November 21, 2005

Mr. Richard W. Boyle
Radioactive Materials Branch
U.S. Department of Transportation
400 Seventh Street, S.W.
Washington, DC 20590

SUBJECT: REPORT ON SPENT FUEL SHIPMENTS MADE WITH RESIDUAL WATER IN THE NAC-LWT CASK

Dear Mr. Boyle:

This letter is to inform you about our evaluation of two instances where international shipments of irradiated nuclear fuel were made with water in the cask, contrary to the conditions in the Certificate of Compliance. The report of these two shipments was made to us under the provisions of 10 CFR 71.95. The attachment to this letter provides information about the shipments and our evaluation.

In summary, two international shipments were made in Model No. NAC-LWT spent fuel casks (Certificate of Compliance No. 9225, issued to NAC International, Inc.). Although the certificate specifies that there must be no free water in the casks when presented for transport, upon receipt, significant quantities of water were found in all three casks shipped. Two casks containing irradiated fuel were shipped from two research reactor sites in Indonesia in March 2004. The casks were shipped to the Idaho National Engineering Laboratory, and water was discovered in both casks upon unloading in June 2004. The second shipment involved a single cask containing commercial light water reactor irradiated fuel rods within an inner sealed canister. The cask was shipped from the La Salle nuclear plant in Ohio to the Studsvik hot cell facility in Sweden. A minor amount of water was observed in October 2003, when the cask was unloaded, and larger amounts were discovered in April 2004, when the empty cask was prepared for decontamination in Sweden.

On July 10-14, 2005, staff from the Spent Fuel Project Office conducted a quality assurance inspection at the NAC offices in Norcross, Georgia. NAC had previously performed a root cause investigation of the two shipments. NAC had determined that the inner, sealed canister used for the shipment of fuel rods from La Salle had not been adequately tested prior to the use of that design. For the Indonesian shipments, the cause was indeterminate, but a number of possible contributing factors were identified. Corrective actions to address both shipments were initiated by NAC prior to the inspection. The inspection included a review of the corrective actions.

We concluded that the safety significance of these two events was low and that the corrective actions proposed by the certificate holder were adequate. If you have any questions regarding this matter, please contact me at 301-415-8513.

Sincerely,

/RA/

Nancy L. Osgood, Senior Project Manager
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket Nos. 71-9225 and 71-0018

We concluded that the safety significance of these two events was low and that the corrective actions proposed by the certificate holder were adequate. If you have any questions regarding this matter, please contact me at 301-415-8513.

Sincerely,

/RA/

Nancy L. Osgood, Senior Project Manager
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket Nos. 71-9225 and 71-0018

Distribution: JPearson MRahimi JUmana SBrown JCaverly JCuadrado SWilliams

Filename: C:\FileNet\ML053250059.wpd

OFC	SFPO	E	SFPO		SFPO	
NAME	NLOsgood		MRDeBose		RANelson	
DATE	11/ 17 /05		11/ 18 / 05		11/ 18 /05	

C=Without attachment/enclosure E=With attachment/enclosure N=No copy **OFFICIAL RECORD COPY**

REPORT ON SPENT FUEL SHIPMENTS
MADE WITH RESIDUAL WATER IN THE NAC-LWT CASK
DOCKET NO. 71-9225
CERTIFICATE OF COMPLIANCE NO. 9225

BACKGROUND

The Model No. NAC-LWT is a cask designed for the transport of irradiated nuclear fuel from commercial and research reactors. The NRC approval is Certificate of Compliance No. 9225, issued to NAC International, Inc., in Norcross, Georgia. The design was approved on December 6, 1989, and a number of casks of this design have been fabricated.

The cask is a steel-encased, lead-shielded truck cask. It can accommodate one pressurized water reactor or two boiling water reactor fuel assemblies, or a number of individual fuel rods. It is also authorized for the transport of a variety of research reactor fuel types, including MTR and TRIGA reactor fuels. Different inner canisters and fuel baskets are used for the various fuel loadings. The overall dimensions of the cask are approximately 65 inches in diameter and 232 inches in length, including impact limiters. The cask weighs up to 52,000 pounds, including a maximum of 4,000 pounds of payload (fuel, canisters, and baskets).

Certificate of Compliance No. 9225 includes the following condition: "The cask must be dry (no free water) when delivered to a carrier for transport." To achieve dryness, the cask is drained and vacuum dried after underwater loading operations. Package Operations, included in the application for package approval, describe these drying operations. In general the process involves draining, then evacuating the cask cavity (and the cavity of any internal, sealed canisters) to a pressure well below the vapor pressure of water at the applicable temperature. The cask cavity is dried to prevent the buildup of internal pressure due to temperature increases from radioactive decay heat and ambient temperatures, including a possible fire in case of a transportation accident.

AFFECTED SHIPMENTS

Shipment from Indonesia

On July 22, 2004, NAC submitted a report to NRC under the provisions of 10 CFR 71.95 (Ref. 1). The report was supplemented on October 15, 2004 (Ref. 2), and February 14, 2005 (Ref. 3). The report described an instance when water was found in two NAC-LWT casks that had been shipped from Indonesia to the Idaho National Engineering Laboratory, near Idaho Falls, Idaho. The casks had been loaded in Indonesia on March 5 and 10, 2004, at the reactor facilities in Bandung and Yogyakarta. The shipments were made as part of the U.S. Department of Energy's program for the return of nuclear fuel from foreign research reactors, and DOE and NAC personnel were present during fuel loading at both reactor facilities.

The fuel shipped from Indonesia was MTR-type fuel, and was shipped without inner sealed canisters in the fuel basket. NAC conducted an investigation and could not determine, with confidence, the cause of the residual water. However, NAC initiated changes in the vacuum drying process to address identified deficiencies in instrumentation and written procedures that could have contributed to the failures. NAC also performed an assessment of the safety

significance of the event. NAC concluded that, based on the estimated volume of the residual water, the internal pressure under both normal and accident conditions would not have exceeded the cask design pressure.

Shipment from La Salle Nuclear Plant

On February 7, 2005, Exelon Generation Company, LLC, submitted a 10 CFR 71.95 report to NRC regarding residual water in a shipment of spent fuel rods from its La Salle nuclear plant near Marseilles, Illinois, to the Studsvik hot-cell facility in Sweden (Ref. 4). Four irradiated fuel rods where shipped in the NAC-LWT cask. Because the fuel rods were considered damaged, they were contained within a sealed inner canister. The inner canister was loaded underwater, vacuum dried, and loaded into the cask. After loading the canister, the cask cavity was also vacuum dried. The fuel was shipped from La Salle on October 6, 2003. On October 21, 2003, Studsvik personnel unloaded the cask and inner canister. A small amount of water was observed from both the cask and canister during unloading. In April 2004, during cask decontamination, a relatively large quantity (one liter or more) of water was removed from the inner canister.

In the report, Exelon identified several potential causes for the residual water: The inner sealed canister design was not subjected to appropriate qualification tests with respect to drying; inappropriate instrumentation was used to monitor the vacuum drying process; and a potential design weakness in the inner canister could have allowed inleakage of water after it had been dried.

Exelon also provided an assessment of the safety significance of the residual water in the cask. Again, it was concluded that the internal pressure under both normal and hypothetical accident conditions would not have exceeded the cask design pressure.

CORRECTIVE ACTIONS

As a result of these two incidents, NAC developed specific corrective actions, both to address the suspected causes of the two incidents and to address other weaknesses identified in the design, testing, and operating of the package. The corrective actions are listed in the attachment to NAC letter to NRC dated February 14, 2005 (Ref. 3). In addition, Exelon proposed development of procedures to address roles and responsibilities for future irradiated fuel shipments. This was in response to the delay in notification of the event to the NRC.

EVALUATION

NRC staff reviewed the reports submitted by NAC and Exelon. NRC staff also had several telephone conference calls with NAC regarding the details of the shipments, their root cause analyses, and corrective actions. In these calls the following additional points were made:

- NAC personnel stated that, to their knowledge, these two shipments were the only ones where there was residual water in the cask. They indicated that the casks have been used frequently for many types of shipments, with no residual water before or since these two shipments.

- NAC personnel stated that they believed that the Package Operations, as described in the package application submitted to the NRC, were appropriate and did not need to be revised. Deficiencies had been identified with respect to the documentation produced during the package operations, and with the instrumentation used to monitor the drying process.

Staff from the Spent Fuel Project Office performed a quality assurance inspection of NAC at its offices in Norcross, Georgia, on July 11-14, 2005. The inspection report was issued on August 18, 2005 (Ref. 5), with a Notice of Violation. The violation stated that, contrary to its quality assurance program, NAC failed to conduct adequate design verification of the sealed canister used for the La Salle shipment. In its letter dated September 12, 2005, NAC provided a reply to the Notice of Violation with its proposed corrective actions (Ref. 6). NAC's response to the inspection report was found to be adequate, as stated in NRC letter dated November 17, 2005 (Ref. 7).

CONCLUSION

Based on the information provided in the reports filed under the provisions of 10 CFR 71.95, findings from the inspection at NAC offices on July 11-14, 2005, and NAC corrective actions, we concluded that the safety significance of these two events was low and that the corrective actions proposed by the certificate holder were adequate.

REFERENCES

1. NAC International Letter dated July 22, 2004, ADAMS Accession Number ML042100037.

2. NAC International Letter dated October 15, 2004, ADAMS Accession Number ML051920364.

3. NAC International Letter dated February 14, 2005, ADAMS Accession Number ML050530181.

4. Exelon Generation Company Letter dated February 7, 2005, ADAMS Accession Number ML050530270.

5. NRC Inspection Report dated August 18, 2005, with enclosures, ADAMS Package Accession Number ML052340057.

6. NAC International Letter dated September 12, 2005, ADAMS Accession Number ML052590154.

7. NRC Letter dated November 17, 2005, ADAMS Accession Number ML053210011.