## Holtec Additional Information to be Considered for Audit

The draft NRC question received says the following:

> "*Based on its review of the permanent deflection criterion and its technical basis in Rev. 2 and Rev. 3 of DS-331, the staff concludes that the maximum permanent deflection, as presented, would not satisfy the requirements of 10 CFR 72.236(c), which requires CoC holders to design storage casks to maintain spent fuel in a subcritical condition.*"

Holtec is concerned that this represents a change in position from prior NRC approvals. Prior NRC approvals starting with Amendment 0 of the HI-STORM FW Storage system indicated that the criterion of maximum permanent deflection was sufficient to maintain fuel in a subcritical condition.

The 72-1032 Amd. 0 SER (ML111950325), Section 7.3.1 says:

> "*The applicant provided a discussion of the potential changes to the basket due to accident conditions. The accident conditions mainly result in deflections of the basket walls. The staff finds that the applicant has addressed these changes, and that the model used to evaluate the criticality safety of the package is representative for normal, off-normal and accident conditions.*
>
> *The applicant provided tabular information in Tables 6.3.3 and 6.3.7 of the HI-STORM FW SAR showing the dimensions of the package used in the criticality analyses. The staff verified that these are consistent with the drawings and that they are conservative with respect to the tolerances and accident conditions discussed.*"

In Finding F7.2, the same SER says the following:

> *The cask and its spent fuel transfer systems are designed to be subcritical under all credible conditions.*

Those statements in the SER are based on the discussion and analysis presented in the HI-STORM FW FSAR (submitted in ML11250A140), as the licensing basis of record. Section 6.1 of the FW FSAR Rev. 0 Section 6.1 states:

> *The off-normal and accident conditions defined in Chapter 2 and considered in Chapter 12 have no adverse effect on the design parameters important to criticality safety, except for the non-mechanistic tip-over event, which could result in limited plastic deformation of the basket. However, a bounding basket deformation is already included in the criticality models for normal conditions, and thus, from the criticality safety standpoint, the off-normal and accident conditions are identical to those for normal conditions.*

Additionally, FW FSAR Rev. 0 Section 6.3.1 states:

> *The structural acceptance criteria for the basket during accident conditions is that the permanent deflection of the basket panels is limited to a fraction of 0.005 (0.5%) of the panel width (see Chapter 3). The analyses in Chapter 3 demonstrate that permanent deformations of the basket walls during accident conditions are far below this limit. In fact, the analyses show that the vast majority of the basket panels remain elastic during and after an accident, and therefore show no permanent deflection whatsoever, and that any deformation is limited to small, localized areas.*

Based on the language in both the SER and FSAR, it is apparent to Holtec that the basket deflection limit was always understood to be permanent deflection. The only safety function of the basket is to maintain the contents of the canister in a subcritical condition, and the criticality analysis clearly identifies permanent deflection as the criterion utilized.

Although the safety function of the basket is specifically to maintain a subcritical condition the criterion is echoed throughout the remainder of the FSAR. Specifically, Chapter 2 "Principal Design Criteria," Section 2.2.3.b lists an acceptance criterion that:

> *The maximum plastic deformation sustained by the fuel basket panels is limited to the value given in Table 2.2.11.*"

Section 2.2.4 also notes that the basket is not specifically subject to ASME limits, but instead references the deflection limit.

The structural portion of the FW SER from its initial approval in Amendment 0 was also clear that the criteria was understood to be permanent deflection, as Section 3.1.2 states:

> *The basket is designed according to displacement criteria in lieu of stress criteria.*

And Section 3.3.3.1 discusses the results of the non-mechanistic tipover evaluation and notes:

> *the fuel basket panels in the active fuel region did not experience any permanent deformation to change the spacing between stored fuel assemblies.*":

From all of these previous licensing basis documents, Holec believes that there is clear documentation that the understanding of the criterion was always permanent deformation and Holtec has applied it consistently as such. In one RAI response on this application, Holtec has acknowledged that some FSAR language could have been made clearer and has attempted to make those clarifications.

Based on the current draft NRC question, the staff appears to view this as a change to the criterion entirely:

> *Prior to Holtec's RAI responses and supplements, Holtec (1) had not previously described the permanent deflection design criterion in the FSAR (2) did not have a technical justification for a permanent deflection design criterion, and (3) the staff had not approved the permanent deflection design criterion. For these reasons, the staff views the maximum permanent deflection limit as an updated proposed change to the fuel basket design criteria in Amendment No. 7, and the staff initiated a review of the proposed change.*"

These statements seem to be in conflict with the long previous certification history of the baskets within the HI-STORM FW system. The previous approvals indicate that the permanent deflection criterion was understood, approved, and that the staff had an appropriate technical basis for those approvals.

In an attempt to address some of the staff's current questions, Holtec has made changes to the position paper (DS-331, ML23227A251) referenced in the FSAR. That position paper is a helpful reference document, and those changes were at the request of the reviewer, but that position paper does not represent a licensing basis document. Position papers are intended to

provide supporting technical information but would not override any NRC SER or Holtec FSAR licensing basis document.

While Holtec believes that the historical use of the permanent deflection is clear, it is understood that the review of the current Amd 7 has raised some additional technical questions. Therefore, Holtec performed additional evaluations on the tipover analysis to specifically quantify the amount of deflection. In previous approvals it had been sufficient to demonstrate that the strains throughout the basket were extremely low. These additional results fully prove that the basket is well within the permanent deformation acceptance criterion, and therefore well within the criticality analysis. Those results were provided in response to RAI 3-9, submitted June 30, 2023 (ML23181A192). The results were added to the FSAR in Section 3.4.4.1.4, Figures in Section 3.4, and into the calculation package submitted along with those RAI responses (HI-2200503, ML23181A200). Note that the permanent deflection results are presented specifically for certain basket designs, which are the bounding canisters and may not be shown for canisters that are not considered bounding.

Based on the above discussion, Holtec believes that the correct deflection criterion was applied in Amd 7, consistent with prior approvals, and hopes that the additional technical information provides clear justification that the criticality analysis bounds the results from a tipover event.