From ATL ?

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October ___, 2000

Brian Gutherman, Licensing Manager
Holtec International, Inc.
Holtec Center
555 Lincoln Drive West
Marlton, NJ 08053

Subject: Request for Additional Information Needed to Assess the Performance of Holtite-A.

Dear Sir,

By application dated (insert date), Holtec International Inc. (Holtec) requested approval of the (insert licensee application title). This request for additional information (RAI) identifies additional information needed by the U.S. Nuclear Regulatory Commission (NRC) staff in connection with the approval of Holtite-A as a shielding material in transportation casks. The requested information is to be used to supplement prior information provided by Holtec to the NRC.

Each individual RAI describes information needed by the staff and the contractors to complete the review of Holtite-A as required by (insert appropriate requirement). This request is being issued per 10 CFR 71.39. For most individual RAIs, the request concerns a set of specific documents submitted by Holtec.

There were situations where supporting calculations, data, and information are needed to support information and claims previously provided by Holtec.

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REQUEST FOR ADDITIONAL INFORMATION

NRC Review of Viability of Holtite-A as a Neutron Attenuator in Transportation Shipping Casks

1. Provide the exact chemical composition of the epoxy resins used in Holtite-A, including the phenol-based epoxide resin and additives (i.e., hindering additives, stabilizers). Use the chemical information that the supplier provided Holtec. Please do not respond by referring to NAC-NS4FR.

   The chemical composition of the monomer (or the ligomer) used is crucial to the physical properties of the final product (final polymer product in the cast). These physical properties define how the resin cures.

2. Specify the following:

   a. The total dose and dose rate at ambient and operational temperatures to which Holtite A is designed.
   b. Whether the specific gravity (1.68 g/cm^3) is for the partially cured or final polymer. If the specific gravity is for partially cured, what is the specific gravity of the final polymer?
   c. The protocol for measuring viscosity.

   Total dose and dose rate are important because of their degradation effects on the polymer. Ionizing radiation, especially gamma, can increase brittleness, create voids, and generate gasses such as hydrogen. NRC must be able to evaluate the effects of irradiation against 10 CFR 71.43(d). The specific gravity of the final polymer that is cured is important so that degradation effects on density of the material can be measured and evaluated. Viscosity before the pour is an important physical criteria for measuring the degree of polymerization of epoxide monomers (or oligomers). Potential biases in the protocol for measuring viscosity need to be identified to ensure a high quality in the final material.

3. Identify the basis for the following ratio:
   Resin: 37 wt% nom.
   ATH: 61.92% nom.
   Boron Carbide: 1.08 wt% nom.

   The basis for the above ratio, obtained from Holtec's documentation on Holtite-A's development history and thermal performance data (Table 2.1), is needed to identify how it was determined and why so that NRC can better understand the primary objectives of the particular mixture. For example, was the elimination of voids the primary reason for this ratio?

4. Provide data showing that 24 hours is enough time for complete curing.

   Procedure HPP-70718-10, rev. 2 states that 24 hours is necessary to allow the material to cure prior to moving the overpack. The basis for this curing time is needed to determine how Holtec arrived at this curing time. Curing time has a significant effect on the creation of voids.

5. Identify the stage (i.e., mixing or final pouring) in which a vacuum is applied and the basis for its use.

   Procedure HPP-70718-10, rev. 2 briefly describes when a vacuum is applied during the mixing and pouring activities. Holtec should explain the scientific basis for the application of a vacuum and its impact on the creation of voids and whether tests were conducted without the use of a vacuum.

6. Identify the name, chemical structure, and removal technique for the solvent used in the curing process.

   Because a solvent is used to clean the mixing and pouring equipment (per Procedure HPP-70718-10, rev. 2), residual solvent may be present when the next batch is manufactured. Residual solvent may impact the performance of the polymer if inadvertently mixed into it, possibly introducing voids or gases.

7. Identify the criteria and sampling protocol the Chief Scientist uses to determine which sample to be tested and to determine that a sample has reached a stable weight or a sufficient duration has elapsed.

   Procedure HPP-5014-3 states some criteria for selecting samples to test and determining when a stable weight or sufficient duration is reached. All criteria used should be provided to determine if any biases exist that may influence the quality of the polymer being manufactured. Other criteria may be related to location of sample to be taken, shape, a change in weight, etc.

8. In the thermal tests for NAC-NS4FR and Holtite-A, explain the following:

   a. The absence of error bars in all tests.
   b. The use of an ordinary saw cutter as opposed to a diamond saw. Also identify the size and shape of the samples created.
   c. Why 4 samples from two batches of Holtite-A were compared to 15 samples of NAC-NS4FR, as opposed to using 15 samples of Holtite-A from one batch for the correlation.

   Error bars help show the number of data points used in determining the curves. Use of

diamond saws have become standard equipment in cutting polymers because of the minimization in the creation of voids during cutting. Use of an ordinary saw cutter may introduce more voids, biasing the evaluation. In conducting comparisons of materials, sampling procedures normally are kept as similar as possible to limit variables that may be introduced into the comparisons.

9. Provide additional data that shows the thermal performance and crack testing of Holtite-A beyond 250 days.

The performance curves for NAC-NS4FR provided by Holtec shows that a second spike in weight loss may be evident after approximately 300 days. Confirmatory information is needed to determine if there is a spike in weight loss in Holtite-A between 300 and 750 days. Since performance data showing the crack test results for NAC-NS4FR are over 750 days, then Holtite-A samples should be tested over a similar time period to conduct a valid comparison.

10. Indicate the final density values of the test samples after thermal treatment.

Final density values will be compared with the initial density prior to thermal treatment to determine the validity of Holtec thermal test results. The density of the final product directly impacts the shielding performance of the material.

11. Provide any data related to tests where the temperature was reduced over time.

During actual use of the polymer, temperature is expected to decline. A reduction in temperature may have a different impact on mechanical properties and void creation in the polymer than when the temperature remains constantly elevated, as performed in the tests. The requested data should more closely simulate actual operating conditions.

12. Provide pictures of the Holtite-A samples after thermal treatment and explain whether the test results were independently determined or verified.

Pictures will visually demonstrate the effects of the performance tests, assisting the NRC in determining the impact of the manufacturing procedures on void creation. Independent validation of test results is an important tool to remove evaluation biases.

13. Indicate the chemical composition of the gaseous materials that were released in the Holtite-A samples during thermal testing.

This information will provide an indication of the rate of degradation of the resin polymer and whether the gases may chemically degrade the polymer, impacting shielding properties.

14. Provide data from any shielding experiments that may have been conducted on the thermally treated samples. Include information related to total absorbed dose and dose-rate effects on the shielding properties.

This information will show the effect of the elevated temperatures on the shielding properties of Holtite-A, providing an indication of the performance of the material in actual operating conditions

15. Provide your quality assurance protocol for ensuring the vendors supply you with the same materials.

The quality of the raw materials being used is an important parameter in the manufacturing process and in minimizing voids and is therefore necessary to evaluate the quality assurance program per 10 CFR 71.37.