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

May 20, 2021

Ms. Kimberly 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 – SECOND REQUEST FOR ADDITIONAL INFORMATION

Dear Ms. Manzione:

By letter dated March 30, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17115A431), as supplemented on April 13 (ML17109A386), October 6 (ML17310A218), December 21 (ML17362A097) and 22 (ML18011A158), 2017; February 23 (ML18058A617), May 24 (ML18150A319), July 27 (ML18213A206), November 30 (ML18345A153), 2018; January 31 (ML19037A280), March 15 (ML19081A083) and 30 (two submissions, ML19094A271 and ML19106A183), May 13 (ML19143A268) and 16 (ML19143A319), and August 26 (ML19248C140), 2019; March 3 (ML20065H155), June 1 (two submissions, ML20153A783 and ML20153A777), July 17 (ML20198M638), September 16 (ML20260H139), October 9 (two submissions, ML20283A789 and ML20290A505), and November 20 (ML20326A005), 2020; and January 4, 2021 (ML21004A241), Holtec International (Holtec) 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 (CISF), 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.

The NRC staff has reviewed your responses to its first-round requests for additional information (RAIs) and determined that additional information is necessary to complete its detailed review and make the required regulatory compliance findings. The information needed by the staff is discussed in the enclosed second-round RAIs. We request that you notify NRC staff in writing, within two weeks of receipt of this letter, of your proposed schedule for submitting responses to the staff's RAIs.

Upon removal of Enclosure 2, this document is uncontrolled

In order to ensure that your responses to the staff's second request for additional information is complete and adequately resolves the remaining issues, the staff strongly recommends that Holtec staff meet with NRC to discuss the proposed answers prior to their submission.

If you have any questions regarding these matters, please contact Mr. Jose R. Cuadrado, Project Manager, at (301) 415-0606.

Sincerely,

Signed by Cuadrado-Caraballo, Jose on 05/20/21

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 No.: 001028/07201051/
L-2018-NEW-0001

Enclosures:
1. Second RAI (Non-Proprietary)
2. Second RAI (Proprietary)

Second Request for Additional Information

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 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17115A431), as supplemented on April 13 (ML17109A386), October 6 (ML17310A218), December 21 (ML17362A097) and 22 (ML18011A158), 2017; February 23 (ML18058A617), May 24 (ML18150A319), July 27 (ML18213A206), November 30 (ML18345A153), 2018; January 31 (ML19037A280), March 15 (ML19081A083) and 30 (two submissions, ML19094A271 and ML19106A183), May 13 (ML19143A268) and 16 (ML19143A319), and August 26 (ML19248C140), 2019; March 3 (ML20065H155), June 1 (two submissions, ML20153A783 and ML20153A777), July 17 (ML20198M638), September 16 (ML20260H139), October 9 (two submissions, ML20283A789 and ML20290A505), and November 20 (ML20326A005), 2020; and January 4, 2021 (ML21004A241), Holtec International (Holtec) 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 (CISF), 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."

This request for additional information (RAI) identifies additional information needed by the NRC staff in connection with its safety review of the HI-STORE CISF license application. The requested information is listed by the specific part of the license application, 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.

Safety Analysis Report (SAR), Chapter 2, "Site Characterization"

RAI 2-7-S: Provide the basis of each assumption taken in assessing the explosion hazards and consequences to structures or systems important to safety at the proposed CISF from a rupture of any pipeline resulting in release and subsequent ignition of the natural gas (SAR Section 2.2.2, "Pipelines").

Several explicit and implicit assumptions were made in the analysis and discussion provided in response to RAI 2-7. At a minimum, the bases for the following assumptions should be provided:

1) Only pipeline incidents of New Mexico are considered in assessing the potential hazard of the proposed CISF.

   Clarify whether specific characteristics of the natural gas pipelines in New Mexico make them unique for assessing the pipeline explosion hazards to the proposed CISF. The rationale for not using the nationwide statistics, consistent with Regulatory Guide 1.91, should be clearly articulated.

2) Different failure mechanisms of the pipeline ultimately leading to a release are treated as separate initiating events given that 24 hours would be needed to take necessary mitigative actions after detecting the release.

   Provide the rationale for treating different failure mechanisms of the pipeline, such as pipeline ruptures, pipeline leaks, pipeline punctures, and equipment-related failure as separate initiating events. Provide the basis for excluding the possibility of crack/hole enlargement in a high-pressure pipeline in 24 hours after leak detection leading to a complete rupture of the pipeline and associated release of natural gas.

3) Probability of sufficient gas released to form a flammable cloud is assumed to be 0.005 or 0.5%.

   During the assumed 24 hour time period before any intervening action could stop the release of natural gas, a significant amount of natural gas from a 20 inch diameter pipeline pressurized at 680 psi can be released, even if it is buried under 30 inches of rock/soil cover. Provide appropriate bases for the assumption that the potential release of natural gas in a 24-hour period is such that the probability of sufficient gas being released to form a flammable cloud is 0.005.

4) The assumption that a flammable cloud has to travel a minimum of a mile without dispersing in the atmosphere before a vapor cloud explosion can occur.

   A vapor cloud will start dispersing in the atmosphere soon after the release and the dispersion process continues as it travels by the prevailing atmospheric conditions; however, consider whether 24 hours would release enough natural gas for a significant portion to remain within the flammable range even as the cloud travels away from the release point. The cloud within the flammable range may be the source of explosion. Provide the rationale for the assumption that a flammable cloud has to travel a minimum of a mile without dispersion before a vapor cloud explosion can occur.

5) The probability that the flammable cloud does not encounter an ignition source as it travels to the CISF is estimated to be 0.01 or 1%.

   Justify this probability given that the nearest pipelines are 0.16 of a mile east of the proposed facility. Ignition sources can be sparks from electrical apparatus; hot surfaces, such as hot steam lines; friction between moving parts of a machinery or pipe fragments or rock pieces in a rupture of a pipeline; presence of open flame or open fire in, for example, furnaces, and heaters, etc. Provide the basis for assuming 1% probability that a vapor cloud would not encounter an ignition source (and create the potential for fire or explosion) before reaching the proposed facility boundary.

6) The probability that the flammable cloud is of sufficient size and concentration to cause an explosion at the proposed CISF was assumed to be 0.01.

   Clarify whether this is a conservative assumption, in light of the assumed 24 hours of continuous release. The event sequence already assumes that the quantity of released gas would be small and the released gas would disperse before reaching the facility, such that only a small portion of the gas cloud would be within the flammable range. Using another small probability value in the event sequence will reduce the estimated frequency of explosion significantly. Provide the basis for the assumption of the probability of cloud size and concentration.

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

RAI 2-8-S: Provide the basis for the statement in the response to RAI 2-8 that, *"[n]o new oil and gas wells will be constructed within the Facility boundaries because new drill islands will not be permitted on the privately owned land."*

The response to RAI 2-8 does not provide a discussion or justification for why new drill islands would not be permitted within the privately owned land where the facility will be constructed.

This information is necessary to determine compliance with 10 CFR 72.24, 72.90(a) through (d), 72.94, and 72.98.

RAI 2-12-S: Provide a legend for Figure 1 to the response to RAI 2-12 (Figure 2.1.24 in HI-STORE SAR, Rev. M) for each color and size of circles and squares depicted. Also, provide a detailed discussion as to why mining of potash would not be feasible beneath or around the proposed CISF site for the proposed duration of the license.

Both SAR Figure 2.1.24 and Figure 1 of the RAI response do not have any description of the colors and symbols used to depict features. Additionally, explain in detail the basis for the conclusion that mining of potash from underneath the proposed CISF site would not be feasible for the proposed duration of the license. For example, explain the extent to which this position relies on the State of New Mexico, Oil Conservation Commission's Order No. R-111-P, or the U.S. Secretary of the Interior Order No. 3324.

This information is necessary to determine compliance with 10 CFR 72.24(a), 72.90(a) through (d), 72.94, and 72.98.

RAI 2-14-S: Explain whether a release of hazardous chemicals while being transported through U.S. Highway 62/180 or by rail cars near the proposed facility would pose any credible hazard to the proposed CISF.

The responses to the RAIs 2-14 and 2-15 account for potential explosions. Explain whether there is a credible hazard from release of other hazardous chemicals, such as a chlorine spill.

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

RAI 2-16-S-1: Provide a technical basis to justify the use of a point estimate instead of an areal estimate of precipitation for the 100-year storm.

In its RAI response and updated SAR, the applicant maintains that point-estimation of the 100-year storm precipitation can be used to estimate flood level at the proposed CISF site. Provide the technical basis for the use of the point-estimation approach versus a comparable areal-estimation approach. Explain how, in selecting representative storm events for flood analysis, the applicant considered the size of the watersheds surrounding the proposed CISF so that temporal and accumulated impacts to the CISF from storms moving through the entire watershed can be accounted for.

This information is necessary to demonstrate compliance with 10 CFR 72.90(b) through (c), 10 CFR 72.92(a) through (b), 72.98(a), and 72.122(b)(2)(i)(A) through (B).

RAI 2-16-S-2: Provide a technical basis to justify the use of the probable maximum precipitation from the Colorado-New Mexico Extreme Precipitation Study.

In the updated SAR, the applicant uses the probable maximum precipitation (PMP) of 6-hour and 24-hour duration to calculate the flood level at the proposed CISF site. PMPs are almost identical for both the 6-hour and 24-hour events. Provide the technical basis for following the Colorado – New Mexico (CO-NM) Extreme Precipitation Study, instead of the National Weather Service's (NWS) Hydrometeorological Reports 51/52. Describe how the PMP was obtained and clarify how the precipitation was distributed over the storm duration, namely how the hyetograph was determined. Given the size of the watersheds surrounding the proposed CISF site, justify why 6-hour and 24-hour events were selected, but 48-hour and 72-hour events were not considered.

This information is necessary to demonstrate compliance with 10 CFR 72.90(b) through (c), 10 CFR 72.92(a) through (b), 72.98(a), and 72.122(b)(2)(i)(A) through (B).

RAI 2-17-S-1: Provide the rationale for using two differing modeling approaches to calculate flood water level at the proposed CISF site.

In the updated SAR, the applicant retains the mass balance approach for the 7.5-inch storm event but uses the hydrological and surface flow routing approach for probable maximum flood (PMF) calculation in the GEI report (GEI, 2019). Justify why, for the mass balance approach, a one-half depth to restrictive layer for subsurface storage of storm water infiltration is conservative. The water levels at Laguna Gatuna and Laguna Plata were initially assumed at 5 feet, but the approach used in hydrological modeling done by GEI Consultants assumes full pool condition. Additionally, Laguna Plata was included in the 100-year mass balance analysis but was used as a receiving water body in the GEI report. In the latter case, clarify whether the PMF water level in and surrounding the laguna was hydrologically modeled or estimated with unstated assumptions. If it was estimated or calculated offline, clarify the boundary condition used to calculate the water level in the laguna. Justify the exclusion of Laguna Plata from the GEI hydrological calculations of surface water elevation due to the selected PMP events and identify the boundary condition for Laguna Plata for the HEC-RAS hydraulic analysis. Justify the use of different modeling approaches in the updated SAR.

This information is necessary to demonstrate compliance with 10 CFR 72.90(a), 72.90(b), and 72.92(c).

<u>Reference:</u>

GEI, 2019. Attachment 6 to the Holtec Letter 5025038, Probable Maximum Flood Analysis, HI-STORE CISF, Lea Country, New Mexico. ML20260H147 (proprietary).

RAI 2-17-S-2: Provide a technical basis to justify the curve numbers (CNs) used for flood analysis.

In the RAI response and updated SAR, the applicant claims to follow the Hierarchical Hazard Analysis (HHA) methodology, which starts from the most conservative assumptions, then follows up with more site-specific data to reduce conservatism. The CNs used are in the range of 40 – 70, indicating fair amount of precipitation loss assumed for the basins and the proposed

CISF site. Discuss the iteration from generic, conservative assumptions (e.g., CNs in the high 90s and/or wet antecedent soil water retention) to more site specific, less conservative ones (i.e., supplementing the generic data such as the NRC soil map to more site specific data such as the onsite measurements of infiltration capacity and evapotranspiration). Justify, with technical basis, that an acceptable level of conservatism is being considered in the flood analysis if only generic, rather than site-specific, information is used.

This information is necessary to demonstrate compliance with 10 CFR 72.90(a), 72.90(b), and 72.92(c).

RAI 2-18-S: Provide a technical basis to justify the representativeness of parameters used for flood analysis.

In response to RAI 2-18, the applicant provided an updated SAR and supporting analyses that use the United States Department of Agriculture Natural Resources Conservation Service (NRCS) data to parameterize its surface water flow model. The NRCS data particularly of interest here—the infiltration rate and soil water capacity—are generic. Using non-site-specific data will incur uncertainty of unknown quantity for the calculated flood water level. If only generic, non site-specific data is available for forward prediction of flood water level, quantify the model prediction uncertainty and prediction sensitivity to model parameters.

This information is necessary to demonstrate compliance with 10 CFR 72.90(a), 72.92(b), and 72.92(c).

RAI 2-19-S: Provide additional information to justify that on-site flooding due to PMP storm events will not cause damage to important to safety (ITS) structures, systems, and components (SSCs) at the HI-STORE CISF site.

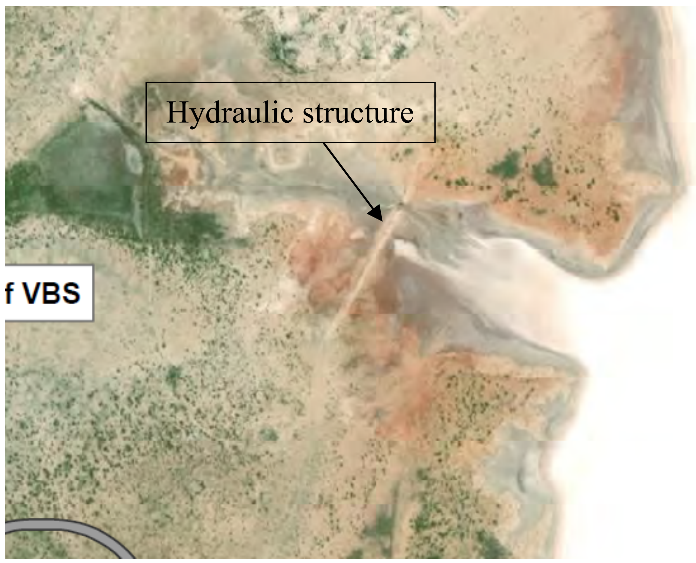
In its response to the RAI and updated SAR, the applicant's analyses suggest flooding can occur at the site, particularly in areas inside the CISF boundary where later phases of the proposed CISF will be constructed. Discuss whether any flood protection is needed for ITS SSCs, according to the NUREG/CR-7046 HHA methodology. If the applicant seeks to claim credit from the HI-STORM UMAX System's flooding analysis, which demonstrates that a canister would not leak in evaluated flooding conditions, the SAR should discuss what effects, if any, the onsite flood water depth would have on the UMAX pad system, including the backfill, cementitious material between casks and around casks. This should include water depth from surface water ponding and a column of saturated subsurface soil with groundwater, including the loading from the saturated backfill material. Furthermore, based on hydraulic modeling results, the applicant should provide a map of the CISF clarifying where soil erosion may occur and its impact, if any, on ITS SSCs or physical security structures. The applicant should describe mitigation actions it plans to take in the event soil erosion does happen.

This information is necessary to demonstrate compliance with 10 CFR 72.122(b)(2)(i)(A) and (B).

RAI 2-20-S: Provide an estimate of the likelihood that flooding may occur from a 100-year storm event as a result of damage to the hydraulic structure near Laguna Gatuna.

In its response to RAI 2-20, the applicant provided a PMP/PMF study (GEI, 2019), which assumes Laguna Gatuna in 'extreme full' condition, with water inundating the hydraulic structure. The effect of the hydraulic structure on flooding is thus accounted for. However, in the 100-yr storm event, where the Laguna was assumed to be filled with 5 feet deep of water, runoff into the wash and the hydraulic structure (looking like an earthen dam with an area that has been broken – see picture taken from the GEI report, Fig. 6) may create back water effect, which in turn may cause flooding around the northeastern corner of the proposed CISF. Provide calculations to estimate the likelihood that flooding may occur and, if so, at what depth under this scenario.

Alternatively, most of the water in Laguna Gatuna will be stored east of this structure in a sub-PMP storm event. Provide additional analyses to determine the potential impact of the structure's partial or complete collapse (e.g., the potential for flooding to the wash northeast of the proposed CISF), particularly under sub-PMP weather conditions.



This information is necessary to demonstrate compliance with 10 CFR 72.90(a), and 72.122(b)(2)(i)(A) and (B).

RAI 2-22-S: Clarify if the impacts from failure of the proposed rail embankment during a flooding event were assessed in the hydraulic modeling exercise.

In its RAI response, the applicant provided a drawing of a standard embankment for the proposed rail line into the CISF site. The embankment appears to be included in the HEC-RAS model (see Appendix F of the GEI report); clarify whether the impact of its failure, with a potential rush of flood water north of the embankment into the proposed CISF, was assessed in the hydraulic modeling exercise (per Figs. 11 and 12 of the GEI report).

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

RAI 2-29-S: Provide the revised version of the geotechnical report.

HI-STORE SAR, Rev. 0J cites the following reference:

> *[2.1.24] GEI Consultants (GEI). "Geotechnical Data Report: HI-STORE CISF Phase 1 Site Characterization." February 2018.*

However, the version of this report on docket is dated December 2017. Describe whether changes have taken place in the revised version that may affect the geotechnical analyses.

This information is necessary to determine compliance with 10 CFR 72.103(f)(2)(ii).

RAI 2-32-S: Provide the document with detailed analysis showing that the site is not susceptible to liquefaction.

The response to RAI 2-32 refers to the following document:

> *GEI Document No. CIS-CS-001-00, "Liquefaction Resistance of Soils for HI-STORE CISF."*

This document has also been referenced in the revised Report No. HI-2188143, "HI-STORE Bearing Capacity and Settlement Calculations." This report provides the details of analysis why the site is not susceptible to liquefaction. However, this report has not been submitted as a part of the application.

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

RAI 2-33-S: Justify why the material properties, as given in Table 5.3 of Report No. HI-2188143, Revision 1, "HI-STORE Bearing Capacity and Settlement Calculations," are appropriate to represent the materials at the proposed site.

Clarify why the value assigned to some geotechnical parameters is appropriate for the site. For example:

1) Table 5.3 of the revised report gives a friction angle for the Residual Soil at the site as 54°. This is an extremely high value even for most of the hard, igneous rock and certainly for a soil. Appendix C of Report No. HI-2188143, Revision 1, "Bearing Capacity and Settlement Calculation," has used a formula to calculate the friction angle φ from EPRI (Kuhlhaway and Main, 1990):

   $$\varphi = 54 - 27.6034\, e^{[-0.0014 \times (N_1)_{60}]}$$

   as a function of the corrected Standard Penetration Test blow count $(N_1)_{60}$. Appendix C shows that $(N_1)_{60}$ values vary from 58 to 173; however, the calculated value of φ remains constant 54° irrespective of $(N_1)_{60}$ values. Provide the appropriate friction angle of the Residual Soil. Additionally, provide the correct source of this equation if it is not the referenced EPRI document.

2) In the revised report, the preconsolidation stress σ_p of the Chinle Formation is taken as the value estimated in sample SW2, obtained at depth of 101 ft below the ground surface. Provide the rationale for using the measured consolidation properties from sample SW2 but not from SW1. The estimated over-consolidation ratio from only SW2 sample seems very high. Provide the rationale for the estimated values of the preconsolidation stress and the over-consolidation ratio.

3) Provide a rationale for why the measured consolidation properties in Chinle mudstone at a depth of 101 ft from the surface (sample SW2) would be appropriate for consolidation settlement in Chinle clay (lean clay or CL) formation near the surface.

4) Page A9 of the revised report states that *"the Chinle Formation mudstone section is considered bedrock. Also, the full depth of the Chinle is considered in the calculation*

> *above (175 ft), this is conservative as the mudstone will not settle as much as the clay."* However, both SW1 and SW2 samples are from the Chinle Formation mudstone, not from the Chinle Formation clay. Provide the rationale for why the consolidation settlement is not underestimated.

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

RAI 2-40-S: Discuss in detail the methodology used to calculate the effective elastic modulus of the subgrade under the support foundation pad using only the estimated long-term settlement, as provided in Holtec Position Paper DS-338, "A Methodology to Compute the Equivalent Elastic Properties of the Subgrade Continuum to Incorporate the Effect of Long-Term Settlement."

The response to RAI 2-40 uses a methodology to derive an effective elastic modulus for the soil column under the support foundation pad. The methodology is described in detail in Holtec Position Paper DS-338, which has not been submitted as part of the application.

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

RAI 2-42-S: Justify why a two-layer system, as used in Report No. HI–2188143, Revision 1, "HI-STORE Bearing Capacity and Settlement Calculations," would be appropriate for estimating the bearing capacity and settlement of the storage pads.

Page A9 of Report No. HI–2188143, Revision 1, "HI-STORE Bearing Capacity and Settlement Calculations," states that *"the Chinle Formation mudstone section is considered bedrock. Also, the full depth of the Chinle is considered in the calculation above (175 ft), this is conservative as the mudstone will not settle as much as the clay.*" The response to RAI 2-42 states that "[i]n the latest revision of Report No. HI-2188143, the top CL soil layer is conservatively assumed throughout the entire 175 ft depth of the Chinle Formation." These statements suggest that the settlement characteristics of the Chinle Formation clay section are different than the Chinle Formation mudrock. Provide the rationale for selecting a two-layer system for estimating the settlement under the storage pads and the Canister Transfer Facility instead of a multilayer system.

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

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

RAI 3-2-S: Clarify what actions the site personnel will take if contamination levels on the canisters of incoming shipments exceed site requirements.

In its response to RAI 3-2, the applicant added TS 3.2.1 to include contamination limits for accessible portions of the canister. The TS also includes a requirement that if the contamination limit is found to be exceeded for a canister, it must be restored within limits in 7 days. However, Section 3.1.4.6 of the SAR states, in part, that *"HP personnel ensure that contamination levels on the canisters of incoming shipments meet site requirements. Canisters exceeding the limits will be returned to the originating power plant for dispositioning.*" Clarify whether this second sentence of this statement is consistent with the TS 3.2.1 requirement to decontaminate a canister exceeding site contamination limits.

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

RAI 3-3-S: Justify the use of canister lid contamination surveys to determine the total amount of canister surface contamination.

In its response to RAI 3-3, the applicant revised SAR Section 3.1.4.2 and 3.1.4.3 to state that the empty transportation cask will be surveyed to confirm that it is free of removable contamination and that decontamination will be performed if any contamination is found. However, the SAR also states that "*With 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*." (Emphasis added.) This is also discussed in SAR Sections 3.1.4.2 and 10.3.3.2, Step 3.

Justify how the canister lid would be representative as a survey for the level of contamination for other accessible areas of the canister, considering that the TS Bases in Chapter 16 of the SAR, Section B 3.2.1, requires the location and number of surface swipes be based on standard industry practices for objects of this size. Additionally, in the event the contamination is higher than the contamination level in TS 3.2.1 and cannot be removed in the period of 7 days, describe what actions site personnel will take. The SAR should be updated, and any additional TS 3.2.1 actions should be provided as necessary depending on the proposed actions.

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

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

RAI 4-2: Provide the ITS classification for the slings used during transfer operations of the multi-purpose canister (MPC) from the transportation cask to the HI-TRAC.

Table 4.2.1 describes the ITS classifications for lifting devices and special lifting devices associated with the movement and transfer of the MPC, but does not describe the ITS classification for the slings used when transferring the MPC from the transportation cask to the HI-TRAC using the cask transfer building (CTB) crane. These slings are a component that provides, in part, the capability to lift, handle, and transfer spent nuclear fuel, and should therefore be classified.

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

Safety Analysis Report (SAR), Chapter 5, "Structural and Installation Evaluation"

RAI 5-3-S: Confirm the anchor rod details as they pertain to the seismic calculations for the HI-TRAC CS (Concrete Shielded) and update the drawings/calculations as necessary.

In its response to RAI 5-3, the applicant stated that the lowest natural frequency of the HI-TRAC CS when subjected to lateral excitation (seismic loads) is 18.979 Hz for 2 resisting anchor bolts. The RAI response calculation appears to assume an anchor rod diameter of 3 inches, while anchor rod (part 4), per Sheet 2 of drawing 10895, indicates a diameter of 3 ¼". An implicit assumption appears to be that the anchor rods secures the HI-TRAC CS.

However, the anchor rods pass through several parts as shown on Sheet 1, drawing 10868, where the opening for the anchor rods is actually wider than the diameter of the anchor rod itself: 3 ¾" for the shield gate bottom flange (Part 13) and 5" through the shield gate top flange (Part 9). Clarify how the anchor rods as shown secure the HI-TRAC CS given that hardware such as anchor rod nuts are not depicted or specified and clarify how Part 4 on Sheet 1 of drawing 10895 engages Part 21 on Sheet 1 of drawing 10868.

Explain why the HI-TRAC CS, as depicted, would remain secure in response to seismic loads (e.g., would not experience increased loading as an inverted pendulum).

Revise the seismic analysis of HI-TRAC CS for both lateral and vertical loads on the anchor rods (which resist combined bending/shear and tension) and connecting components (Part 10 and 11 on Sheet 2 of Drawing 10895), and their depiction on the licensing drawings as necessary.

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

RAI 5-4-S: Provide additional information on cask handling operations.

In its response to RAI 5-4, the applicant stated that a work shift is 8 hours long. In SAR Section 4.3.6, the applicant states that it follows the "universally practiced 'lift and set' rule," which excludes certain operations from seismic qualification. The applicant further stated, "For clarity of application, any activity that spans less than a work shift is deemed to be seismic-exempt." However, the 'lift and set' rule" is not defined nor recognized by the NRC. Additionally, the HI-STORE CISF may potentially handle thousands of canisters, which cumulatively would far exceed 8 hours to handle. Even if a strong technical basis were provided for any seismic exemption, additional operational procedures or administrative controls would have to be provided. The cask is susceptible to seismic loads as shown in Figure 3.1.1f of the SAR, where the cask lid is completely unbolted, the canister is on its side, and susceptible to having fuel/canister slide out and drop onto the cask transfer building floor. The staff requests the following:

1. Provide seismic qualification supporting calculations for cask upending, attaching of slings, or installation of fasteners, and;

2. Describe the condition of the canister when subjected to seismic loads when performing cask handling operations.

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

RAI 5-8-S: Provide calculations/analyses of the vertical cask transporter (VCT) when transporting a loaded HI-TRAC CS.

The response to RAI 5-8 does not address the staff's request. The SAR does not provide sufficient information or design details to support the assumptions for treating the VCT as a rigid body or the use of the PGA (Peak Ground Acceleration) alone with an uncharacterized/designed tensioned restraint strap.

In its response, the applicant stated in part:

"The HI-TRAC CS is physically secured against the chassis of the VCT using a tensioned restraint strap while it is in transit. This prevents the HI-TRAC CS from swaying with respect to the VCT. Also, by bracing the HI-TRAC CS against the VCT, the flexible beam modes associated with the VCT lift towers are diminished since the massive HI-TRAC CS is restrained against lateral motion (relative to VCT). The VCT chassis is a large welded steel structure with a substantial cross-section, which behaves like a rigid body under seismic loading."

Provide calculations supporting these assertions. The analysis of the system should incorporate the response spectrum of the site, actual dynamic behavior of the system (VCT & load which do not necessarily act in unison) subjected to a 3-dimensional seismic time history analysis to support tipping and sliding calculations. Note that lateral portion of seismic loads can be applied at any direction. The analysis should include:

1. Details for the tensioned restrained strap, such as material properties, dimensions, configuration relative to the cask, acceptable tensioning procedures, and depiction in the licensing drawings and in the SAR, if not provided already. The dynamic analysis (time history) should consider the tension strap's potential to go "slack" or "stretch" when subjected to seismic loads when attempting to restrain a fully loaded cask, as it is expected to potentially sustain very large alternating loads. This information should be noted in the licensing drawings and/or SAR.

2. Materials, dimensions, configurations, and specifications of the VCT while carrying a fully or partially loaded canister. The SAR describes the VCT as a very "open-ended" device that has the "ability to raise or lower a cask", and can have several suspensions (wheeled, tracked, etc.). The dynamic analysis of such an "open ended" vehicle would have to cover a multitude of parameters pertinent to a time history analysis. The VCT carrying a fully loaded canister will have at least two significant modes of vibration, where the VCT displaces laterally due to its suspension and tall nature, and the carried load is free to oscillate relative to the VCT in any direction.

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

RAI 5-9-S: Provide calculations and drawings to support the design of the CTB.

In RAI 5-9, staff requested additional information regarding the collapse scenarios for the CTB on the HI-TRAC CS. In its response, the applicant stated that the CTB is now classified as ITS-C. However, no building design was provided to to justify the CTB's structural integrity in response to natural phenomena, blast, etc., which would preclude the need to analyze the effects of a collapse on the HI-TRAC CS.

The response should provide site specific licensing drawings and design calculations for the CTB that include structurally pertinent information, such as dimensions, members sizes, materials, connection details, welding/bolting, foundation details, crane detail designs, geotechnical calculations including soil-structure interaction, etc. Since the CTB is now classified as ITS-C, the applicant should incorporate applicable structural design codes (ACI, ANSI and AISC).

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

RAI 5-10-S: Clarify the number of "canister deployments" that can be made with the HI-TRAC CS, VCT, and associated lifting equipment, which incorporates low cycle fatigue and a dynamic load factor.

For discussion purposes, canister deployment can be defined as the movement of a canister upon initial receipt from rail car to its final ventilated vertical module (VVM) location, or from the VVM back to the rail car. The fatigue calculations provided in the response to RAI 5-10 do not show how low stress, high cycle fatigue combined with low cycle, high-stress fatigue corresponds to a canister deployment. Potentially hundreds, if not thousands, of low cycles may be experienced by the VCT. The distance of each canister deployment should also be noted, as long distances while in transit will accrue many more cycles. Operating experience shows that hundreds of fatigue cycles will occur for even relatively short distances for just one canister. Clarify the number of "canister deployments" that can be made with the HI-TRAC CS, VCT, and associated lifting equipment.

In addition, justify the use of dynamic load factor increase of 15%. The 15% increase in "live load" should be applied as a 1.15 factor to maximize (worsen) alternating stresses and not behave as a stress reduction factor, per Section 10.5 of Supplement 10 in Holtec Report No. HI-2177585R1 for those components loaded in tension. Confirm that the dynamic load factor is applied appropriately and update the calculations and SAR as necessary.

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

RAI 5-11-S: Provide clarification on groove weld options on drawings and groove weld design.

In Note 2 on Sheet 1 of 5, Drawing 10868, the applicant indicated that the fabricator can replace all fillet welds with grove welds of equal or greater strength, as indicated in other licensing drawings.

Specifically, the revised drawing states:

> *"FILLET WELDS MAY BE REPLACED WITH GROOVE WELDS OF EQUIVALENT OR GREATER EFFECTIVE THROAT THICKNESS AS DEFINED BY NF-3324.5."*

This response does not provide a groove weld design, only a code to design to, rather than a weld option for the actual design that demonstrates equivalent weld strength. Clarify how the fabricator will be able to replace fillet welds with groove welds of equal or greater strength.

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

RAI 5-13-S: Justify the basis for the assertion that the welds are 'not safety-significant'. Specify and size all the welds used for the components depicted on Sheets 3 and 4 of Drawing 10895.

In its response to RAI 5-13, the applicant stated that:

> *"Note 3 on Sheet 1 of Drawing 10895 is modified as follows, to clarify that the note is applicable to the CTF Shell:*
>
> *SHELL (ITEM 1) MAY BE FABRICATED FROM MULTIPLE PIECES WITH NON-STRUCTURAL WELDS SUCH AS INDICATED BY WELDS 3-1, 3-2 AND 3-3 SHOWN*

ON SHEET 3. TYPE OF WELD, NUMBER, AND LOCATION OF WELDS TO BE DETERMINED BY FABRICATOR.

The CTF shell and shell welds are non-structural, as the structural loads on the CTF are imparted on the CTB slab at the top and the CTF foundation slab at the base. Number, type and locations of welds are therefore not specified on licensing drawing 10895 as they are not safety-significant."

However, these welds are safety related since they transfer load and have stresses, which are tabulated in Table 5.4.1, when subjected to seismic loads during cask transfer operations. The latest revision of SAR Section 5.4 further discusses this. Thus, all components shown on Sheets 3 and 4 of Drawing 10895 need to be welded to a specified code, such as ASME NF, and have appropriate weld sizes supporting their structural integrity, including any supporting calculations as it is not clear how these welds that are not specified are sized. This includes the adapter plate, schedule 40 pipes used for heat rejection when a cask is in the pit, the shell of the pit itself, and all connecting components since all are subjected to seismic demands. The adapter plate (BOM 10) is currently classified as NITS, but should be ITS, as it must still be designed to prevent block shear around the anchor rods for instance, and the plate "tabs" used to inset the adaptor into the CTF shell to prevent lateral movement of the HI-TRAC CS during seismic events.

Specify and size all the welds used for the components depicted on Sheets 3 and 4 of Drawing 10895 and classify them accordingly as ITS or NITS for use in the CTF. The applicant should also consider the prestressing nature of the wet Controlled Low-Strength Material (CLSM) cast against the CTF shell.

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

RAI 5-14-S: Provide structural calculations and drawing details for the HI-STAR 190 SL pedestal.

In its response to RAI 5-14, the applicant provided some details regarding the construction of a pedestal that is to be used in conjunction with the HI-STAR 190SL in the CTF cavity (Sheet 10895, Drawing 4). Provide structural calculations to justify the heat dissipation properties of the HI-STAR 190SL cask pedestal, including updating the drawings with connection details, such as weld locations, weld sizes, and other appropriate weld information.

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

RAI 5-15-S: Revise finite element models (FEM) to address possible excessive hour glassing energy.

In response to RAI 5-15, the applicant stated that the excessive amount of hour glassing energy was not of concern due to the kinetic energy of the system. The staff notes excessive hour glassing can be an indicator of the FEM possibly exhibiting unrealistic behavior. Additionally, the staff notes that the kinetic energy generated by a stationary structure during a seismic event is not of interest for this analysis. The area of interest is the performance of the HI-TRAC CS and the strains and stresses within itself.

Revise the model and any output results for the stack-up and the "Safe Shutdown Earthquake" (SSE) scenarios such that the ratio of hour glassing energy to internal energy is less than 10% as per LS-DYNA recommendations or otherwise further justify why the hour glassing energy would not adversely affect the structural integrity of the HI-TRAC CS.

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

RAI 5-18-S-1: Provide additional information on the suitability of the CLSM.

Section 2.6.6 of the UMAX FSAR indicates that the CLSM material in Space A shown in Figure 4.3.1 of the HI-STORE SAR will have a compressive strength of 1,000 psi and a density of 120 pcf. However, the response to RAI 5-18 indicates that the material will have a compressive strength of 1200 psi. CLSM material is intended to be used as backfill material but Licensing Drawing 10895 shows that it is used as primary load bearing material. CLSM material can have a compressive strength as low as 50 psi, yet no compressive strength has been specified on the licensing drawings. ACI 229R-13 (ACI 229R-99, referenced by the applicant, has been superseded) indicates that this material cannot be treated as low strength concrete, since it is unreinforced, and only suitable as backfill. Given the wide range of material properties and densities of CLSM, the staff requests the following:

1. Indicate the compressive strength and density of the CLSM on Licensing Drawing 10895;

2. Justify how CLSM is suitable as a primary load bearing material as currently indicated in the drawings.

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

RAI 5-18-S-2. Provide floor slab design details and calculations for the CTF.

The geometry and footprint of the VCT have a large influence on the floor's capacity to resist loads and must be accounted for when designing the CTB floor slab, CTF pit, and its influence on the CTB. Therefore, the floor slab should be designated as ITS.

Explain whether live loads generated by the building itself and overhead crane transiting with a load nearby could influence the CTF pit design by imparting additional loads via their foundations. In addition to the CTB, seismic loads using time history analysis should also be considered for the CTB, its foundation, and the CTF pit, and input/output files provided accordingly.

The CLSM material is depicted in Licensing Drawing 10895 as a floor slab that is directly loaded around the canister transfer pit shell by the crawler, which weighs more than the indicated 180,000 lbs., given the cask weight it carries when transiting and downloading in the cask transfer pit. Given that the CLSM is unreinforced and will be used as a floor slab per licensing drawing 10895, the staff requests the following:

1. Justify how the CLSM will support shear loads;

2. Justify how the CLSM will maintain structural integrity under loads when the CTB is used by the VCT.

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

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

In its response to RAI 5-21, the applicant did not fully address the staff's request. Supplement 5 to Holtec Report No. HI-2177585 provides stress-strain curves with estimated 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 to support the seismic evaluations. The staff notes that the letter (ML21110A671) transmitting responses to NRC staff RAIs for the Model No. ATB-1T package used a methodology to construct stress-strain curves for SA-516 Gr. 70 at 400 degrees F that could be incorporated or referenced in this application.

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

RAI 5-23-S: Provide supporting buckling calculations for the transport cask horizontal lift beam, sling specifications, crane details, CTB details and floor slab safety classification.

In its RAI response, the applicant provided an incomplete buckling analysis. It indicated that it would provide slenderness ratio values to support a buckling analysis of the transport cask horizontal lift beam (BOM 1-3, Sheet 1 of Drawing 10894) in a future revision of Supplement 9 to Holtec Report No. HI-2177585. The applicant should examine all code provisions, and not just ASME NF-3322.1 (slenderness ratio criteria). Confirm that all provisions (and design criteria) stipulated in section NF of the ASME code have been met and update the SAR accordingly. In addition, all slings (lifting equipment) appear to have only been designated as commercial items on the licensing drawings. Clarify whether the slings' capacity accounted for the seismic loading. Thus, material specifications for the slings and their dimensions should be placed on the drawings and the SAR updated appropriately.

In general, with respect to seismic loads, the applicant has relied upon a lifting analysis to support the dynamic analyses for the tilt frame and saddle. Explain how this essentially static scenario appropriately accounts for the dynamic behavior of the components in a seismic event such as when a cask begins to oscillate during the event. Such a scenario will depend on the interaction of the crane that supports the cask, since it is free to move independently from the carried cask itself. Thus, provide greater detail regarding the crane design (materials, member sizes, layout, connection details, etc.).

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

RAI 5-24-S: Provide justification for the seismic loads on the tilt frame, saddle, transport cask horizontal lift beam, slings, and other lifting equipment used to lift a transportation cask.

In its response to RAI 5-24, the applicant stated that, in essence, the combination of existing analysis along with certain assumptions of the seismic loading, ensure that safety factors for the tilt frame, saddle, transport cask horizontal lift beam, slings, and other lifting equipment used to lift a transportation cask are greater than one.

The applicant's response considered that the components are rigid for the dynamic aspect of the analysis. This approach further assumes that the use of the peak seismic response based on a response spectrum is sufficient without further performing an actual dynamic time history of the components for all situations depicted in Figures 3.1.1. However, seismic loads that would occur in Figure 3.1.1, are three dimensional in nature, and should be applied at any orientation.

Accordingly, in all scenarios depicted in Figure 3.1.1, the interaction of the building and/or crane with the loaded cask should be addressed. The following scenarios should be considered:

a. Based on the "representative drawings" of the crane in Appendix A of Holtec Report No. HI-2177585R0, the cask could have a large degree of freedom when subjected to seismic loads. Accordingly, analyze whether the loaded cask's movement under seismic loads would result in collision with other components (e.g., the crane, CTB, saddle, tilt frame, etc.). Justify whether the slings arranged as depicted in Figure 3.1.1b provide sufficient torsional or lateral resistance to three (3) seismic components.". As indicated previously, the crane design needs to be considered in a time history analysis when carrying a cask.

b. In Figure 3.1.1d, the cask as depicted will impart lateral shearing forces at the trunnion bearing portion of the tilt frame. Analyze whether failure of this location during a seismic event could cause the unsupported cask to potentially rotate and strike the CTB floor. In addition, explain whether the cask may bear on only one side of the tilt frame, causing that side of the tilt frame to flex, potentially causing the cask to lose contact at the other trunnion (slip off the tilt frame). The applicant should evaluate the tilt frame, saddle, and slab connections (anchor bolts) to resist static and dynamic loads.

c. A similar scenario to that referenced in (b) above is also present in Figure 3.1.1g. Here, with lifting equipment still attached when upending a cask, any lateral movement of the crane could "pull" the lifting equipment out. Explain whether, depending on the angle of the cask while being lifted, the cask may strike the floor when the tilt frame is sheared at the trunnion bearing location. The applicant should evaluate this scenario for dynamic stability of the cask lifting.

d. Figure 3.1.1f depicts the "canister" with its bolts removed. Analyze the loss of the lid and the sliding out of the fuel/canister within the over pack while still on the tilt frame and saddle due to seismic loading. Analyze whether this scenario during operation could cause an unshielded canister to slide out relative to the shielded overpack (and any associated effects for dose or canister integrity from dropping on the building floor).

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

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

RAI 6-1-S: [Contains Proprietary Information, see Enclosure 2]

RAI 6-2-S: Provide justification for the statement in Section 9.2.1, "Storage Systems," of the HI-STORE SAR that the pressure and temperature induced stresses a loaded canister will experience at the HI-STORE CISF, due to the ambient temperature at the site, will be bounded by those for which the canisters have been analyzed by thermal models in the HI-STORM UMAX FSAR (Docket No. 72-1040).

The HI-STORE SAR describes the design basis heat load for all canisters eligible for storage at HI-STORE (see Tables 4.1.1, “Maximum Decay Heat Load for MPC-37 (PWR Fuel Assembly),” and 4.1.2, “Maximum Decay Heat Load MPC-89 (BWR Fuel Assembly),”) as lower than that of the canisters certified under Docket No. 72-1040 (see Tables 2.1.8, “HI-STORM UMAX MPC-37 Permissible Heat Loads,” and 2.1.9, “HI-STORM UMAX MPC-89 Permissible Heat Loads,” in the HI-STORM UMAX FSAR). The application states that it follows that the pressure in the canisters and hence any pressure-induced stresses will be lower in HI-STORE canisters than their certification-basis in the HI-STORM UMAX FSAR; however, this statement has not been justified. The canisters in the HI-STORM UMAX FSAR were analyzed with the assumed 26.67 °C (80 °F) ambient temperature boundary condition applied to the thermal model; however, according to the FLUENT model provided in the HI-STORE CISF SAR, the inlet boundary temperature for the normal conditions model was 16.67 °C (62 °F), which was reported as the annual average temperature. As mentioned in staff’s RAI 6-2, this temperature does not consider that during three months of the year at the proposed site, the average monthly maximum temperature ranges from 33.65 °C (92.57 °F) to 34.23 °C (93.62 °F), as reported in Table 2.3.1 of the HI-STORE SAR. The average monthly maximum temperature ranges are consistent with how NUREG-1567 defines, “Normal,” which is:

> *The maximum level of an event or condition expected to routinely occur. The ISFSI is expected [to] remain fully functional and to experience no temporary or permanent degradation from normal operations, events, and conditions. Compares to “Design Event I” of ANSI/ANS 57.9. Events and conditions that exceed the levels associated with “normal” are considered to be, and to have the response allowed for, “off-normal” or “accident-level” events and conditions.*

Therefore, for normal conditions, defined as the maximum level of an event or condition expected to routinely occur, it has not been justified that the maximum ambient condition expected to routinely occur has been used as input to the stresses that that the canister will experience at the HI-STORE CISF, especially considering the high ambient temperatures that are present for up to three months out of a year. Nor has it been justified that the temperature-induced and pressure-induced stresses that the canister will experience at the HI-STORE CISF, which should consider the maximum ambient temperature, are, therefore, bounded by those for which the canisters are analyzed by thermal models in the HI-STORM UMAX docket, where a lower ambient temperature was used. This information is needed to demonstrate that the confinement boundary can withstand the stresses and pressures experienced during normal, off-normal, and accident conditions and remain below allowable limits.

The demonstration and justification in the HI-STORE SAR that the CISF can meet the above-mentioned items can consider new analyses or relevant analyses (e.g., higher ambient temperature) in the HI-STORE SAR and the cited UMAX FSAR.

This information is needed to determine compliance with 10 CFR 72.122(h) and 72.128(a)(4).

RAI 6-5-S: Clarify that the generic Operational Limit described in HI-STORE CIS SAR Section 10.3.3.1 will state that an approved methodology will be used if there is a need to evaluate a time limit during the operation.

The response to RAI 6-5 states that the Operational Limit in HI-STORE CIS SAR Section 10.3.3.1 is a generic requirement; this recognizes that the bounding MPC-37 and MPC-89 canisters in the HI-STAR 190, which is the content and transportation package requested to be licensed in this submittal, do not have a time limit. The "generic" language in the Operational Limit should be clarified to reflect that approved methodology should be used in an evaluation (e.g., as discussed in SAR Section 6.4.2.4).

This information is needed to determine compliance with 10 CFR 72.122(h) and 72.128(a)(4).

RAI 6-7-S: Clarify whether there is a need for removal of the outlet vents during use of the HI-TRAC (per HI-STORE SAR Section 10.3.3.5) and, if so, the measures that will take place to ensure debris will not enter the annulus.

The response to RAI 6-7 states that the 15 feet, 6 inches pitch was incorporated in the Technical Specifications and that the incorrect pitch in HI-STORE SAR Table 1.1.1 was corrected. If removal of outlet vents is still needed with the revised pitch, the SAR should be updated to mention the measures necessary to ensure debris does not enter the annulus while the outlet vents are removed.

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

RAI 6-8-S: Clarify in the HI-STORE SAR and Technical Specifications that operations will be taken in an appropriate timeframe to ensure that large blockages of inlet and outlet vents will not result in temperatures above allowable values.

Depending on when the issue is corrected, Technical Specification LCO 3.1.1 and SR 3.1.2 can allow a vent to be blocked for up to 62 hours. However, there is no way to know, *a priori*, whether the vents have been blocked 51% or 85% or 100% (for example) between the surveillances that take place every 24 hours. Recognizing that the information from the UMAX FSAR Section 4.6.2.3 indicates that 100% inlet vent blockage could result in cladding temperatures of 518 °C after 32 hours, language in the HI-STORE CIS SAR and Technical Specification should clarify that surveillances that discover large blockages must quickly act within a time period shorter than the allowed 62 hours.

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

RAI 6-9-S: Clarify in the HI-STORE SAR that temperature monitors and associated temperature monitoring instrumentation used as the sole means of surveillance are designated as ITS.

As a result of RAI 6-9, HI-STORE SAR Section 3.4.1 was updated to mention that temperature monitors and associated temperature monitoring instrumentation used as the sole means of surveillance are designated as ITS. However, other relevant portions of the SAR were not similarly revised. For example, the current HI-STORE SAR Section 3.1.5.4 informs the reader that temperature monitors are not classified as ITS.

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

RAI 6-11-S: Revise the headings and descriptions within the HI-STORE SAR and the Technical Specifications that pertain to vent blockage so that they reflect the analyses that demonstrate thermal performance.

There are several instances in the HI-STORE SAR and Technical Specifications whereby the headings and discussions associated with vent blockage do not reflect the conditions of the referenced analyses.

According to HI-STORE SAR Chapter 15.2.4, the off-normal event is titled "Partial Blockage of the Air Inlet and Outlet Ducts." It states that SAR Section 6.5.1 is bounded by the evaluations reported in Section 4.6.1 of the HI-STORM UMAX FSAR (incorporated by reference). However, the HI-STORM UMAX off-normal event is titled "Partial Blockage of Air Inlet Plenum", in which it is assumed that only the UMAX air inlet vents are 50% blocked. If the application refers to the UMAX FSAR analysis that assumes 50% inlet vents blocked and 100% outlet vents unblocked, then the heading and description of HI-STORE CIS SAR Chapter 15.2.4 should indicate it is based on assuming 50% inlet vent blockage and 100% outlet vent unblocked.

In addition, the heading for the proposed HI-STORE Technical Specification LCO 3.1.1 states that the heat removal system is operable when 50% or more of the inlet vent duct areas and 50% or more of the outlet vent area are unblocked and available for flow. However, the time periods associated with the LCO are based on the analysis in UMAX FSAR Section 4.6.1, in which only the air inlet vents are blocked by 50%, which is not as severe a condition as stated in Technical Specification LCO 3.1.1. The time periods in the Technical Specification should be based on a representative thermal analysis. If the application relies on the UMAX FSAR analysis that assumes 50% inlet vents blocked and 100% outlet vents unblocked, then the heading for Technical Specification LCO 3.1.1 should indicate it is based on assuming 50% inlet vent blockage and 100% outlet vent unblocked.

The headings and descriptions in the HI-STORE SAR and the Technical Specifications should reflect what has been analyzed so that the person inspecting the vents recognizes when an operating condition is an analyzed condition or not.

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

RAI 6-12-S: Provide the maximum ambient temperature for conducting operations in the proposed HI-STORE Technical Specifications.

Currently, proposed HI-STORE Technical Specification 4.2.4 provides a minimum ambient temperature for performing short term operations; provide a corresponding maximum temperature limit for operations (e.g., transfer). Although the response to RAI 6-12 stated that including a maximum ambient temperature is unnecessary, the Technical Specifications should indicate the maximum ambient temperature for conducting operations and the basis for that value should be provided, recognizing that ambient temperatures could reach 108 °F at the site and that, depending on site operations, temperatures inside a building can be greater than ambient conditions.

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

RAI 6-18-S: [Contains Proprietary Information, see Enclosure 2]

RAI 6-19-S: Provide updated heat transfer boundary condition assumptions associated with the potential collapse of a reinforced concrete structure for a canister placed within the HI-TRAC CS and HI-STAR 190 package while inside the CTF and CTB.

Certain assumptions discussed in the response to RAI 6-19 are based on the effect of corrugated metal collapsing over the HI-TRAC CS and HI-STAR 190 package in the CTB and CTF. However, the design of the CTB has been revised to a reinforced concrete frame structure rather than a corrugated structure. A reinforced concrete frame structure, if it collapsed, would include different types of debris around the HI-TRAC CS, HI-STAR 190, and CTF, which could result in different thermal-related assumptions (including those listed in items (a) through (f) in the original RAI 6-19) than those originally considered for a corrugated structure. This issue was not addressed in the RAI response.

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

RAI 6-21-S: Provide a technical justification for the value of the reduced concrete density that is used in the shielding analysis for transfer cask concrete that exceeds the accident temperature limit.

The response to RAI 6-21 states that the concrete in the HI-TRAC CS transfer cask that exceeds the accident temperature limit is accounted for by using a reduced density in the shielding analysis to reflect potential degradation (as documented in HI-STORE SAR Table 7.3.1). Clarify how the reduced concrete density value was determined and how it conservatively accounted for all credible degradation effects, including any bulk effects (e.g., reduced water content) and those that may result in localized reduction of shielding capability (e.g., spalling, cracking).

This information is needed to determine compliance with 10 CFR 72.24(d), 72.106(b), and 72.128(a).

RAI 6-25-S: Justify the appropriateness of the "Unconditionally Safe Threshold" (UST) concept as defined in the HI-STORE SAR (e.g. Glossary, Section 1.0.1, Chapter 6).

It appears that the application is using the concept of UST for the first time. Clarify the descriptions in the Glossary, HI-STORE SAR Section 1.0.1, and Chapter 6 to provide a more detailed discussion of the UST, including how and when it is used for analyses and operations. In particular, explain how the use of the UST is compatible with the requirements of 10 CFR 72.48. Section 1.0.1 of the HI-STORE CIS SAR states that the UST defines the boundary that does not require the use of a 10 CFR 72.48 change process. However, the assessment required to be performed per the 10 CFR 72.48(c)(1) process for changes to the facility or spent fuel storage cask design as described in the FSAR or in the procedures as described in the FSAR is required for <u>all</u> applicable changes, including changes in evaluations that demonstrates the intended functions will be accomplished, and should be documented in accordance with 10 CFR 72.48(d)(1).

This information is needed to determine compliance with 10 CFR 72.48, 72.24(d), and 72.128(a).

RAI 6-26: Clarify whether the HI-STAR 190 transportation package remains leaktight in the event of a building collapse scenario that could occur before a receipt inspection leakage rate test is performed.

Explain whether the response to RAI 6-26, which describes that the sealing function of the HI-STAR 190 is not relied upon in a building collapse scenario, is consistent with the response to RAI LA-1 (ADAMS Accession No. ML19016A481), which describes that the integrity of the containment boundary of the HI-STAR 190 transportation package is maintained to be leaktight under conditions analyzed at the HI-STORE CISF without any time based restrictions.

The applicant states that the temperature of the HI-STAR 190 O-ring under that building collapse accident is 243 °C (469.4 °F). This temperature exceeds the 210 °C (410 °F) maximum temperature limit of the HI-STAR 190 O-ring that is provided in Table 4.4.4, "HI-STAR 190 Materials Temperature Limits," of the HI-STORE SAR, which could impact the ability for the HI-STAR 190 to remain leaktight. The ability of the HI-STAR 190 to remain leaktight would be important if there is a building collapse before a receipt inspection leakage rate test is performed that demonstrates that the MPC-37 or MPC-89 (i.e., the storage confinement boundary) is leaktight.

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

RAI 6-28-S: Clarify in the Caution box of Step 9 in Section 10.3.3.5 of the HI-STORE SAR that the time limit to open the shield gate is found in SAR Section 6.4.3.8 and that, if blockage of air flow cannot be removed within the SAR Section 6.4.3.8 time limit, then corrective actions must be taken within the timeframe of the relevantly defined accident condition scenario.

The text should clearly state that the relevant initial time limit (and calculation for determining the time limit) before ITS components reach <u>normal</u> allowable temperature limits is found in HI-STORE SAR Section 6.4.3.8.

In addition, clarify why SAR Section 10.3.3.5 (i.e., Caution box) does not mention that an accident condition is considered when the MPC experiences blockage of air flow within the HI-TRAC for periods greater than 6 hours. The user should be made aware that there is a limited amount of time before conditions may be reached when cladding (and other ITS components) are above their <u>accident</u> allowable temperature limits. To that end, the RAI response states that the analysis for the malfunction described in SAR Section 10.3.3.5 was bounded by the burial under debris event in the HI-STORM UMAX FSAR, which is found in Section 4.6.2.4 of the HI-STORM UMAX FSAR. The Caution box should reference that discussion, which indicates a specific time limit to reach allowable temperatures.

Finally, as stated in the RAI response, the burial under debris event appears to be relevant to the shield gate malfunction, considering that both inlet and outlet vents are unavailable to transfer heat. This is different from the Section 4.6.2.3, "100% blockage of air inlets" scenario in the HI-STORM UMAX FSAR, which allows for some heat removal via outlet ducts, currently stated in the Caution box. Therefore, the Caution box should refer to the analysis associated with the burial under debris event mentioned in the RAI response.

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

RAI 6-32-S: Demonstrate that there are no structural implications of thermal stresses at off-normal conditions (and any relevant accident condition) while the loaded MPC is placed within the HI-TRAC CS, CTF, and the UMAX module/VVM.

The effect of thermal stresses was considered in Holtec Report No. HI-2177553 "Thermal Analysis of HI-TRAC CS Transfer Cask" for normal conditions within the HI-TRAC CS, in Report No. HI-2177597, "HI-STORE CTF Thermal Evaluation" for "hot operation" conditions within the HI-STAR 190, and in Report No. HI-2177591 "Thermal Evaluations of HI-STORM UMAX at HI-STORE CIS Facility" for long term storage of the MPC within UMAX. These documents did not consider the impact of thermal stresses associated with off-normal conditions (and relevant accident conditions, e.g., extreme ambient temperatures) for the new design aspects of the HI-STORE system (e.g., HI-TRAC CS, CTF, and new design aspects of the VVM). Calculations should ensure the designs have adequately addressed (e.g., through sufficient clearance between components) the effects of potential thermal stresses from the varying temperatures and corresponding thermal expansions/contractions during normal and off-normal operations (and relevant accident conditions, e.g., extreme ambient temperatures).

Finally, although the RAI response appears to indicate that thermal stresses do not have to be analyzed due to language in ASME Code Section III, Subsection NF for Class 3 supports (mentioned in the response to RAI 6-32), the ASME Code does not assume that a system design will withstand thermal stresses, and, therefore, the effect of the thermal stresses should be addressed in the SAR.

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

RAI 6-34: Demonstrate how the increased amount of pressure due to rupture of rods would increase heat transfer through the UMAX system.

Although the footnote in HI-STORE SAR Section 6.4.3.2 indicated there would be improved thermal performance as a result of rod rupture, there were no supporting analyses which demonstrated that effect. Note that Interim Staff Guidance-7, "Potential Generic Issue Concerning Cask Heat Transfer in a Transportation Accident" has indicated the potential for higher component temperatures due to rod rupture.

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

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

RAI 7-13: Revise Section 2.1 "Approved Contents, Fuel Specifications and Loading Conditions" of the Technical Specifications (TSs) for the HI-STORE CISF to add explicit specifications for the allowable contents for the MPC-37 and MPC-89 canisters that are qualified to be transported to the facility by the HI-STAR 190 package design that is approved based on the HI-STAR 190 SAR, Revision 3 (ML18306A916).

10 CFR 72.24(a) requires, *"[a] description and safety assessment of the site on which the ISFSI or MRS is to be located, with appropriate attention to the design bases for external events. Such assessment must contain an analysis and evaluation of the major structures, systems, and components of the ISFSI or MRS that bear on the suitability of the site when the <u>ISFSI or MRS is operated at its design capacity</u>."* (Emphasis added.)

In its response to the staff's RAIs, the applicant submitted revised shielding calculations (ML21004A242). In the revised shielding calculations, the source terms are developed based on the allowable contents for the MPC-37 and MPC-89 canisters as defined in Tables 7.C.8 and 7.C.10 of the HI-STAR 190 package SAR (ML17031A369). The applicant needs to add Tables 7.C.8 and 7.C.10 of the SAR for the HI-STAR 190 package, which includes specifications for the allowable combinations of burnup, enrichment, and cooling times for the authorized contents, into the Technical Specifications for the HI-STORE CISF.

This information is necessary to determine compliance with 10 CFR 72.24(a) and 72.26.

RAI 7-14: Clarify if the HI-STORE CISF closure lid for the storage module VVM will address design changes previously implemented by Holtec to improve the shielding effectiveness of the UMAX Closure lid (ML16341B080). Specifically, clarify in the HI-STORE SAR the dose rate measurement locations and dose rate acceptance criterion for this new closure lid design. If the design has not been approved by the time of this application, the applicant needs to explicitly state that this design is part of the application for review and approval.

The HI-STORE CISF design uses a new closure lid for the storage module VVM and the applicant provided the drawings for the new lid. However, the applicant stated in the SAR that the closure lid design for the HI-STORE CISF is identical to that of the UMAX system. In its response to RAI 7-7, the applicant states that the HI-STORE CISF uses Version C of the HI-STORM UMAX closure lid design. However, Version C is not part of the certified design of Amendment 2 of CoC 1040 (ML16341B080), which is referenced in the HI-STORE SAR. Currently, Amendment 4 to the UMAX system resolved some of the issues with the previously approved amendments and Holtec has committed to taking corrective action(s) on them (ML17286A702). Therefore, the committed corrective actions, which include, but are not limited to, revised dose rates and locations, should be incorporated into the HI-STORE SAR.

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

RAI 7-15: **[Contains Proprietary Information, see Enclosure 2]**

RAI 7-16: Provide the Calculation Package titled: "Source Terms and Loading Patterns using SCALE 6.2," Holtec International, HI-2167524, Revision 5 and the base version from which Revision 5 was developed.

The applicant referenced the calculation package "Source Terms and Loading Patterns using SCALE 6.2," Holtec International, HI-2167524, Revision 5 in Holtec Report HI-2201004, "Bounding Source Terms for the HI-STORE CIS Facility" submitted on January 5, 2021 (ML21004A249). However, the referenced report was not submitted in the application materials, nor the actual calculation.

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

RAI 7-17: Provide the output files for the HI-TRAC CS and the VVM models to show how the subcritical neutrons and the secondary gammas were accounted for in the shielding calculations and demonstrate that the calculations have properly converged.

In its response to the staff's first round RAIs, the applicant submitted revised shielding calculations (ML21004A242). In the revised calculations, the applicant provided a graphic representation of the MCNP model it created for the HI-TRAC CS transfer cask and the calculated dose rates around the transfer cask and storage VVM. The applicant states that the subcritical multiplication neutrons and the secondary gammas are included in the shielding calculations. However, there is no information in the SAR that shows how the subcritical neutrons and the secondary gammas were accounted for in the shielding calculations and that the calculations have properly converged. An output file for each of the calculations that produced the results as shown in Table 7.4.1, Table 7.4.2, and Table 7.4.3 of the revised SAR will provide the information necessary for the staff to determine the reliability and accuracy of the results. Please note that only the output file is needed for each model that produces the results as presented in Table 7.4.1, Table 7.4.2, and Table 7.4.3 of the SAR.

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

RAI 7-18: Provide a detailed description of the method used to calculate the production rate of Carbon-14 in the air. Additionally, provide the properties of the air (including the density, composition, and flow rate) used in the C-14 production calculation.

Carbon-14 production resulting from neutron irradiation of the isotopes of $^{14}N(n, p)^{14}C$, $^{17}O(n, \alpha)^{14}C$, and $^{16}O(n, \alpha)^{13}C/^{13}C(n, \gamma)^{14}C$ is a two-step reaction in which an O-16 atom absorbs a neutron to produce a C-13 atom by $^{16}O(n, \alpha)^{13}C$ reaction and the C-13 atom further absorbs a neutron to produce C-14 by $^{13}C(n, \gamma)^{14}C$ reaction. As such, the air activation calculation involves three major parameters: the neutron flux, the air flow rate, and concentrations of the isotopes of ^{14}N, ^{17}O, and ^{16}O in the air. The applicant states in the calculation package titled "HI-STORM UMAX C-14 Dose Rate versus Distance" (ML21004A248):

> *"MCNP calculations are performed to determine air activation within and surrounding the UMAX system."*

However, the staff's understanding of the MCNP code is that it can only calculate the neutron reaction rates with the isotopes/elements of interest in a static system. Therefore, provide an explanation on how the air flow rate was handled in the model, to clarify how the air flow rate was factored into the C-14 production analysis.

In addition, Table 5-1 of the C-14 dose rate calculation package (ML21004A248) includes the density of the air but does not provide information for the air composition. Because the composition for the air is critical for the air activation calculation, provide the composition of the air and a justification for the applicability of the air density and air composition data for the calculation of C-14 production at the HI-STORE CISF.

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

RAI 7-19: Clarify the definition of "proximity of dose location" and justify why the selected air activation is conservative or recalculate the C-14 production as necessary.

The applicant submitted revised shielding calculations on January 4, 2021 (ML21004A242) and a supporting technical report titled: "HI-STORM UMAX C-14 Dose Rate versus Distance." In the technical report, the applicant states:

"There are two sources of C-14 radiation dose rates at any location, which are:
- Activated air generated at proximity of dose location,
- Activated air generated at further distances."

Clarify where the "proximity of dose location" is and why this selected location for calculation of the air activation is conservative.

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

Safety Analysis Report (SAR), Chapter 9, "Confinement Evaluation"

RAI 9-3-S: Clarify the content in Section 9.2.2, "Operational Activities," (Page 9-7) of the HI-STORE SAR.

In the response to RAI 9-3, Section 9.2.2 of the HI-STORE SAR was revised to state that "no credible normal, off-normal or accident conditions" could challenge the integrity of the canister confinement integrity and result in a release of any radioactivity. However, Section 9.2.2 should consistently address normal, off-normal and accident conditions while on-site prior to, or during receipt inspection. Clarify how this was addressed in the following sentence from Section 9.2.2 (the text below is underlined for added emphasis).

> *"Hence once the canisters have passed the receipt inspection, also discussed in Subsection 9.2.1, there is no credible normal, off-normal, or accident conditions that could challenge the integrity of the canister confinement system and result in a release of any radioactivity."*

If there is/are (a) normal, off-normal, or accident condition(s) that could challenge the canister confinement system while on-site prior to, or during, receipt inspection, those should be described in the SAR. Explain how the statement in Section 9.2.2 is consistent with Section 9.2.1, "Storage Systems," (Page 9-4) which states:

> *"All normal, off-normal and accident conditions relevant to confinement integrity for which the canister is certified in the HI-STORM UMAX docket are equal to or less severe at the HI-STORE facility. Therefore, there are no new conditions for the HI-STORE CIS facility that would require additional confinement analyses."*

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

RAI 9-6-S: Provide an update to Appendix A of the proposed Materials License to address RAI 9-6 (ADAMS Accession No. ML19016A481).

Although the RAI response to RAI 9-6 indicated that Appendix A of the proposed Materials License has been updated, no changes were provided (ADAMS Accession No. ML18345A138).

This information is needed to determine compliance with 10 CFR 72.24(g) and 72.44(c)(5).

Safety Analysis Report (SAR), Chapter 17, "Materials Evaluation"

RAI 17-2-S: Provide justification that the proposed flaw-analysis approach (absent material acceptance testing) can be used to demonstrate adequate fracture toughness of steels used for special lifting devices.

In the response to RAI 17-2, SAR Section 4.5.1.2 was revised to state that the fracture toughness of steels for special lifting devices will be demonstrated by (1) complying with the toughness testing requirements of ASME Code Section III, Subarticle NF-2300 or (2) performing an analysis that shows that a maximum permissible flaw (per inspection) will not propagate under the maximum load condition.

Explain how, for option 2, the maximum permissible flaw would be established without acceptance testing to confirm the fracture toughness of the material.

This information is needed to demonstrate compliance with 10 CFR 72.120(a).

RAI 17-8-S: Clarify the testing criteria used to demonstrate adequate fracture toughness of the ferritic steel subcomponents of the transfer cask, tilt frame, CTF, and VCT.

The response to RAI 17-8 provided fracture testing criteria for the ferritic steel SSCs at the HI-STORE site. The staff requires clarifying information, as follows:

- Address the initial request related to the ferritic steel portions of the VCT designed to ASME Code Section III, Subsection NF.
- In the new SAR Tables 17.4.1, 17.4.2, and 17.4.3, clarify the entries for the test temperature for the weld coupons. The test temperature entries refer to a requirement that the nil ductility transition temperature (NDT) be 0 °F. However, the referenced test method (per NF-2430) is a Charpy impact test, which does not measure NDT. As a result, clarify what is intended by defining the impact test temperature in terms of a required NDT.
- SAR Section 17.4.3 states that the transfer cask, transfer facility, and the tilt frame may only be used if the 3-day average daily temperature at the HI-STORE site is above the 0 °F impact test temperature of the ferritic steels. However, neither SAR Chapter 3, "Operations at the HI-STORE Facility," nor the Technical Specifications include any reference to this operating limit; clarify how site personnel would be aware of, and implement, this limit. Also, clarify whether the site personnel are to use the average from the 3 prior days before verifying that transfer operations can be initiated, and if so, why those prior temperatures would be a useful measure of the steel fracture performance at the time of the operations (specifically, if the temperature of the operations may be significantly below that average).

This information is required to demonstrate compliance with 10 CFR 72.24(c)(3) and (d).

RAI 17-12-S: Provide a technical justification that demonstrates that the proposed periodic inspection of one MPC is capable of assessing potential degradation of up to 500 MPCs that originate from several storage sites.

The response to RAI 17-18 justified the proposed inspection of one MPC every 5 years by stating that NRC guidance indicates that examining one canister is appropriate.

The staff notes that the guidance in NUREG-1927 and NUREG-2214, which recommend that at least one canister be examined at each site, was established to ensure that each storage site included an inspection to capture the effects of site-specific conditions and storage system design features that may affect susceptibility to stress corrosion cracking (SCC). Based on the current population of loaded MPC-37 and MPC-89 canisters, the HI-STORE site may receive MPCs from at least 9 different sites, each with unique environmental conditions and potentially unique design features (e.g., above ground vs below-ground storage). The number of potential originating sites could grow if additional sites adopt the MPC-37 or MPC-89 designs. Some conditions, such as deposits on the canisters, could carry over to the HI-STORE site.

Also, as stated in RAIs 17-12 and 17-18, the HI-STORE site has its own unique conditions that determine susceptibility to SCC, such as the proximity to chloride sources. Considering the variety of conditions at the originating storage sites, the HI-STORE site conditions associated with salt-containing playas, and the uncertainty in how these conditions may promote SCC, clarify how an inspection sample size of one MPC was determined to be sufficient to ensure that confinement is maintained for the potential 500 MPCs at the HI-STORE site.

This information is needed to demonstrate compliance with 10 CFR 72.120(a).

RAI 17-14-S: Provide a technical justification that demonstrates that the proposed periodic inspection of the internal surfaces one VVM is capable of assessing potential degradation of the steel surfaces, coatings, and divider shell insulation of up to 500 VVMs on the HI-STORE site for the 40-year license term.

The maintenance activities in SAR Table 10.3.1 and aging management activities in SAR Section 18.7 describe the 5-year inspection of the interior surfaces of one VVM to assess the condition of the carbon steel internal passages, coatings, and divider shell insulation.

SAR Section 18.3 states that corrosion of the painted carbon steel surfaces at the HI-STORE site is expected, which is consistent with the conclusion of NUREG-2214 for carbon steel exposed to outdoor environments. Considering the SAR statement, the staff concerns regarding potential airborne salts (see RAI 17-12-S), and the large number of VVMs, clarify how a sample size of one VVM was determined to be sufficient to verify the condition of the potential 500 VVMs at the HI-STORE site over the 40-year license term. Additionally, since the one inspection is expected to be performed on the same VVM each interval, explain how the examination of the single VVM will be capable of verifying the structural, shielding, and heat transfer functions of all VVMs at the site.

This information is needed to demonstrate compliance with 10 CFR 72.120(a).

RAI 17-17-S: [Contains Proprietary Information, see Enclosure 2]

RAI 17-19-S-1: **[Contains Proprietary Information, see Enclosure 2]**

RAI 17-19-S-2: **[Contains Proprietary Information, see Enclosure 2]**

RAI 17-20-S: **[Contains Proprietary Information, see Enclosure 2]**

RAI 17-21-S: Provide the technical justification for receiving MPCs that may have experienced aging degradation prior to arriving at the HI-STORE site or propose activities that are capable of evaluating the integrity of the arriving canisters.

The response to RAI 17-21 stated that there is no mechanism that could challenge the integrity of the canisters, citing the NRC's certification of the HI-STORM UMAX design for the 20-year life of that system. The response did not address MPCs in service longer than 20 years.

The staff notes that the original certification of the UMAX storage system for 20 years relied, in part, on the demonstration of the integrity of the as-built canister through ASME Code ultrasonic, surface, and volumetric examinations and pressure testing (and approved alternatives). However, for storage terms greater than 20 years, the NRC has determined that SCC has the potential to challenge canister integrity.

Explain how potentially aged MPCs will be determined to be suitable for storage of spent fuel at the HI-STORE site under normal, off-normal, and accident conditions. As stated in RAI 17-21, while the proposed canister leak testing provides information on the state of confinement at the time of receipt, this testing does not provide information on the integrity of the MPCs (e.g, partial through-wall flaws) at the time of receipt. The staff notes that the HI-STAR 190 transportation cask CoC includes inspections of some MPCs prior to transport that may inform canister integrity; however, these inspections are not performed on MPCs that do not contain high-burnup fuel.

The staff needs information on analyses or proposed inspection activities that demonstrate the integrity of the MPCs arriving at the HI-STORE site. If the integrity of the MPCs relies, in part, on inspection results or other operational practices at the originating storage site, then the HI-STORE safety analysis should specifically identify the requirements for those prior activities.

This information is needed to demonstrate compliance with 10 CFR 72.120(a).

RAI 17-26-S: **[Contains Proprietary Information, see Enclosure 2]**

RAI 17-28-S: **[Contains Proprietary Information, see Enclosure 2]**

<u>Editorial Observations:</u>

- RAI 3-1: The response to RAI 3-1 states that HI-STAR 190 references were removed from the HI-STORE SAR Section 1.2.7.c. However, a reference to HI-STAR 190 remains.

- **Appendix A of the Proposed Materials License, Technical Specification 3.2.1:**
    - In Condition A., CANISTER is spelled incorrectly
    - Removable is spelled incorrectly throughout

- CANISTER is also spelled incorrectly in Chapter 16 of the SAR in the bases section for SR 3.2.1.1.

- LA-2, within Section 5.5.1, “Radioactive Effluent Control Program,” of Appendix A of the proposed Materials License, “Section 5.5.<u>6</u>.b” should be revised to “Section 5.5.<u>5</u>.b”.

- LA-3, within Section 5.5.6.c, “Technical Specifications (TS) Bases Control Program” of Appendix A of the proposed Materials License, “5.1.1.b” should be revised to “5.5.6.b“.

- 10-2, within Section 5.5.5.b.2 of Appendix A, “Table 5.1,” should be revised to, “Table 5-1”.

- Appendix A of the proposed Materials License (ADAMS Accession No. ML20326A009) appears to inadvertently exclude information that was provided in an earlier version (ADAMS Accession No. ML18345A138).

Letter to K. Manzione, Holtec International - Second Request for Additional Information for the Holtec HI-STORE CISF DATE May 20, 2021

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