CHAPTER 2 STRUCTURAL AND MATERIALS REVIEW:

2-1 Provide the updated LS-DYNA model files for the 2.1% drop analyses.

The applicant's response to the RAI 2-3, dated November 7, 2022, assumed that it was simply addressing the alphabetical listing of the *d3plot* file names on the SharePoint site. Rather, the large set of downloadable files appears to contain result files from different analyses. For example, postprocessing of the results for the 2.1% oblique analysis from the SharePoint directory *SD-B-one-fuel* indicated *d3plot* files were inadvertently intermingled from multiple models. The time step jumps from 0.08s at State 161 to 0.0405s at State 162. Additionally, the file *1.d3plot74* was missing from the *SD-B-one- fuel* directory, although the applicant's response to RAI 2-5 indicated that both of the 2.1% drop analyses have been updated.

The applicant should provide complete LS-DYNA file sets for the updated 2.1% drop analyses for review and verify that the files are uploaded correctly to the SharePoint site.

This information is needed to determine compliance with 10 CFR 71.71 (c) and 71.73(c).

Holtec Response:

We apologize for the oversight in the previous RAI 2-3 response. It has come to our attention that the response, which was submitted for review to the USNRC on 12/22/2022, did not include the updated LS-DYNA analysis input/output files on SharePoint. We want to assure you that this issue has been rectified, and we appreciate your understanding and patience in this matter. All the revised LS-DYNA analyses, as outlined in the Revision Log of the calculation package HI-216723R6, have now been uploaded to SharePoint. These updated files are readily available for review and reference.

2-2 Explain the changes made to the load cases evaluated in Holtec Report HI-2167023-R6 and ensure the SAR is updated consistently.

The NCT load case N2 (1-ft side drop) has been re-analyzed with updated results presented in the revised Holtec Report HI-2167023-R6. The reasoning for the revised analysis is not discussed but may include the same changes made to the 2.1% loading cases in response to RAI 2-5, dated November 7, 2022. Additionally, the selected results of the SAR have not been updated to be consistent with the report. For example:

The stress intensity results in table 8.3 of HI-2167023-R6 have been updated with the results of this revised analysis; however, the results of table 2.6.6 of the SAR have not been updated to reflect the new calculated stress intensity values and safety factors.

Figure 8.10.2 has been updated in HI-2167023-R6; however, figure 2.6.5 of the SAR has not been updated to reflect this change.

The previous version of appendix H from Holtec Report HI-2167023-R5

documented two analyses for 50% loading cases that were stated to be “consistent with the F-32 basket partial loading pattern considered in the shielding analysis”. The updated appendix H from Holtec Report HI-2167023-R6 no longer includes these 50% loading cases.

The applicant should: (i) provide an explanation of the changes made to NCT load case N2 and update the SAR results to be consistent with HI-2167023-R6, and (ii) explain why the 50% loading cases are no longer included in the latest revision of appendix H from Holtec Report HI-2167023-R6 and verify that these cases are not required to support the shielding evaluations or assumptions.

This information is needed to determine compliance with 10 CFR 71.71(c) and 71.73(c).

Holtec Response:
The changes made to NCT load case N2 (1-ft side drop) in the main body of Holtec Report HI-2167023-R6 (which is also identified as Case 10 in Table 7.1 of HI-2167023-R6) are, in fact, a direct consequence of the response to RAI 2-5.
[

PROPRIETARY INFORMATION WITHHELD PER 10CFR2.390

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2-3 Provide the materials of construction and qualification data (e.g., manufacturer data sheets or other testing) for the quiver seal/gasket materials that support the SAR maximum temperature limits and the capability to maintain the quiver's leaktightness criteria per the operational requirements in SAR table 7.1.8

In its RAI 2-7, dated November 7, 2022, staff asked for the design documentation of the quiver to support the safety review of its mechanical performance and sealing capability. Staff specifically requested the (i) structural materials of construction, including governing codes and standards; weld design, fabrication, and examination codes and standards; mechanical properties used in the structural analysis, and (ii) seal/gasket materials of construction in sufficient detail to support the SAR maximum temperature limits and the capability to maintain the quiver's leaktightness criteria. The applicant did not provide the requested documentation.

This information is needed to demonstrate compliance with 10 CFR 71.33, 71.43, 71.71 and 71.73.

Holtec Response:
The requested information related to the design and qualification of the Quiver can be found in the latest revision (Rev. 3) to Westinghouse report NRT 18-403, which is referenced in the HI-STAR 80 SAR and also provided as Enclosure 6 to this RAI submittal.

CHAPTER 5 SHIELDING REVIEW

5-1 Justify that the HI-STAR 80, when loaded with quivers that contain fuel debris, will meet regulatory dose rate limits when considering the reconfiguration of the source term.

The staff has found that the response to RAI 5-1, dated November 7, 2022, is not adequate. In the response to RAI 5-1, Holtec has stated that *"Quivers are bundles of a limited number of sealed steel tubes where each tube contains just a single rod (or the remnants thereof). See Figure 1.2.2 for a side view. Hence there is no large open volume at the bottom (or top) of the quiver where broken parts of individual rods could accumulate*."

Although figure 1.2.2 appears to show separate tubes, this is not a licensing drawing. Further, it is stated that it is a "typical quiver." Therefore, the structural integrity of the quivers cannot be credited within the shielding evaluation. Even if the structural integrity of the quiver is demonstrated, because the quiver is allowed to contain broken fuel rods and fuel debris, the shielding evaluation still needs to demonstrate that the HI-STAR 80, considering the burnup profile associated with the quivers, is within regulatory limits under NCT and HAC.

The burnup profile of intact spent fuel assemblies is peaked near the center and when considering fuel debris within the quivers, there would not be any burnup profile associated with this material; therefore, broken rods and fuel debris should not be modeled with a decreased source term near the top and bottom extremities.

This information is needed to determine compliance with 10 CFR 71.47 and 71.51(a)(2).

Holtec Response:

With respect to the structural integrity of the quivers, please see the response to RAI 2-3 above.

To confirm that the HI-STAR 80, when loaded with quivers that contain fuel debris, will meet regulatory dose rate limits, additional dose analyses for selected cases for both the PWR and BWR basket were performed, including cases with reconfigured content and bounding source terms uniform along the reconfigured length. The analyses show that even for the reconfigured content and the bounding source terms, and considering other conservative assumptions such as neglecting any material of the quiver that would provide additional shielding, the dose rates are bounded by the configuration with full assemblies in all basket locations. For further details see the updated SAR Section 5.4.12.