Holtec Response to Request for Additional Information (Batch 2)

Docket No. 72-1014
Holtec International
HI-STORM 100
Multipurpose Canister Storage System
Certificate of Compliance No. 1014
Amendment No. 16

RAI 5-1

Clarify which cross-section libraries were used in the Scale 6.2.1 and MCNP5-1.51 calculations for the unventilated with high density concrete (UVH) overpack.

The applicant states in report HI-2201113 that the source term was evaluated using Scale 6.2.1 with 252-energy group libraries; however, the applicant did not show which libraries were used in this evaluation. The applicant also needs to show which libraries were used in the MCNP calculation.

This information is required to demonstrate compliance with 10 CFR 72.236(d).

Holtec RAI Response:

The predefined TRITON libraries provided with SCALE 6.2.1, namely "bw15x15" for B&W 15x15 fuel and "ge7x7-0" for GE 7x7 fuel, both calculated using the ENDF/B-VII.1 252-group cross-section library, have been used for generation of the design basis source terms. These are the same source terms that have been already employed for the shielding analysis of the HI-STORM 100S Version E System in Supplement II of the FSAR.

The MCNP5-1.51 calculations have been performed using the default cross-section libraries provided with the code, as discussed in Subsection A2.3 of HI-2201113. Primarily, ENDF/B-VII.0 and ENDF/B-VI.8 are used for neutrons and photons, respectively. ENDF/B-VI neutron cross-sections are also used for some natural elements.

The code description in FSAR Supplement 5.IV has been updated with this information.

RAI 5-2

Verify whether the combinations of burnup, initial enrichment, and cooling time (BECT) proposed in chapter 2 of the safety analysis report (SAR) and appendices B and B-100U represent the bounding source terms for all associated fuel loading patterns in the HI-STORM 100 system to be authorized under Amendment No. 16.

The applicant requested that fuel qualification tables be replaced with simpler sets of burnup and cooling time and the minimum cooling time reduced to 1 year. The applicant revised the SAR to include combinations of BECT in tables 2.1.28 and 2.1.29. The applicant stated that these BECT combinations used in calculations results in a much simpler combination of burnup as function of cooling time. The applicant did not show that these BECT combinations result in source terms that are reasonably bounding for all realistically expected assemblies. It is stated in the SAR that maximum decay heat is used to bound the design basis source terms to demonstrate compliance with 10 CFR 72.236(d). There is no information provided on the relationship between the decay heat and the radiological source terms since the equation previously used to determine the maximum burnup as a function of cooling time and cooling time dependent coefficients is deleted from the SAR. There are BECT combinations for which an assembly could produce the same decay heat but potentially have higher than design basis radiation source terms (neutron, gamma, or both). The applicant did not show that these combinations sufficiently bound all possible fuel loadings.

It is important to note that the recommendations in NUREG/CR-6716, "Recommendations on Fuel Parameters for Standard Technical Specifications for Spent Fuel Storage Casks," (ML010820352) are based on a balanced evaluation of parameters important to safety while alleviating limitations in the technical specifications to provide the CoC holders flexibility to make design changes under the provisions in 10 CFR 72.48.

This information is required to demonstrate compliance with 10 CFR 72.236(d).

Holtec RAI Response:

Aboveground Overpack

The combinations of burnup and cooling time proposed in Chapter 2 of the FSAR, and listed in CoC Appendices B and B-100U present the bounding source terms for the following reasons:

- The burnup and cooling times are specified as limits, hence only assemblies that meet these burnups and cooling times are permitted to be loaded
- All burnup and cooling time combinations are evaluated in the dose analyses, together with a conservatively low enrichment, and the dose rates calculated for the worst combination of those are presented (see FSAR Tables 5.4.21 and 5.4.22).
- All dose rates that are calculated use source terms based on these BECTs and the previously defined design basis parameters.

This approach is consistent with the findings presented in the report referenced at the end of RAI 5-4 since the approach uses BECT limits for dose calculations separate and independent from the decay heat limits, recognizing the fact that specifying decay heat limits alone is not sufficient to establish bounding dose rates, and that the relationship between decay heat and BECTs is too complicated to establish an easy calculated relationship between them.

Furthermore, the following goals are met by replacing the equations previously used to determine the maximum burnup as a function of cooling time and cooling time dependent coefficients with a table of fixed burnup and cooling time combination:

1) *The qualification approach is simplified.*
   - Although the change results in slightly more conservative calculated dose rates in many cases, that is considered acceptable since it removes the burden of the complicated qualification process from the users of the system.
   - To assure that despite these increased calculated dose rates the expected dose rates and occupational dose will remain within the previously approved range, a CoC dose rate limit for the side of the cask is introduced for all HI-TRAC versions.

2) *The close connection between BECT limits and decay heat limits is removed.*
   In the revised approach, BECT limits and decay heat limits need to be applied independently, and only fuel assemblies that meet both limits are acceptable for loading.
   - Expressed differently, meeting decay heat limit does not imply the BECT limits are met, and vice versa. There could be assemblies that meet the decay heat limits but not the BECT limits, or that meet the BECT limits and not the decay heat limits. Such assemblies are then not qualified for loading.
   - The BECT limits are still *informed* to some degree by the decay heat limits, but this is just to avoid excessively conservative BECT limits that would result in excessive dose rates.

The conservatively low enrichments used in the dose analyses as a function of burnup are listed in FSAR Table 5.4.20. They had been established in the previous HI-STORM 100 CoC Amendment 15. Based on the use of these enrichments, no minimum enrichment limit is required for any of the burnup and cooling time limits.

Underground Overpack

The discussions provided above for the aboveground overpack also principally apply to the underground version (HI-STORM 100U). However, the 100U was previously only qualified for fuel with a minimum cooling time of 3 years. Hence, when replacing the extensive tables with a simplified list of burnups and cooling times, only the combinations with a cooling time of 3 years or more are now considered. This is consistent with the dose calculations that had previously been performed for the 100U (see FSAR Supplement 5.I).Therefore, no changes or additions to the dose analyses are required.

RAI 5-3

Justify that the site-specific evaluation does not need evaluation for accident conditions.

In HI-2201113 Revision 0, HI-STORM 100 Version UVH Shielding Analysis, the applicant states that:

> "The calculations for HI-TRAC Version MS are performed using the minimum lead and water jacket thicknesses, reference dimensions or with the content or shielding thickness adjustment, that ensures that the dose rate at the cask surface is less than or equal to the dose rate limit introduced in the FSAR.
>
> The analyses summarized in this report demonstrate that the HI-STORM 100 System, including the HI-STORM 100 Version UVH storage cask and the HITRAC Version MS transfer cask, is capable of meeting the 10 CFR 72.104 limits and support ALARA practices. Under bounding conditions, the requirements from 10 CFR 72.106 will always be met at 100 m from the ISFSI. Additional site-specific evaluations for accident conditions are therefore not required. The shielding evaluation provides reasonable assurance that the HI-STORM 100 System will allow safe storage of spent fuel"

From this statement, the reason for not evaluating site-specific accident conditions is not clear in the shielding evaluation of the UVH. The evaluation in FSAR is done for minimum lead and water thickness and not for complete loss of water jacket. The applicant needs to show how this evaluation bound the accident condition.

This information is required to demonstrate compliance with 10 CFR 72.104 and 72.106.

Holtec RAI Response:

The calculations for the accident conditions use the lower bound shielding thicknesses of the HI-TRAC cask and complete loss of water in the water jacket (see Paragraph C3.1.2 of HI-2201113 and Subsection 5.IV.1.2 of the FSAR), and were performed for the MPC-32M canister with the limiting content. This way, the dose rates, as presented in Table 5.IV.1.4 of the FSAR, are the bounding dose rates under accident conditions. Calculations with reference dimensions, or with content or shielding thickness adjustments, were only performed for normal conditions.

Corresponding statements in the Executive Summary and Conclusion Section of report HI-2201113 have been clarified.

RAI 5-4

[PROPRIETARY INFORMATION WITHHELD IN ACCORDANCE WITH 10CFR2.390]

Holtec RAI Response:

[PROPRIETARY INFORMATION WITHHELD IN ACCORDANCE WITH 10CFR2.390]