May 31, 2001

TO ADDRESSEE ONLY

Mr. Wayne Hodges
Deputy Director
Spent Fuel Project Office
United States Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Subject: Allegation NMSS-2000-A-0013, Public Disclosure

Reference:
1. NRC Letter, Brach to Davis, May 12, 2000, re: Allegation NMSS-2000-A-0013
2. NAC Letter ED20000709, Davis to Hodges, June 2, 2000, re: Allegation NMSS-2000-A-0013
3. NRC Letter, Brach to Davis, May 1, 2001, re: Public Disclosure Determination Regarding Allegation NMSS-2000-A-0013

Dear Mr. Hodges:

In accordance with conference call discussions with the NRC Spent Fuel Project Office staff and in response to Reference 3, NAC International herewith submits Response #1 to the Request for Additional Information as non-proprietary information and a non-proprietary version of Response #3 to the Request for Additional Information.

I believe that the enclosed is fully responsive to your request for non-proprietary versions of Responses #1 and #3.

Please contact me if you have any questions or require any additional information.

Sincerely,

Charles W. Pennington
Senior Vice President
Engineering Services & Product Development

Enclosure

ED20010790

Q-5

1. **NRC RAI 1:**

Describe the actions taken by NAC in response to the quality assurance concerns identified in the letter from Holtec to NAC dated April 20, 1998.

NAC Response

1. By way of background, and to fully clarify some antecedents of the particular event in question, the statement in the Holtec letter related to "installing" NS-4-FR, referenced in the first paragraph of your letter to NAC of 5/12/2000, is not accurate. In fact, NAC has found much in that Holtec letter that is either false or misleading and which appears designed to lead a not-fully-informed reader to a less than accurate conclusion.

From the outset, Holtec never asked for and NAC never offered to supply the very small samples for Holtec's testing with a fully qualified installation of the material in the particular geometries agreed upon. In fact, the small samples and geometries were selected by Holtec during a telephone conference discussing the test objectives prior to the placement of the order to allow for easy sectioning for boron stratification testing and for thermal testing in autoclaves or ovens at the lowest cost possible. Considering the specific testing and cost objectives, it was discussed and agreed to during this telephone conference that specific installation procedures would not be required for these samples. NAC provided the manufacturing (material procurement and mixing) of the NS-4-FR in accordance with our proprietary and trade secret specifications and our Quality Assurance program. The enclosed purchase order documentation from Holtec also shows that manufacturing of NS-4-FR was their originally stipulated procurement requirement.

Installation of the NS-4-FR for these small samples in accordance with pre-approved procedures, use of our proven, high capacity installation systems, and with mock-up testing before the actual installation (our approach for use of NS-4-FR in first-of-a-kind safety related applications) was never requested or offered.

With regard to the subject event, as soon as NAC received the Holtec letter of April 20, 1998, we conducted an internal review verifying that our performance was consistent with the requirements of Holtec's PO and with our own Quality Assurance program. NAC responded to the referenced Holtec letter with our letter dated April 23, 1998, stating that the material had been provided in accordance with the Holtec Purchase Order and NAC Quality Assurance program. This material had been formulated and certified by testing to meet the specifications for NS-4-FR. Installation of the mixed material into the Holtec specified molds was not controlled to eliminate voids. Holtec's stated purpose for obtaining these test samples was to provide material for thermal aging tests and the evaluation of boron stratification during the curing cycle.

NAC again informed Holtec that the delivery system and methodology used for the installation of the mixed NS-4-FR was an important part of the installation process to assure a void free installation, and that, without the system and methodology validated for unique casting of materials and geometry, the observation of voids in their sectioned pieces was not surprising.

Holtec responded to our letter of April 23 in a letter dated May 12, 1998, which addressed specific questions related to installation and chemistry of the formulation.

NAC responded to this second letter on June 2, 1998, again highlighting the importance in following qualified installation procedures when the objective of the casting process includes control of voids. We again informed them that their samples used a simple free pour rather than a controlled delivery approach. NAC also responded to specific questions related to the historic record of the chemical formulation of the NS-4-FR product stating that raw material specification and suppliers of these raw materials had not changed from the time of the original formulation.

Copies of all four of the above referenced letters are attached for information.

As an epilogue to this event, NAC developed a heightened concern about Holtite-A when we read in the Scientech letter from Holtec's expert and source of design input for Holtite-A that the very type of voids that are predictable without proper installation and that had been observed by Holtec would not occur in NS-4-FR. This apparent failure to understand NS-4-FR and to know that a significant effort directed at procedures and methods is necessary for assuring that such voids do not occur indicates to NAC a potentially significant problem with Holtite-A resulting from improper design input. As we have stated often to all customers and to Holtec, the proprietary and trade secret elements of NS-4-FR comprise 3 separate functions:

1. raw material specification/procurement
2. material manufacture (formulation, mixing and timing) and
3. material installation

We met our obligations in each of these areas for the subject event, but we retain grave concerns about the corresponding functions with respect to Holtite-A. In the common vernacular, NAC believes this entire event was a staged "set up" to provide an excuse for the taking of technology. In good faith, we could not have avoided the situation, but, unfortunately, the attempted taking has resulted in a substitute product that is not NS-4-FR and possibly presents a number of safety issues.

3. **NRC RAI 3:**

Discuss and provide test data and other information that demonstrate the long-term thermal stability and long-term radiation stability of NS-4-FR during its expected life-time in a transportation or storage cask.

NAC Response

3. The original material formulation owner/developer, Dow and Bisco Products, has published material specification technical data information stating that NS-4-FR retains long term functional stability at temperatures from -40°F to 300°F. In addition to this specific data, Bisco Products had performed thermal tests showing stability of the material through temperatures as high as 338°F. Beyond this data developed by Bisco Products, over the past ten years several organizations associated with the current owner of the NS-4 technology have performed independent investigations of off gassing and material loss when NS-4-FR is confined in different configurations and exposed to temperatures both less than and greater than 300°F. The following reports are enclosed herewith.

    1. Experimental Studies on Long-term Thermal Degradation of Enclosed Neutron Shielding Resin, R. Asano and N. Niomura.

    2. Evaluation Test on the Thermal Stability of Resin as Neutron Shielding Material for Spent Fuel Transport Cask, Y. Momma, M. Matsumoto, M. Takani, et. al.

In summary, these reports document material stability under a number of different conditions and temperatures ranging from 125°C (257°F) through 200°C (392°F). Test conditions included specimens open to the atmosphere and enclosed in a contained cavity at both constant and cyclic thermal loads. Both tests demonstrate that NS-4-FR is a stable material without any observed failures in the form of cracks at prolonged exposure to temperatures above the published specification limit of 300°F.

Dow/Bisco's early work and these reports demonstrate the long term thermal stability of NS-4-FR.

Evaluation of the NS-4-FR formulation's exposure to radiation has been investigated and documented in studies of both neutron and gamma exposure.

Radiation effect reviews on materials in nuclear power plants have shown that [redacted], such as NS-4-FR, do not undergo loss of mechanical properties at exposures of $2x10^8$ rads or greater. Of particular importance to the shielding system as employed in storage, transfer, and transport casks is the ability of the [redacted] material to retain its hydrogen content under long term radiation exposure. [PROPRIETARY INFORMATION]

These exposures are significantly higher than those seen in any neutron shield component of the NAC-MPC or NAC-UMS systems. The transfer cask neutron shielding of the UMS systems would require over 500 years of continuous design basis neutron source exposure and/or 50 years of continuous design basis gamma exposure to reach the test irradiation levels. The neutron shielding in the transport system would require even

longer exposure time due to its lower design basis fuel source term. Similarly, the neutron shielding employed in the storage cask shield plug is placed above the canister lid and, as such, is exposed to significantly lower neutron and gamma fluxes than those seen by the transfer cask shield.

[PROPRIETARY INFORMATION]