72-1008
72-1014
71-9261

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May 8, 1998

Dr. Carl Paperiello
Director, NMSS
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Subject: Generic Issue in Fuel Basket Design
Holtec Project 5014

Reference: USNRC Docket Nos. 71-9261, 72-1008, and 72-1014

Dear Dr. Paperiello:

Holtec International ("Holtec") has identified a potential generic issue involving the anomalous behavior of certain dry cask storage system fuel basket designs during the vacuum drying operation, which takes place following the loading of spent fuel into the fuel basket.

The fuel basket design in question is the classical construction wherein the neutron absorber (Boral™ or equivalent) is affixed to the surface of the storage cell using a stainless steel sheathing which is seal-welded to the cell wall (creating a "poison pocket"). The all-around seal weld has been utilized in the classical basket designs to prevent the pool water from coming in contact with the aluminum in the neutron absorber and causing hydrogen generation. We are aware that previously certified casks, as well as several undergoing certification at this time, utilize this construction.

As the technical reasoning and description presented in the following would suggest, this attempt to isolate the neutron absorber may not arrest hydrogen generation, and may indeed alter the criticality safety characteristics of the fuel basket during the vacuum drying process.

Mechanism

During the vacuum drying operation, the neutron absorber pockets become pressure containment chambers with the ambient air inside the poison pocket (trapped after the circumferential weld seal closure is completed) exerting an internal pressure equal to the differential pressure between the inside (approximately 14.7 psi) and outside (approaching vacuum). The pressure of 14.7 psi is enough to plastically deform a sheathing, which, in some cases, is only 0.0178-inch thick. In fact, even thicker sheathings (such as 0.075" wall used in our design) will deform plastically. Further, the internal pressure in the pocket will rise as the vacuum condition in the basket impedes heat dissipation, raising

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the basket's (and the poison pocket's) temperature. The pressure in the poison pocket will rise linearly with absolute temperature of air in the pocket. The deformation (bulging) of the sheathing or failure of the seal weld will alleviate pressure build-up in the pocket. Depending on the sheathing thickness and the quality of the pocket closure seal welds, bulging, weld failure (or both) may occur, impairing the fuel basket's integrity.

Potential Consequences

The bulging of the sheathing will introduce a physical indeterminacy to the location of the neutron poison, thus modifying the reactivity of the basket. Failure of the seal weld would permit water to enter the pocket (in the event of a future submergence), causing hydrogen generation.

Solution

Holtec's proposed solution to this design problem is to use passivated or anodized Boral, which eliminates the hydrogen water reaction. Holtec also proposes to equip the poison pocket with appropriately sized vent and drain openings at the four corners of the Boral panels. Both of the above design measures have been used by Holtec International in the company's wet storage projects with complete success.

The above solution is being implemented in our HI-STAR/HI-STORM fuel baskets designs, after the project team has arrived at the conclusion that *none* of the safety analyses documented in the TSAR and SAR submittals to the Commission is affected. Only one design drawing and the Boral Material Procurement Specification need to be amended. The drawing will be submitted on the appropriate dockets during the next revision.

Over the past two years, we have probed every aspect of the technologies which undergird our HI-STAR/HI-STORM Systems. The uncovering of the "poison pocket" malfunction problem described above is the latest contribution of our Spent Fuel Division to the cask industry. Two years ago, the same Holtec team helped the NRC discover the erroneous shielding analysis methodology which had been embedded in the cask design industry for years. Quietly, we have also been active in assisting other cask suppliers discern fundamental errors in their designs outside the regulatory arena. In a recent communication, we have cautioned the supplier of a vertical ventilated cask system to avoid repeating the fundamental error in the "thermal chimney" analysis of the past. In a similar spirit of technical openness, we have published a technical paper which explains the insufficiency of the thin "box type" fuel basket design with respect to the ASME Code stress limits (for storage or transport). Finally, we have asked our peer cask supplier firms to benefit from the knowledge we gain through our (and the industry's) maiden program to build a full-scale HI-STAR MPC-68 prototype.

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Our unrelenting efforts to eliminate all weaknesses from our HI-STAR/HI-STORM Systems should give the necessary confidence to the staff as the SFPO moves towards certifying our systems.

We would be pleased to answer any staff's questions on this matter, should further clarification be needed.

Sincerely,

K.P. Singh
President and Chief Executive Officer

P.S. This letter will be posted on our Web Site (http://www.holtecinternational.com) to facilitate its dissemination to the industry.

cc: Mr. Charles Haughney, NRC
Dr. Susan Shenkman, NRC
Mr. Fritz Sturz, NRC
Mr. Eric Leeds, NRC
Mr. Mark Delligatti, NRC

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