, the HI-STORE CIS does not generate radioactive wastes in any form during operations. Therefore, implicitly, the HI-STORE CISF complies with the radioactive wastes and radiological impact criteria in 10 CFR 20 and 10 CFR 72"*. However, Chapter 3 and 10 of the SAR both state that specific surfaces of the canister and transportation cask will be swiped and tested for contamination. The wastes generated from these activities may create small amounts of low-level radioactive wastes and measures to ensure proper management and disposal of these wastes should be discussed in the SAR.

This information is needed to determine compliance with 10 CFR 72.44(d)

<u>HI-STORE CISF Training and Qualifications Program (TQP) (Holtec Report HI-2177562)</u>

RAI TQP-1: Describe the basic working training for an employee, such as a rigger, that would be operating or using the lifting devices and special lifting devices important to safety.

The Training and Qualification Program for the HI-STORE CISF includes training and qualification for the operation of the important to safety crane, MPC, HI-TRAC, and associated equipment. However, it does not describe the requirements for training and qualification of riggers who will be operating and using the important to safety lifting devices and special lifting devices, as described in SAR Chapter 4.

This information is needed to determine compliance with 10 CFR 72.192.

RAI TQP-2: Describe the frequency for refresher or continuing training for the job specific descriptions in Section 6.0 of the Training and Qualification Program.

Section 1.0 of the Training and Qualification Program states that the training requirements and qualification for the CIS Facility include refresher training. However, no frequency for refresher training is described, except for the Emergency Response Team. A frequency should be provided to justify the adequacy of the training program to maintain operator knowledge and qualifications.

This information is needed to determine compliance with 10 CFR 72.192.

RAI TQP-3: Describe or state the passing grade for successfully completing examinations to demonstrate competency.

Section 1.0 of the Training and Qualification Program states that following technical training, trainees must successfully complete written, practical, or oral examinations to demonstrate competency. However, no passing grade is described to justify what constitutes successful completion of an examination and demonstrates competency.

This information is needed to determine compliance with 10 CFR 72.192.

<u>Editorial Observations (EO):</u>

EO-1: Clarify or correct the following items:

a. Table 4.4.4 of the HI-STORE SAR has superscripts a. through h.; however, there were no corresponding notes associated with the superscripts.
b. Section 10.3.3 (Page 10-12) of the HI-STORE SAR states, *"Independent safety reviews will be performed and documented by qualified Independent Safety Reviewers (ISR) prior the performance of any operations."* The word, "To," may have been omitted.
c. Section 5.5.1 of Appendix A to the Proposed License(Page 5-2) should be revised to add a period at the end of the sentence: "*Therefore, specific operating procedures for the control of radioactive effluents and monitoring program for effluents at the HI-STORE CIS Facility are not required<u>.</u>"*
d. The definition of the transfer cask in the Proposed License refers to the transfer cask as the HI-STAR CS, rather than HI-TRAC CS.
e. SAR Section 17.8 refers to Table 17.1.3. This reference should be to Table 17.1.4.
f. SAR Table 1.5.1 incorrectly titles Drawing No. 10895. The canister transfer facility is referred to as the cask transfer facility.
g. The cask transfer facility foundation is described as an ITS component in SAR Section 5.3.3.2; however, this structure does not appear in SAR Table 4.2.1 (ITS SCCs), and it is not discussed in the aging management scoping discussion in Section 2.2.1 of Holtec Report No. HI-2167378.
h. SAR Section 17.5 refers to the "ASNT" designation for a qualified weld examiner; however, that acronym is not defined and no reference to a specific standard is provided.
i. The referenced footnotes are missing in SAR Table 4.4.4, "HI-STAR 190 Materials Temperature Limits."