

**Audit Plan**  
**NRC Staff Audit of Holtec's Responses to Second Request for Additional Information,**  
**issued in connection with NRC's Review of the HI-STORE Consolidated Interim Storage**  
**Facility (Docket No. 72-1051)**  
**December 8, 2021**

**A. Location**

The audit will be held virtually on December 8, 2021, from 9:00 am – 4:00 pm EST

**B. Background**

The NRC staff is conducting a detailed safety, security, and environmental review of Holtec International's application for a site-specific independent spent fuel storage installation license to construct and operate the HI-STORE Consolidated Interim Storage Facility (CISF). In connection with its safety review, the staff has identified several issues related to Holtec's responses to NRC staff's second request for additional information (ML21124A308). Holtec's responses were submitted on June 30 (ML21224A105), August 16 (ML21228A201), and August 31 (ML21243A525), 2021. During the audit, NRC staff will discuss these issues and examine detailed proprietary calculations and analyses referenced in the responses. The audit will inform NRC's understanding of the remaining issues and support the preparation of a third request for additional information.

**C. Audit Scope**

The staff expects to discuss the following topics during the audit:

**1. Holtec Responses to SAR Chapter 2 RAIs on Pipeline, Rail, Highway Hazards; Geotechnical Data (RAI 2-7-S, RAI 2-14-S, and RAI 2-33-S)**

- Response to RAI 2-14-S and Report No. HI-2210620, Rev. 0, "HI-STORE Highway 62/180 Hazardous Chemicals Risk Evaluation":
  - [Contains Proprietary Information – See enclosure]
- Response to RAI 2-14-S and Report No. HI-2210619, Rev. 0, "HI-STORE Railway Hazardous Chemicals Risk Evaluation":
  - [Contains Proprietary Information – See enclosure]
- Response to RAI 2-7-S and Report No. HI-2210487, Rev. 0, "HI-STORE Gas Pipelines Risk Evaluation":
  - [Contains Proprietary Information – See enclosure]
- Response to RAI 2-33-S and Report No. HI-2188143, Rev. 2, "HI-STORE Bearing Capacity and Settlement Calculations":
  - [Contains Proprietary Information – See enclosure]

**2. Holtec Responses to SAR Chapter 2 RAIs on Flooding Hazards (RAI 2-16-S-2, RAI 2-18-S, and RAI 2-19-S)**

- Response to RAI 2-16-S and Report No. CIS-RP-003-02, Rev. 2, "Probable Maximum Flood Analysis HI-STORE CISF":

- [Contains Proprietary Information – See enclosure]
- Response to RAI 2-18-S and Report No. CIS-RP-003-02, Rev. 2, "Probable Maximum Flood Analysis HI-STORE CISF":
  - [Contains Proprietary Information – See enclosure]
- Response to RAI 2-19-S:
  - The response cites the HI-STORM UMAX FSAR, which states that the UMAX System is capable of being submerged up to 125 ft of water. However, the RAI also requested that the applicant clarify the additional impact of the overburden created by backfill materials. In addition, the response does not discuss the effects on spent fuel canister integrity that may result from flood water deposits on the canister surfaces.

### **3. Holtec Responses to SAR Chapter 3 RAIs on Site Operations (RAI 3-2-S)**

- Potential inconsistency between the revised wording in SAR Section 3.1.1, Technical Specification 3.2.1, and the corresponding Technical Specification Bases (Section B3.2.1, Appendix to SAR Chapter 16)
- Discussion of facility operations for the HI-PORT transfer vehicle:
  - Revision 00 of the HI-STORE SAR proposes the use of the HI-PORT transfer vehicle for canister transfer operations between the proposed Canister Transfer Building (CTB) and the UMAX ISFSI pad at the CISF. However, neither SAR Chapter 3 or SAR Chapter 10, provide a description of facility operations or detailed operation procedures for the HI-PORT transfer vehicle.

### **4. Holtec Responses to SAR Chapter 7 RAIs on Shielding Evaluation (RAI 7-13, RAI 7-14, RAI 7-17, RAI 7-18)**

- Responses to RAI 7-17:
  - Verify and confirm that the output files for shielding calculations are correct for the specific source term and licensing basis or provide the correct files as necessary.
  - Justify 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.
  - [Contains Proprietary Information – See enclosure]
- Responses to RAI 7-17:
  - 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]
- Responses to RAI 7-17:
  - Clarify the values 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," for the HI-STAR 190 HI-STAR 190 Source Term Calculation Package

- [Contains Proprietary Information – See enclosure]
- Responses to RAI 7-17:
  - Justify the calculation for 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]
- Responses to RAI 7-18:
  - Justify the C-14 release limit value used in the C-14 calculation.
  - [Contains Proprietary Information – See enclosure]
- Responses to RAI 7-17:
  - Justify the 2000 hours per year occupancy estimate of the real individual at the controlled area boundary.
  - [Contains Proprietary Information – See enclosure]
- Responses to RAI 7-17:
  - 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.
  - [Contains Proprietary Information – See enclosure]
- Responses to RAI 7-17:
  - Revise the reference for the subgrade backfill material in Drawing No. 10875 and justify why soil is used in the MCNP model for VVM shielding calculations.
  - [Contains Proprietary Information – See enclosure]
- Responses to RAI 7-18:
  - Justify or revise the C-14 concentration acceptance value.
  - [Contains Proprietary Information – See enclosure]
- Responses to RAI 7-13:
  - 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 ISFSI.
  - Technical Specification (TS) 2-1, item 6, states that “For 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 specific definition for BWR non-fuel hardware. If the fuel channel is the only allowable “non-fuel hardware” to the MPC-89 canister, revise the TS to provide explicit definition for the BWR non-fuel hardware.

- Responses to RAI 7-13:
  - Explain how the gammas from non-fuel hardware are treated in the shielding model or confirm that non-fuel hardware is not part of the authorized contents.
  - TS 2.1, “Approved Contents, Fuel Specifications and Loading Conditions” states, “For 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.
  
- Responses to RAI 7-14:
  - Clarify whether the shielding calculations adequately consider non-fuel hardware in the canister.
  - [Contains Proprietary Information – See enclosure]

## **5. Holtec Responses to RAI 17-2-S, 17-12-S, 17-14-S, and 17-21-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 states that SAR Chapter 18 was revised to reflect the “[a]doption of the HI-STAR 190 inspection checklist as a mandatory requirement for all MPCs, including those not containing high-burnup fuel.” However, no changes to the SAR were made with respect to the referenced “checklist”, nor is it clear what exactly is meant by “checklist.”
  - 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)
  
- Response to RAI 17-12-S:
  - SAR Section 18.5, “Canister Aging Management Program,” was not revised per the response to RAI 17-12-S. The RAI response states 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).
  - The actual revision to the SAR was to SAR Table 18.5.1, which describes corrosion coupon testing protocols – which is unrelated to the subject of the RAI. An independent reading of SAR Table 18.5.1 would conclude that corrosion coupons need to be placed near the inlets of one canister from each originating site.

Table 18.5.1: Initial Coupon Testing Protocol

Test Item	Count	Remarks
Test Coupons/canister	Four Coupons	One in each quadrant located near the inlets
Canister Sample Size	A minimum of one canister from each originating site	Selected based on the criteria presented in the MPC AMP in [1.2.1]
Coupon Testing Frequency	Once Every Five Years	Frequency aligns with visual inspections (See Table 18.6.1).
Note 1: Coupon testing must not be solely relied as a basis for acceptable performance. Note 2: Coupon evaluation must be coordinated with eddy current and visual inspection results to provide a comprehensive and informed basis for future inspections.		

- SAR Section 18.5.1 still discusses the visual inspection of an MPC; this was not revised to state “one canister from each originating site”:

**18.5.1 Visual Examination**

The canister AMP involves monitoring the exterior surface of a MPC, including visual

- SAR Section 18.5 should be revised per the RAI response to clearly state that the external surface of one canister from each originating site will be inspected via the remote visual method.
- Response to RAI 17-2-S:
  - The response to 17-2-S introduced a new option to qualify the fracture performance of steels for special lifting devices, using a methodology that does not appear to be adequate.
  - The response added a new option in SAR Section 4.5.1.2 to verify the fracture performance of steels for special lifting devices (as an alternative to the “standard” option of simply conforming to the ASME B&PV Code fracture criteria).
  - The new option to establish of minimum fracture properties is based on a fracture toughness vs. NDTT curve in NUREG-1815, which is specifically for steels with yield strengths less than 100 ksi. However, it proposes to use this methodology for steels of significantly higher strength (not evaluated in NUREG-1815). For example, the steel for the HI-TRAC lift link is STREX 900E, which has a minimum yield strength of 120 ksi (but likely in practice would be between 130-140 ksi).
  - The response should justify why the new fracture acceptance option (that uses the fracture toughness vs. NDTT curve in NUREG-1815) is relevant to very high strength steels (greater than 100 ksi yield strength).
- 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).

- Per the response, the applicant revised the VVM Aging Management Program (effective when the VVM exceeds 20 years of service) in the Aging Assessment Report (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):

*“All VVMs that contain the MPCs used for the MPC AMP shall be inspected”*

This revision suggests that the 5-year VVM inspection begins as soon as the VVM is placed into service.

- Editorial Observations:
  - SAR Table 4.2.1 was not revised 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 HI-2167378 references “MPC AMP.”

**D. Audit Team**

1. Jose Cuadrado, Project Manager
2. Yaira Diaz-Sanabria, Chief – Storage and Transportation Licensing Branch
3. Amitava Ghosh, Geotechnical Engineer
4. John Wise, Senior Materials Engineer
5. Zhian Li, Senior Nuclear Engineer
6. Jin-Ping Gwo, Systems Performance Analyst
7. Jeremy Tapp, Storage and Transportation Inspector
8. Eli Goldfeiz, Health Physicist

**E. Special Requests**

Appropriate handling and protection of proprietary information shall be acknowledged and observed throughout the audit.

**F. Deliverables**

NRC staff will issue an audit summary after completing the audit. The audit summary will discuss the outcomes of the audit and outline future actions for the completion of NRC staff’s review of the license application.