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

March 23, 2022

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 – THIRD REQUEST FOR ADDITIONAL INFORMATION

Dear Kimberly Manzione:

By letter dated March 30, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17115A431), as supplemented, 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.

As discussed in our letter dated November 19, 2021 (ML21322A219), the NRC staff has reviewed your responses to its second 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 third 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. The NRC staff expects to publish a revised schedule for the completion of its safety review, environmental review, and final licensing decision approximately 30 days after it receives your responses to these RAIs.

In order to ensure that your responses to the staff's third RAI 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.

Upon removal of Enclosure 2, this document is uncontrolled

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 03/23/22

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. Third RAI (Non-Proprietary)
2. Third RAI (Proprietary)

Third 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; January 4 (ML21004A241), June 30 (ML21224A105), August 16 (ML21228A201), August 31 (ML21243A525), and October 31, 2021 (ML21304A003), 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-1: 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"). At a minimum, the bases for the following assumptions should be provided and clarified:

1) **[Contains Proprietary Information, see Enclosure 2]**

2) **[Contains Proprietary Information, see Enclosure 2]**

3) **[Contains Proprietary Information, see Enclosure 2]**

4) **[Contains Proprietary Information, see Enclosure 2]**

5) **[Contains Proprietary Information, see Enclosure 2]**

6) **[Contains Proprietary Information, see Enclosure 2]**

7) **[Contains Proprietary Information, see Enclosure 2]**

8) **[Contains Proprietary Information, see Enclosure 2]**

9) **[Contains Proprietary Information, see Enclosure 2]**

10) **[Contains Proprietary Information, see Enclosure 2]**

11) Provide the correct URL to access the PHMSA Pipeline Incident Data.

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

RAI 2-14-S-1: Justify the following assumptions in SAR Section 2.2.4, "Ground Transportation," and HI-2210620, "HI-STORE Highway 62/180 Hazardous Chemicals Risk Evaluation," that hazardous cargos while being transported by the 62/180 Highway using tank trucks near the proposed site would not pose a credible hazard to the proposed CISF.:

1) **[Contains Proprietary Information, see Enclosure 2]**

2) Justify the wind directions selected for ALOHA analysis.

3) Provide correct URL to access the relevant data from the accident/incident database from the Federal Railroad Administration.

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

RAI 2-15-S: Justify the following assumptions in SAR Section 2.2.4, "Ground Transportation," and HI-2210619, "HI-STORE Railway Hazardous Chemicals Risk Evaluation," that hazardous cargos while being transported by rail cars near the proposed site would not pose any credible hazard to the proposed CISF:

1) Define the terms accident and incident associated with railway mishaps as used in the SAR and HI-221019.

2) **[Contains Proprietary Information, see Enclosure 2]**

3) Provide correct URL to access the relevant data from the accident/incident database from the Federal Railroad Administration.

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-3: Provide a technical basis and additional information to justify that the selected probable maximum precipitations (PMPs) are resulted from corresponding probable maximum storms (PMSs) for all PMP durations.

The applicant identified the PMPs of various duration according to two methods – the National Weather Service Hydrometeorological Report (HMR) 51/52 [National Oceanic and Atmospheric Administration, 1980 and 1982] and the CO-NM [Colorado Division of Water Resources, 2018] methods. In calculating the HMR 51/52 PMPs, the applicant placed the storm center at the centroid of the entire watershed, which is comprised of five subbasins contributing to potential

flooding events at the proposed CISF site. The U.S. Army Corps of Engineers user's manual for the HMR52 software [USACE, 1987] suggested that the center of the storm, in additional to storm size and orientation, be adjusted to assure the precipitation as calculated by the software is the PMP. Additionally, determination of the controlling PMP should be based on the probable maximum flood (PMF) water level. The applicant should clearly identify the model parameters and hydraulic modeling results in its justification for the selection of the controlling PMP. The applicant should also provide the hydrologic and hydraulic model input files, for verification of the controlling PMP by the staff.

This information is necessary to determine 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-4: Provide additional technical basis to justify that the Clark Unit Hydrograph method results in the highest probable maximum flood (PMF) water level.

The applicant examined three rainfall to surface runoff transformation methods, namely the Clark Unit Hydrograph (CUH), the Soil Conservation Service (SCS) Hydrograph, and the U. S. Bureau of Reclamation Flood Hydrology Manual Method [GEI Consultants, 2021]. The applicant reported that the CUH produced the highest peak of flow [Figure 12, GEI Consultants, 2021]. It is important to note that PMF water level is a more important indicator of flood impact to onsite structure, system, and components (SSC) important to safety than flow rate. In particular, Figure 12 suggests that the SCS method resulted in later peak arrival but higher total water volume among the three hydrographs tested. The applicant should provide additional information, e.g., comparison of PMF water levels at various SSC locations using the three unit hydrographs, including the parameters used for calculating the flow rates and water levels.

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

RAI 2-18-S-1: Provide additional technical basis to justify the use of the initial and constant loss method in determining rainfall excess.

In the hydrologic models of the CISF, the applicant selected, among others, the initial and constant loss method to determine rainfall loss and thus rainfall excess that was subsequently transformed to surface runoff. However, the applicant provided little justification as to why the method is applicable, for example, to the antecedent soil moisture content, to the depth of soil profiles that may accommodate a constant loss rate, and to restrictive layer of soil or formation beneath land surface. The applicant cited the New Mexico Office of State Engineer [NMOSE, 2008] and selected constant loss rates referenced in the publication for various soil groups. The applicant should provide additional information to justify the selection of the 'median' constant loss rates without determining the sensitivity of model results to this particular model parameter. The applicant should also justify model assumptions, its selection of model parameters, and subsequently compare model calculated rainfall excess against standard engineering practices, for example, the 2008 NMOSE hydrologic modeling guidelines.

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

RAI 2-18-S-2: Provide technical basis to justify the outflow structure parameters and outflow curve at the three large playas, Lagunas Gatuna, Plata, and Tonto, used in the hydrologic models.

The applicant used a broad-crested dam as the outflow structure for Lagunas Gatuna and Tonto, and an outflow curve for Laguna Plata in the hydrologic model. The applicant indicated that the selection of these model inputs was based on digital elevation models obtained from the United States Geological Survey. However, no information can be found in the SAR or the GEI report indicating the outflow area geometry and the relevant parameters used to obtain the outflow curve for Laguna Plata. The applicant should provide additional information to justify the use of these input values.

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

RAI 2-18-S-3: Add probable maximum seiche wave height to PMF water level.

Surge and seiche affect sites adjacent to large water bodies or the oceans. The CISF site is adjacent to the large Laguna Gatuna playa. The applicant's hydrologic and hydraulic calculations indicated that the western boundary of Laguna Gatuna reaches the CISF under the 72-hour PMP condition. The applicant should calculate the seiche wave height under this condition and add the result to the PMF water level.

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

RAI 2-18-S-4: Justify the exclusion of ice flooding given the large playa Laguna Gatuna is adjacent to the site boundary.

Winter precipitation has been recorded in the area surrounding the site. For example, the applicant reported that the maximum recorded snow accumulation for Hobbs, NM, is 12.2 inches. It is also likely that freezing of the water retained in nearby Laguna Gatuna can occur in the winter. The applicant should provide additional information to justify that ice flooding would not impact the onsite structure, system, and component important to safety.

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

References:

1. Colorado Division of Water Resources, Department of Natural Resources, 2018. "Colorado – New Mexico Regional Extreme Precipitation Study, Summary Report, Volume II. Deterministic Regional Probable Maximum Precipitation Estimation." November, 2018.

2. GEI Consultants, 2021. Report CIS-RP 003-02, "Probable Maximum Flood Analysis, HI-STORE CISF, Lea County, New Mexico." July 2021.

3. National Oceanic and Atmospheric Administration (NOAA), 1982. "Application of Probable Maximum Precipitation Estimates – United States East of the 105th Meridian, Hydrometeorological Report Number 52 (HMR-52)", National Oceanic and Atmospheric Administration, August, 1982.

4. NOAA, 1980. "Probable Maximum Precipitation Estimates – United States East of the 105th Meridian, Hydrometeorological Report Number 51 (HMR-51)", National Oceanic and Atmospheric Administration, August, 1980.

5. New Mexico Office of the State Engineer (NMOSE), 2008. “Hydrologic Analysis for Dams,” August 15, 2008.

6. United States Army Corps of Engineers, 1987. “HMR 52, Probable Maximum Storm (Eastern United States), User’s Manual,” Revised April 1987.

RAI 2-33-S: Provide the material properties of each stratigraphic layer of the subgrade used in estimating the immediate and long-term (consolidation) settlement of the storage pads and the Canister Transfer Facility (CTF) in HI-2188143, Revision 2, “HI-STORE Bearing Capacity and Settlement Calculations.” Provide details of the approach used in determining the required properties if not directly measured in the field or in the laboratory.

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

RAI 2-42-S-1: Justify the following assumptions regarding Report No. HI–2188143, Revision 1, “HI-STORE Bearing Capacity and Settlement Calculations”:

1) Justify whether a two-layer or a three-layer subsurface would be appropriate for estimating the bearing capacity and settlement (both immediate and long-term) of the storage pads and the Canister Transfer Facility (CTF). Update Table 5.3 of document HI-2188143 accordingly.

2) Provide details of the methods used to estimate the bearing capacity and the immediate and long-term settlements of the storage pads and the CTF.

3) Describe the approach selected to demonstrate that the maximum long-term settlement of the storage pads at the proposed HI-STORE facility would be bounded by the limiting maximum long-term settlement of the UMAX FSAR.

4) The HI-STORM UMAX FSAR considers a 5 × 5 array of vertical ventilated modules (VVMs) to determine the design long-term settlement (0.2 inch) of the storage pad; however, in the proposed CISF, each storage pad will have a 25 × 10 array of VVMs instead. Provide the rationale for whether the comparison should be at a 5 × 5 array of VVMs (proposed CISF represented by an equivalent 5 × 5 array) or the UMAX FSAR 5 × 5 VVMs array converted to an equivalent 25 × 10 VVMs array.

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

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

RAI 5-27: Verify and describe in Section 1.0, “Purpose”, of Holtec Report No. HI-2210576, Rev. 0, “Structural Analysis of HI-STORE Cask Transfer Building,” if the CTB roof design considered wet load of concrete for the composite roof during construction.

If the corrugated steel is used as a form work, the wet concrete will deflect during pouring of the concrete while rebars are not bonded. The staff needs this information to confirm the roof slab will not fail during construction.

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

RAI 5-28: Identify the design basis ACI codes in HI-STORE SAR Chapter 4.

SAR Section 4.6.2 does not list ACI 349-06. However, Section 2.0 of Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building," lists ACI 349-06. Also, there are two ACI 318 design code revisions (Revision -05 and -14) listed in the calculation. The staff is not clear which of these codes corresponds to the design basis codes for the facility. Identify code sections and/or provisions where applicable for the SSCs in the SAR.

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

RAI 5-29: Explain the comparison of the mesh size selection described in Section 3.4, "Static Analysis" of Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building."

[Contains Proprietary Information, see Enclosure 2]

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

RAI 5-30: Provide the expected engineered fill properties that will be used for the CTB analysis, including thickness of the fill.

Section 4.0, "Assumptions", of Item #4 in Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building," does not provide the expected engineered fill properties that will be used for the CTB analysis, including thickness of the fill. These properties are required inputs to both the dynamic and static analyses. Also, include these properties in the SAR for the staff safety finding.

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

RAI 5-31: Explain how the rail car's assumed weight in Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building," will be controlled in the final design.

Section 4.0, "Assumptions", Item #6, of the Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building," assumes a weight for the rail car. Explain how the rail car's assumed weight will be controlled in the final design. This information is needed in the SAR for the final design/as-built verification of the CTB.

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

RAI 5-32: Justify why lateral braces need not be considered in the analyses in Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building."

[Contains Proprietary Information, see Enclosure 2]

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

RAI 5-33: Provide additional justification and discussion for the CTB overhead crane runway beam.

Section 4.0, "Assumptions", Item #10 (Page 18 of 386), of Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building," assumes that the overhead crane

runway beam is not part of the CTB analysis. The staff needs to confirm the beam design is adequate to support the design bases loads and load path to the CTB. The staff cannot verify how loads are distributed from the beam into the structure under different crane operating conditions. Discuss how the assumption is supported by the analysis. Update the SAR to include the crane loads that will be transferred to the structure. Include the demand vs capacity ratios for the critical columns and the connection between the columns and the basemat.

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

RAI 5-34: Revise Chapter 5 of HI-STORE SAR to include additional information and references from Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building."

SAR Chapter 5 should be revised to include tables similar to Table 9-1 (Page 22 of 386), "Summary of Minimum Safety Factors under Static Load Combination" of Holtec Report No. HI-2210576, Rev. 0. In addition, include other critical information required for the staff's safety finding within SAR Chapter 5, including, but not limited to, critical sections of the CTB, such as the walls, base-slab, and roof. The staff's safety findings should reference the SAR as much as possible and minimize reference materials from Holtec Report No. HI-2210576, Rev. 0.

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

RAI 5-35: Justify the exclusion of selected time histories in Figures 3-1 to 3-3 of Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building."

[Contains Proprietary Information, see Enclosure 2]

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

RAI 5-36: Discuss how the guidance in NUREG-0800, Section 3.7.1 and 10 CFR Part 50, Appendix S are satisfied in Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building."

[Contains Proprietary Information, see Enclosure 2]

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

RAI 5-37: Discuss and justify the assumptions made in Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building," regarding the analysis of seismic loads and tornado missiles on the CTB ITS SSCs.

[Contains Proprietary Information, see Enclosure 2]. Also, describe and provide the bases for protection of ITS (important to safety) SSCs from tornado missiles entering from the large openings of the CTB building. Update the SAR description with the loading scenario, including the crane and tornado missiles.

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

RAI 5-38: Justify the statements in Appendix C, Section C3.2 of Holtec Report No. HI-2210576, Rev. 0, "Structural Analysis of HI-STORE Cask Transfer Building," regarding the CTB overhead crane's acceptance.

[Contains Proprietary Information, see Enclosure 2]. Since the CTB crane is an ITS SSC, provide justification for the assumption in the SAR that controls are based on the design and procurement specifications. The staff needs this information to have reasonable assurance that the safety function of the SSC will be met, given that the complete crane design has not been submitted.

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

RAI 5-39: Clarify how the HI-PORT transporter, when traveling with a loaded HI-TRAC CS, is designed to withstand the effects of tornado winds and missiles. Confirm that the HI-PORT and HI-TRAC CS are evaluated for overturning and sliding from design-basis wind, as well as tornado missile impact loads, while in this configuration and update the operations chapter and Technical Specifications, as appropriate.

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

RAI 5-40: Clarify how the VCT, when traveling with a loaded HI-TRAC CS, is designed to withstand the effects of tornado winds and missiles. Confirm that the VCT and HI-TRAC CS are evaluated for overturning and sliding from design-basis wind, as well as tornado missile impact loads, while in this configuration and update the operations chapter and Technical Specifications, as appropriate. In addition, specify the constraints of the VCT movement on the ISFSI pad and the approach apron.

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

RAI 5-41: Provide additional details of the cask transfer route or heavy-haul path.

Because the HI-PORT is classified as an ITS-C SSC, per Table 4.2.1 of the SAR, and will be performing frequent trips with a loaded HI-TRAC CS, the SAR should provide information on the design criteria of the haul path (as shown in Drawing 10940) to ensure that the design and/operating criteria of the HI-PORT will be met. Provide the design parameters of the haul path (e.g., bearing capacity requirements, surface type, grade, etc.).

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

RAI 5-42: Provide additional details for the analysis of the HI-PORT transporter under design basis normal, off-normal, and accident conditions.

SAR Table 4.2.1 describes the HI-PORT as an ITS-C SSC. SAR Section 5.5.3.2 refers to SAR Section 4.5.4 for the design criteria of the HI-PORT. However, SAR Section 4.5.4 only specifies generic requirements for “Miscellaneous Ancillaries,” and classifies the HI-PORT as such. It further states that the “[d]esign loads and associated applicable to the ancillary under normal and accident conditions (if any) shall be defined based on its function and application,” and refers to ASME Section III, Subsection NF, Class 3, for compliance with the stress analyses on the ancillaries. The staff cannot find related analyses and/or evaluations for the HI-PORT under normal, off-normal, and accident conditions. The staff recognizes that an analysis for the seismic accident condition for the HI-PORT is provided in HI-2177585, Rev. 2. Specify and evaluate the design basis conditions and loadings associated with normal, off-normal, and accident conditions for the HI-PORT, as appropriate, and provide a table with this information

(similar to Table 4.5.3). In addition, provide the purchase specification (Holtec Purchase Specification PS-5025-0001, "Purchase Specification for the HI-STORE HI-PORT", Revision 0) or other documentation that identifies the HI-PORT materials of construction that define the mechanical properties used in the structural analysis.

This information is necessary to determine compliance with 10 CFR 72.120(a) and 72.122(b)(2)i.

RAI 5-43: Clarify how off-normal loads were considered in the design of ITS components.

Some components and/or ancillary equipment do not specifically address or reference which off-normal conditions were considered, if any. Identify any off-normal loads and align with SAR Section 15.2.

This information is necessary to determine compliance with 10 CFR 72.122(b)(1).

Safety Analysis Report (SAR), Chapter 6, "Thermal Evaluation"

RAI 6-35: Confirm that the use of the HI-PORT transport vehicle is adequately bounded by the postulated HI-TRAC CS fire accident. Revise proposed Technical Specification 4.2.5 to specify a limit to the amount of combustible material in the cask transporters, and to ensure the limit is also applicable to the proposed HI-PORT transport vehicle.

SAR Section 6.5.2.1 assumes and analyzes the effects of a postulated fire that considers the Vertical Cask Transporter (VCT) related fuel, hydraulic fluid, and tires. However, the SAR does not state whether the postulated VCT related combustible material would bound a similar fire accident from the HI-PORT transport vehicle combustible material (e.g., fuel, hydraulic fluid, and tires). Since the HI-PORT transport vehicle will be used to transfer a loaded HI-TRAC CS from the CTB to the UMAX ISFSI pad at the CISF, the SAR should discuss if a postulated fire from the HI-PORT transport vehicle combustible material is bounded by the VCT related combustible material fire accident scenario. In addition, proposed Technical Specification 4.2.5 should state a limit for the amount of combustible material in both the VCT and HI-PORT transport vehicle.

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

Safety Analysis Report (SAR), Chapter 7, "Shielding Evaluation"

RAI 7-20: Pertaining to the shielding calculations for the HI-STORE CISF:

1. Verify and confirm that the output files for shielding calculations are the ones that Holtec intended to submit for review as the licensing basis or provide the correct files as necessary.

2. Explain with justifications how the uncertainties associated with the calculations for dose and dose rate with different regional sources are applied to the final total dose and dose rates.

In its response to RAI 7-17 (ML21124A308), the applicant provided a set of calculations for the dose rates in the near field (around the VVM storage module), dose rate as a function of

distance from the ISFSI pad to the controlled area boundary, and annual dose at the controlled area boundary of the CISF. During its review of these files, the staff has observed the following:

a. **[Contains Proprietary Information, see Enclosure 2].**
b. **[Contains Proprietary Information, see Enclosure 2].**
c. **[Contains Proprietary Information, see Enclosure 2].**
d. **[Contains Proprietary Information, see Enclosure 2].**
e. **[Contains Proprietary Information, see Enclosure 2].**

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

RAI 7-21: Justify how the uncertainties and relative errors associated with the different calculations for dose and dose rates were determined and applied to the final total dose and dose rates.

[Contains Proprietary Information, see Enclosure 2]

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

RAI 7-22: Explain and justify which values have been used for the fuel assembly characteristic parameters, as shown in Table A.1: “Fuel Assembly Parameters for ORIGAMI Input”, Table A.2: “Reactor Operating Parameters,” of the HI-STAR 190 Source Term Calc Package.

[Contains Proprietary Information, see Enclosure 2]

This information is needed to determine compliance with the regulatory requirements of 10 CFR 72.104, 72.106, and 20.1201.

RAI 7-23: Explain the calculation of the source terms for the spent fuel assembly (FA) with burnup exceeding 60 GWd/MTU and demonstrate that treatments, if any, are appropriate and adequate to assure reliable calculations of the source terms from the spent fuel.

[Contains Proprietary Information, see Enclosure 2]

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

RAI 7-24: Justify the C-14 release limit value used in the C-14 calculation.

[Contains Proprietary Information, see Enclosure 2]

This information is needed to determine compliance with 10 CFR 72.104, 20.1201, and 20.1301.

RAI 7-25: Justify the assumed 2000 hours per year occupancy of the real individual at the controlled area boundary.

In its response to RAI 7-17 (ML21124A308), the applicant provided its revised estimate of dose for a real individual at the controlled area boundary with 400 meters from the ISFSI pad and

1000 meters from the ISFSI pad. The applicant assumed that the occupancy of the real induvial is 2000 hours at the controlled area boundary and 8760 hours at the location that is 1000 meters from ISFSI pad. However, it is not clear what the bases are for these assumptions.

This information is needed to determine compliance with the regulatory requirements of 10 CFR 72.104 and 20.1301.

RAI 7-26: Justify the assumption that the concrete component of the HI-TRAC CS transfer cask will only lose the hydrogen under accident conditions. If additional damage mechanisms are plausible, describe how the shielding analysis accounts for the associated decrease in concrete shielding performance and revise the shielding analysis as necessary.

In its response to RAI 6-21-S and RAI 7-17 (ML21124A308), the applicant assumed that the concrete component of the HI-TRAC CS transfer cask would lose only the hydrogen in the concrete layer under accident conditions. However, it is not clear whether this assumed condition would bound all plausible loss of concrete such as localized spallation and cracking of the concrete under fire accident. Based on studies, concrete will change both its mechanical and chemical properties. Beyond the moisture plateau, when the temperature reaches about 400 °C, the calcium hydroxide in the cement will begin to dehydrate, generating more water vapor and also bringing about a significant reduction in the physical strength of the material. Other changes may occur in the aggregate at higher temperatures. For example, quartz-based aggregates increase in volume, due to a mineral transformation, at about 575 °C [Ref. 1]. One of the most complex and hence poorly understood behavioral characteristics in the reaction of concrete to high temperatures or fire is the phenomenon of 'explosive spalling' [2, 3]. This process is often assumed to occur only at high temperatures, yet it has also been observed in the early stages of a fire [4] and at temperatures as low as 200 °C [5]. Also, Holtec Position Paper DS-289 (2017) states that spalling can occur during rapid heating; however, neither the SAR nor the RAI response provided any information with respect to the heating rates throughout the concrete cross section in a fire.

The processes leading to cracking are generally believed to be similar to those which generate spalling. Thermal expansion and dehydration of the concrete due to heating may lead to the formation of fissures in the concrete rather than, or in addition to, explosive spalling. Based on these published papers and Holtec's position paper, spalling and cracking should also be considered and accounted for in assessing the behaviors of the concrete shield used in the HI-TRAC CS transfer cask.

This information is needed to determine compliance with 10 CFR 72.106, 20.1201, and 20.1301.

References:

1. S. Welch, et. al. "Behaviour of concrete structures in fire," Thermal Science, January 2007
2. Khoury G.A., Effect of fire on concrete and concrete structures, Progress in Structural Engineering and Materials, 2 (2000), 4, pp. 429-447
3. Tenchev, R. & Purnell, P., An application of a damage constitutive model to concrete at high temperature and prediction of spalling, Int. J. Solids & Structures, 42 (2005), 26, pp. 6550-6565

4. Canisius, T.D.G., Waleed, N. & Matthews. S.L., Evaluation of effects of the fire test on Cardington concrete building, Proceedings (CIB Publication No. 290, eds. Shafi, F., Bukowski, R. & Klemencic, R.), CIB-CTBUH Int. Conf. on Tall Buildings, Kuala Lumpur, Malaysia, 20-23 October 2003, pp. 353-360
5. Both, C., van de Haar, P., Tan, G. & Wolsink, G., Evaluation of passive fire protection measures for concrete tunnel linings, Proceedings, Int. Conf. on Tunnel Fires & Escape from Tunnels, Lyon, France, 5-7 May 1999, pp. 95-104

RAI 7-27: Revise the reference for the subgrade backfill material in drawings 10875 and explain why soil is used in the MCNP model for VVM shielding calculations.

[Contains Proprietary Information, see Enclosure 2]

This information is needed to determine compliance with 10 CFR 72.104, 20.1201, and 20.1301.

RAI 7-28: Clarify the definition of non-fuel hardware for BWR fuel or revise the definition of the following item in the Technical Specifications (TS) for the HI-STORE CISF.

In response to RAI 7-13, the applicant provided a revised TS 2-1, item 6, that states "[f]or fuel assemblies in the MPC-89, the decay heat limits shown in Table 2-2. Note that these maximum fuel storage location decay heat limits must account for decay heat from both the fuel assembly and any non-fuel hardware." However, the TS does not provide a specific definition for BWR non-fuel hardware. The staff's understanding is that, except for fuel channel, non-fuel hardware is not authorized to be loaded into the MPC-89 canister by design. If fuel channel is the only allowable "non-fuel hardware" to the MCNP-89 canister, revise the TS to provide explicit definition for the BWR non-fuel hardware.

This information is needed to determine compliance with 10 CFR 72.104, 72.106, 20.1201, and 20.1301.

RAI 7-29: Explain how the gamma radiation from nonfuel hardware is treated in the shielding model or confirm that non-fuel hardware is not part of the authorized contents.

In response to RAI 7-13, the applicant provided a revised TS 2.1 "Approved Contents, Fuel Specifications and Loading Conditions" that states: "[f]or fuel assemblies in the MPC-37, the decay heat limits shown in Table 2-1. Note that these maximum fuel storage location decay heat limits must account for decay heat from both the fuel assembly and any non-fuel hardware. These fuel assemblies must also meet the restrictions on burnup, enrichment, and cooling time specified in the HI-STAR 190 SAR, Table 7.C.8 (HI-2146214, Revision 3)." Table 7.C.13 of the HI-STAR 190 SAR (HI-2146214, Revision 3) includes specifications for the required cooling times of the allowable non-fuel hardware.

In addition, TS 2-1, item 6, states that "[f]or fuel assemblies in the MPC-89, the decay heat limits shown in Table 2-2. Note that these maximum fuel storage location decay heat limits must account for decay heat from both the fuel assembly and any non-fuel hardware."

This information is needed to determine compliance with 10 CFR 72.104, 72.106, 20.1201, and 20.1301.

RAI 7-30: Provide the shielding calculations for the canister containing non-fuel hardware.

[Contains Proprietary Information, see Enclosure 2]

This information is needed to determine compliance with 10 CFR 72.104, 72.106, 20.1201, and 20.1301.

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

RAI 10-19: Revise SAR Chapter 10 to provide detailed procedures for canister transfer operations with the HI-PORT transport vehicle.

Section 3.1.4 of the HI-STORE SAR (Revision 0O) describes the use of the HI-PORT transport vehicle during canister transfer operations at the CISF. Specifically, it describes the use of HI-PORT to transfer a loaded HI-TRAC CS transfer cask from the Canister Transfer Building to the UMAX ISFSI pad, where the HI-PORT meets the VCT, which lifts the HI-TRAC CS off the HI-PORT deck. However, SAR Sections 10.3.3.2 and 10.3.3.4 do not cite the HI-PORT vehicle nor do they provide detailed descriptions or procedures for operations with the HI-PORT. The applicant should revise SAR Chapter 3 and Chapter 10, as necessary, to ensure that operations with the HI-PORT transport vehicle are adequately described.

This information is needed to determine compliance with 10 CFR 72.24(h) and (n); and 72.122 (b)(1) and (f).

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

RAI 17-12-S-1: Revise Section 18.5 of the HI-STORE SAR to include inspection requirements for spent fuel canisters.

SAR Section 18.5, "Canister Aging Management Program," was not revised per the applicant's response to RAI 17-12-S. The RAI response stated that the SAR was revised to state that a minimum of one canister from each originating site will be inspected via remote visual methods (and, as necessary, follow-up surface or volumetric techniques). However, the actual revision to the SAR was to a table that describes *corrosion coupon testing protocols* – which is unrelated to the subject of the RAI. An independent reading of Table 18.5.1 would conclude that corrosion coupons need to be placed near the inlets of one canister from each originating site. SAR Section 18.5.1 still discusses the visual inspection of an MPC but was not revised to state "one canister from each originating site." SAR Section 18.5 should be revised to clearly state that the external surface of one canister from each originating site will be inspected via the remote visual method.

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

RAI 17-14-S-1: Revise the description of the HI-STORE CISF aging management program in SAR Chapter 18 to reflect the response to RAI 17-14-S.

The SAR was not updated correctly to reflect the response to RAI 17-14-S; rather than revise the SAR *aging management* description, the applicant revised the SAR *maintenance* description (these are two different sets of activities with different implementation timelines). Specifically, the applicant revised the VVM Aging Management Program (effective when the VVM exceeds

20 years of service) in the Aging Assessment Report (Holtec Report No. HI-2167378) to require that the internal surfaces to be inspected for all VVMs that house an MPC that is also undergoing remote inspection (i.e., when an MPC is being remotely inspected, also look at the VVM internal cavity surrounding that MPC). However, the applicant did not make any changes to the VVM AMP description in SAR Chapter 18 to reflect the change. The applicant did make a change to the Maintenance activity description (effective immediately) description in the SAR (SAR Table 10.3.1, item 10) to state that "[a]ll VVMs that contain the MPCs used for the MPC AMP shall be inspected." An independent reading of this table would lead to a conclusion that the 5-year VVM inspection begins as soon as the VVM is placed into service.

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

RAI 17-21-S-1: Revise SAR Chapter 10 to include information about inspections referenced in Holtec's response to RAI 17-21-S.

The SAR was not revised per the applicant's response to RAI 17-21-S related to inspections to verify the condition of the incoming canisters. The RAI response stated that SAR Chapter 18 was revised to reflect the: "Adoption of the HI-STAR 190 inspection checklist as a mandatory requirement for all MPCs, including those not containing high-burnup fuel." However, no such changes to the SAR were made with respect to the referenced "checklist", and thus the staff cannot evaluate the adequacy of the RAI response. In addition, it is not clear why SAR Chapter 18, "Aging Management Program," would be cited for revision for this item, rather than Chapter 10, "Conduct of Operations Evaluation," where other such MPC receipt criteria are documented.

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

Editorial Observations:

- Update SAR Table 4.2.1 per the response to RAI 17-1:
    - The response stated that "special lifting devices" will be removed, while HI-TRAC CS lift link will be added.
- Harmonize the name of the MPC AMP between the SAR and Holtec Report No. HI-2167378, "Aging Assessment and Management Program for HI-STORE CIS":
    - SAR Chapter 18 references "Canister AMP", while Holtec Report No. HI-2167378 references "MPC AMP".
- In the first sentence of Section 4.3.1.4 of the SAR, "The MPC provides for confinement of all radioactive materials for all design basis, off-normal and postulated accident conditions.," the word, "normal," is missing after, "design basis."
- Section 9.5.1 (page 9-10) of the SAR should be revised to read 18.13 and 18.15 (from 18.12 and 18.14).
- SAR Reference 10.3.2 for Recommended SNT-TC-1A should be updated from December 1992 to 2006.

Letter to K. Manzione, Holtec International - Third Request for Additional Information - Holtec HI-STORE CISF DATE March 23, 2022

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