ALLEGATION CONCERNS AND PROPOSED FINDINGS FOR HOLTITE-A & NS-4-FR

Concern-01: There is a threat to public health and safety due to the current uncertainties in using of Holtite-A as a neutron shield in the HI-STAR and HI-STORM casks.

Proposed Finding: This concern is not substantiated. The neutron shield is only required to meet radiological requirements for normal conditions of use. Possible failures of the neutron shield that were considered by staff were improper manufacturing of material and unexpected long-term degradation of the material. These failures could result in chemical or physical (including voids) properties that do not satisfy design basis shielding parameters, and subsequently result in unsafe radiological conditions. The staff has reasonable assurance that any safety-significant failure and an unsafe radiological condition would be detected during routine operation and regulatory limits would not be exceeded. [illegible]

For both the transportation and storage casks designs, the SAR requires verification of chemical composition and physical state of the neutron shield material during fabrication. For the transportation aspects of the design, the adequacy of the fabricated shield is verified by (1) scanning of the neutron shield (6x6 inch test grid) prior to first use [Condition 6.b.5], (2) routine radiological monitoring during use [Part 20], and (3) performing radiological measurements at representative points of the cask prior to each shipment [10 CFR 71.47]. For the storage aspects of the design, the adequacy of the fabricated shield is verified by (1) measurement of representative points to satisfy dose rate technical specifications prior to placement on pad [TS 2.2.1], (2) routine radiological monitoring during use [Part 20], (3) passive TLD monitoring of storage pad during operation [Part 20 & 72], and (4) a program required in the SAR to re-verify adequacy of shield by measuring surface dose rates every 5 years [Section 9.? of the SAR].

Open Items

(1) Do cask users employ adequate radiological monitoring programs as represented above? For example, would routine measurements detect significant voids during use and does every storage site have passive TLD monitoring around pad to detect gross degradation in shield?

(2) Is it okay to state although we have reasonable assurance the shield will perform within its design basis, a significant failure would be detected by measurements anyway? Will individual casks need periodic monitoring beyond that of what is considered routine (e.g. periodic surface measurements)?

(3) Should hydrogen accumulation within the shield shell be examined as a potential safety problem?

Proposed Resolution of Items:

Item-1 Contact NRC regional personnel and licensees to get better understanding of passive monitoring.

Item-2 Staff recommends position valid, but is generic issue for Management consideration.

Item-3 The staff recommends getting a structural reviewer involved with this question

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Concern-02: Holtite-A does not meet the performance specifications for shielding as described in the SAR.

Proposed Finding: This concern is not substantiated. The performance specifications for the shielding material in the Holtec casks are (1) minimum density of 1.68 g/cc, (2) minimum hydrogen concentration of 6%, (3) minimum B_4C concentration of 1%, (4) no significant voids, (5) a homogenous B_4C distribution, and (6) maximum weight loss of 4% at design basis thermal & radiation exposure. Performance specifications 1 through 5 are verified by batch chemical analyses and other observations during cask fabrication. The staff did not find any problems with these verification methods and assumes they will be appropriately verified prior to use.

The maximum weight loss of the material was verified by accelerated temperature testing of Holtite-A in 1999, prior to use in a cask. Holtec has data that shows a weight loss greater than 3.0% for 90 days at 325 degrees in their Holtite-A material. Holtec has used this data and data generated by the Japanese on NS-4-FR to predict the weight loss does not exceed 4% weight loss for 20 years. The staff found with reasonable assurance that this information adequately demonstrates Holtite-A meets the 4% performance specification. However, this data for Holtite-A thermal stability is not currently in the SAR.

Open Items:

(1) Is the Holtec thermal testing program sufficient? Holtec's testing program identified NAC NS-4-FR samples that had unacceptable weight loss. Inspection at NAC did not identify any material problems with NS-4-FR or a reason for the failure. If Holtec's testing program used for the NAC's NS-4-FR samples were flawed, then their other data for Holtite-A may not be valid.

(2) Does thermal weight loss data as presented by Holtec, if performed correctly, provide reasonable assurance that material will not exhibit weight loss exceeding 4%? If not, what testing is needed to provide reasonable assurance to NRC (e.g. longer times, cumulative radiation, etc..)? Can Holtec use any reliance on Japanese data for Bisco NS-4-FR?

(3) Does physical test data need to be presented in the SAR, as part of the cask design basis?

(4) Does chemical formulation of Holtite-A or other pertinent information need to be presented in the SAR as part of the cask design basis?

(5) How much deviation in the formulation and/or mixing is allowed before supporting thermal stability data becomes invalid? In other words, is Holtec's QC program technically sufficient to determine affects of modifying formulation and mixing, with respect to test data? The staff has found that deviations in the formulation and mixing of material may affect physical properties to varying degrees.

Proposed Resolution of Items:

Item-1 The staff will examine Holtec weight loss testing program further by inspection or request for information. Staff recommends inspection?

Item-2 The staff review of this issue is on-going?

Item-3 Staff does not believe this information is necessary for future applications, but is appropriate at this point in Holtec SARs. This is an inspect able item.

Item-4 Recommendations??

Item-5 The staff review of this issue is on-going?

Concern-03: Holtec misrepresented Holtite-A as being the same material as NS-4-FR in the HI-STAR 100 SARs submitted to NRC.

Proposed Finding: This concern is partially substantiated. Holtec has stated Holtite-A is a trademark name for its neutron shield material. The HI-STAR 100 SAR also states Holtite-A is a commercial version of Bisco NS-4-FR. The staff has determined that differences in epoxy formulations and proprietary mixing procedures ~~for Bisco NS-4-FR and Holtite-A fabricated by Holtec~~ could potentially cause chemical or physical differences between the materials. However, test data for both materials indicate they exhibit similar properties with respect to shielding performance and long-term stability. The staff did not find evidence that indicated Holtec intentionally misled NRC about Holtec's belief that Holtite-A made by them was the same as Bisco NS-4-FR. From a shielding performance standpoint, the staff believes that Bisco NS-4-FR and Holtite-A fabricated by Holtec will behave relatively the same.

However, the staff has found that this concern is partially substantiated because certain physical data regarding Holtite-A in the HI-STAR 100 SAR was misrepresented. The SAR presented thermal stability data and chemical analyses for Holtite-A to demonstrate its suitability for the cask. This data was derived from tests performed by Holtec on NS-4-FR samples purchased from NAC. As of August 1998, Holtec believed they had tested Bisco NS-4-FR and the SAR data remained valid. However, the same test samples later failed. Holtec stated they no longer believed the samples they tested were actually Bisco NS-4-FR at that point. Holtec failed to revise the SAR in subsequent submittals to NRC in order to clarify the data. The staff believes this data is invalid for representing any characteristics of Bisco NS-4-FR or Holtite-A.

Because of potential material variations from differences in proprietary formulation and mixing procedures, the staff believes Holtite-A should be treated as a material separate from Bisco NS-4-FR. The description of Holtite-A should be clarified with respect to its relationship to Bisco NS-4-FR, as appropriate. The staff has asked Holtec to revise the SAR analyses of Holtite-A as appropriate.

Open Items:

(1) See All Open Items for Concern-02.

(2) Does the finding regarding treatment of Holtite-A and NS-4-FR as separate materials invalidate the NRC basis for approval? The NRC SER treats Holtite-A as the same as NS-4-FR. However, it mostly refers to the suitability of its shielding properties rather than the suitability of NS-4-FR itself.

(3) How should Holtec implement change to SAR regarding description of Holtite-A, by license amendment or as allowed by 72.48? Technically the data in the SAR regarding recent physical testing is incorrect.

(4) At this point, can Holtec justify that Holtite-A properties will be the same/similar to Bisco NS-4-FR because the basic formulation and mixing of the two are similar? Also, see Item 2 of Concern-02.

Resolution of Open Items

Item-1 See All Resolutions of Open Items for Concern-02

Item-2 Finding does not invalidate NRC basis for approval. A review regarding the suitability of Holtite-A during license review was minor. This was due to the safety significance of the neutron shield with respect to the entire cask. The staff was focused primarily on shielding specifications for the neutron shield and required Holtec to commit to these specifications in the design drawings. The staff also considered periodic dose measurements as a defense in depth against any thermal degradation questions at the time of the review. However, the latter is not documented in the SER.

Item-3 The staff believes Holtec may implement the change by amendment or would also be able to meet 72.48 criteria. However, see Item-2.

Item-4 Recommendations??

Concern-04: The use of NS-4-FR test data to justify the properties of Holtite-A is invalid if the composition or fabrication process of Holtite-A is different than that for NS-4-FR.

Finding: This concern is partially substantiated. The fact that the general formulation of epoxy resin and hardener is the same as NS-4-FR provides evidence that Holtite-A can be reasonably expected to have similar properties to Bisco NS-4-FR. However, it is the staff position that thermal testing of actual Holtite-A samples is required to verify thermal stability over time. Holtec has performed these tests, but is presented in the SAR.

Open Items:

(1) See Open Item 4 for Concern-03.

(2) Does this concern have to be addressed at all in allegation space?

Resolution of Open Items:

Item-1 See Resolution of Open Item 4 for Concern-03

Item-2 Suggestions anyone?

Concern-05: Holtec has relied on material properties of NS-4-FR as a technical basis for Holtite-A. However, Holtec earlier deemed NS-4-FR samples that were provided by NAC to be inadequate for the HI-STAR 100.

Proposed Finding: This concern is partially substantiated. Internal memos at Holtec indicates in an initial memo to disqualify NS-4-FR as a suitable material because of voids founds in NS-4-FR samples provided by NAC. Holtec has stated however, NAC convinced them that problem was with pouring and NS-4-FR material properties would not be affected. These facts have not been disputed by NAC.

Holtec identified thermal stability problems with the NS-4-FR samples during subsequent testing. Holtec indicated they did not disqualify NS-4-FR as a suitable neutron shield material, rather they disqualified the material provided by NAC as being suitable NS-4-FR. Holtec indicated they then pursued to manufacture NS-4-FR / Holtite-A themselves.

The allegation is substantiated regarding physical test data as discussed in the proposed finding of Concern-03 regarding thermal stability problems.

Open Items:

(1) Does this make sense in the time-line of events?

Resolution of Open Items:

Item-1 Staff needs to review time-line of events once again based on information provided by Holtec and NAC.

Concern-06: Holtec inappropriately relied on personal recollection from Mr. Larry Dietrick to develop Holtite-A. Holtec has stated Mr. Dietrick qualified Holtite-A. However, Mr. Dietrick expected Holtec to implement testing to substantiate its performance.

Proposed Finding: The concern is not substantiated. Holtec has demonstrated that the qualifications of Mr. Dietrick is acceptable for assuring the basic epoxy formulation of Holtite-A is the same as the basic Bisco NS-4-FR formulation. Holtec also relied on information provided by Bisco material suppliers and independent testing to confirm the Holtite-A formulation is the same as the NS-4-FR formulation.

The staff does agree that differences in proprietary mixing procedures may be different among NS-4-FR and Holtite-A

Open Items:

None.

Concern-07: Holtec has not completed long-term testing of Holtite-A to verify its long-term thermal and radiation stability.

Proposed Finding: This concern is not substantiated. Holtec has completed accelerated thermal testing of Holtite-A to demonstrate its ability to meet maximum weight loss specifications. Holtec is continuing testing to further investigate long-term stability properties at their own initiative.

Open Items:

(1) See Open Item 2 for Concern-02.

Concern-08: Holtec's attempt to benchmark Holtite-A against NS-4-FR produced inconclusive results regarding B_4C distribution.

Proposed Finding: This concern is substantiated, but not relevant. Discussion with laboratory testing facilities indicate Holtec had precison problems with B4C distribution. However, the staff believes this occurred during research and development to develop Holtite-A formulation and mixing procedures. There is no evidence that Holtite-A as currently installed in casks have these problems during batch testing.

Open-Items:

(1) Need to verify this information with Holtec.

Resolution of Open Items:

Item-1 Request verification via phone, or request for information to Holtec.

Concern-09: Auditors from three utilities found no data to support testing of Holtite-A.

Proposed Finding: This concern is not substantiated. An audit report issued by the utilities found data to support testing of Holitite-A

Open Items:

None

Concern-10: Holtec is using inadequate testing procedures to verify long-term stability of material.

Proposed Finding: This concern has not been evaluated. Awaiting for additional information from NAC.

Open Items:

Concern-11: Problems with voiding and thermal stability that were identified by Holtec International with samples of NS-4-FR, indicate NAC may be manufacturing NS-4-FR incorrectly.

Proposed Finding: This concern is dependent on the findings for Holtec in Concerns 1-10. It appears problems with voids identified by Holtec relate to the unqualified pouring used by NAC. The root cause for failed test samples in the thermal have not yet been determined by NAC, Holtec, or the staff.

Open Items:

(1) Does the reason for failure of the NAC NS-4-FR test samples need to be explained to close allegation?

Resolution of Open Items:

Item-1 The staff recommends identifying cause. The staff will examine Holtec weight loss testing program further by inspection or request for information. Staff recommends inspection?

OLD COMMENTS