REQUEST FOR ADDITIONAL INFORMATION #2
NAC INTERNATIONAL, INC.
DOCKET NO. 72-1031
MAGNASTOR® CASK STORAGE SYSTEM
CERTIFICATE OF COMPLIANCE NO. 1031
AMENDMENT NO. 1

By letter dated March 26, 2009 (ADAMS Accession No. ML090890292) NAC International, Inc. submitted an application to amend Certificate of Compliance No. 1031 and license Technical Specifications in accordance with 10 CFR Part 72. The amendment proposes to define and clarify the requirements for qualification and testing of BORAL neutron absorber material. The first request for additional information (RAI) was issued (ML091870790) and a response was received (ML092520258). The staff has determined that further information is needed to complete its technical review. Each RAI describes information needed by the staff to complete its review of the application and the Safety Analysis Report (SAR) to determine whether the applicant has demonstrated compliance with the regulatory requirements.

Editorial 1) The staff proposed in draft Interim Staff Guidance Document 23 (ISG-23) that thermal neutron beams up to 2.54-cm in diameter with a 10-percent tolerance are acceptable for qualification and acceptance testing of boron carbide/aluminum based neutron absorbing materials.[1] In accordance with this guidance, the applicant may choose to increase the size of the neutron beam used for qualification and acceptance testing.

[1] Draft Interim Staff Guidance Document 23 (ISG-23), "Application of ASTM Standard Practice C1671-07 when performing technical reviews of spent fuel storage and transportation packaging licensing actions," U.S. Nuclear Regulatory Commission, Division of Spent Fuel Storage and Transportation, June 2009.

RAI 1) Specify a minimum chemical purity, and/or the chemical requirements of the boron carbide powder used in the neutron absorbing materials. Alternatively, specify a nationally recognized standard associated with the boron carbide powder (e.g. ASTM C 750 – 03, Type 1).

The minimum chemical purity and/or the chemical requirements of the boron carbide powder should be specified to ensure that the overall properties (e.g. corrosion resistance) of the neutron absorbing material are not influenced by contaminants.

In the past the staff has accepted the use of ASTM C750 – 03, Type 1 boron carbide powder. Such a standard specifies the general purity of the powder, minimum boron content, maximum halogen content, and maximum soluble boron.

This information is needed to determine compliance with 10 CFR 72.124(a).

RAI 2) Clarify how heterogeneous calibration standards for neutron attenuation measurements of neutron absorbing materials are calibrated in Section 10.1.6.4.5 of the application.

The staff considers the following acceptable for use; "*Standards will be calibrated, traceable to nationally recognized standards, or by attenuation of a monoenergetic neutron beam correlated to the known cross section of boron 10 at that energy.*"

This information is needed to determine compliance with 10 CFR 72.124(a).

RAI 3) Specify qualifying mechanical test(s) for the neutron absorbing materials in the Technical Specifications.

The staff understands that no structural credit is given to the neutron absorbers; however, the neutron absorbing materials should demonstrate a minimum level of mechanical integrity to ensure proper operation during a hypothetical accident. Mechanical testing is therefore necessary to verify a minimal level of durability for the neutron absorber materials and can not be substituted by dimensional measurements or "certified quality-controlled test results," unless an explicit explanation of the test results is provided.

Furthermore, the mechanical integrity of laminated neutron absorbing materials is determined not only by the mechanical properties of the aluminum cladding, but also by the bond between the cladding and porous boron carbide/aluminum core. The yield strength of a composite material can only be determined by mechanical testing of the composite, and can not be determined solely on the yield strength of the cladding. Current wording in Section 10.1.6.4.4 of the FSAR appears to permit the use of aluminum clad neutron absorbing materials which have not undergone *any* mechanical qualifying tests.

Qualitative tests (e.g. ASTM E 290 – 97) demonstrating the mechanical durability of neutron absorbing materials may be acceptable to staff, if the applicant can provide a technical justification, and appropriate acceptance criteria.

This information is needed to determine compliance with 10 CFR 72.124(a).

RAI 4) Specify the maximum total and open porosity of the neutron absorbing materials in the Technical Specifications. Excluding Boral, if the open porosity of the neutron absorbing material is greater than 0.5%, then qualifying tests should be conducted to ensure that the material will not blister when submerged and subsequently dried.

Porosity, particularly open porosity, influences the corrosion behavior of the neutron absorbing materials. For unclad neutron absorbing materials, a maximum open porosity of 0.5% generally negates the need for blister testing.

This information is needed to determine compliance with 10 CFR 72.124(a).

RAI 5) Specify in the Technical Specifications the maximum boron or boron carbide content (volume or weight percent) of the neutron absorbing materials to which such materials can be qualified.

The boron or boron carbide content of the neutron absorbing materials heavily affects the mechanical, thermal, and physical properties of neutron absorbing materials. Conventional fabrication methods of borated aluminum alloys and particle-reinforced metal matrix composites limit the amount of boron and boron carbide that can be incorporated into an aluminum matrix. By bounding the boron carbide content (typically volume 40%), the staff is able to make general determinations about the validity of the bounding properties of the neutron absorbing material reported in the application (e.g., thermal conductivity, elastic modulus, etc.).

The applicant is encouraged to look at other licensing actions taken by the staff to determine what volume or weight percent limits that staff has permitted in such materials.

This information is needed to determine compliance with 10 CFR 72.124(a).

RAI 6) Clarify the second bullet in Section 10.1.6.4.5.

The second bullet in Section 10.1.6.4.5 is acceptable to the staff for neutron absorbing materials which receive 75% credit, but appears to permit wet chemistry to function as the primary method for determining ^{10}B in neutron absorbing materials receiving 90% credit as well, which would not be acceptable to staff.

For 90% credit of the neutron absorber towards k_{eff}, partial substitution of neutron attenuation acceptance tests by wet chemistry methods may be acceptable if the supplier of neutron absorbing materials has conducted a sufficient number of qualifying neutron attenuation tests, and the wet chemistry methods have been benchmarked against neutron attenuation results. If statistically significant comparative results between wet chemistry tests and neutron attenuation tests are provided the staff may make a safety determination permitting the increased use of wet chemistry analysis as a substitution for neutron attenuation measurements.

An example of an adequate acceptance testing for a material receiving 90% credit would be the previously approved sampling plan for the MAGNASTOR: "The sampling plan shall require that each of the first 50 sheets of neutron absorber material from a lot, or a coupon taken there from, be tested. Thereafter, coupons shall be taken from 10 randomly selected sheets from each set of 50 sheets. This 1 in 5 sampling plan shall continue until there is a change in lot or batch of constituent materials of the sheet (i.e., boron carbide powder or aluminum powder) or a process change. A measured value less than the required minimum areal density of ^{10}B during the reduced inspection is defined as nonconforming, along with other contiguous sheets, and mandates a return to 100% inspection for the next 50 sheets."

This information is needed to determine compliance with 10 CFR 72.124(a).