TRANSNUCLEAR
AN AREVA COMPANY

July 26, 2010
E-29703

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Subject: Revision 7 to Transnuclear, Inc. (TN) Application for Amendment 1 to the NUHOMS® HD System (Docket No. 72-1030; TAC NO. L24153)

Based on recent discussions with the NRC staff, neutron absorber testing requirements in Updated Final Safety Analysis Report (UFSAR) Chapter 9 have been changed, and a correction has been made to the proposed Technical Specifications (TS) table of contents. This submittal provides the associate changed UFSAR and proposed TS pages.

Enclosure 1 provides a list of Amendment 1 Revision 7 TS and UFSAR replacement pages included herein, with discussion regarding the changes. Enclosure 2 provides the TS and UFSAR Amendment 1 replacement pages.

In both the TS and the UFSAR, Amendment 1 Revisions 0, 1, 2, 3, 4, 5, 6, and 7 changes are shown using italics for inserted text and revision bars for changed areas; however, Revision 7 changes are shaded to distinguish these new changes from Revisions 0, 1, 2, 3, 4, 5 and 6 changes. For the UFSAR, page footers for replacement pages are annotated as "Amendment 1, Rev. 7, 7/10."

Should the NRC staff require additional information to support review of this application, please do not hesitate to contact Mr. Don Shaw at 410-910-6878 or me at 410-910-6881.

Sincerely,

Robert A. Saffell Chief Operating Officer

for Jayant Bondre, Ph.D.
Vice President - Engineering

cc: B. Jennifer Davis (NRC SFST) (six paper copies of this cover letter and Enclosures 1 and 2, provided separately)

Enclosures:

1. List of Changed Pages and Discussion of Changes for CoC 1030 Amendment 1 Application Revision 7
2. NUHOMS® HD Amendment 1 Application Revision 7, Changed Proposed Technical Specifications and Proposed Updated Final Safety Analysis Report Pages

7135 Minstrel Way, Suite 300, Columbia, MD 21045
Phone: 410-910-6900 ◆ Fax: 410-910-6902

NMSS01

List of Changed Pages and Discussion of Changes for CoC 1030 Amendment 1 Application Revision 7

Page	Discussion
TS Page i	Reference to Section 3.1.4 is deleted, as there is no such section.
TS Page ii	With the change described above, information shifted from Page ii to Page i.
UFSAR Page 9-3	In Section 9.1.7.1, a change is made to provide for boron phases other than AlB_2 or TiB_2 that may occur depending on the cooling rate in borated aluminum. Also in Section 9.1.7.1, a change is made which deletes "with sufficient margin to minimize rejection, typically 10% excess." This statement is descriptive, without an explicit requirement. This statement is not essential because the explicit requirement is provided by the minimum areal density specification, by the neutron attenuation testing requirement, and by the statistical treatment of the neutron attenuation test data.
UFSAR Page 9-4	In Section 9.1.7.2, a change is made which deletes "it is a low porosity product." This statement is descriptive, without an explicit requirement. This statement is not essential because the explicit requirement is provided by the minimum density and maximum interconnected porosity test requirements. Also in Section 9.1.7.2, a change is made which deletes "with a metallurgically bonded matrix." This statement is descriptive, without an explicit requirement. The intention was to distinguish MMCs from mechanically bonded material like BORAL®, but it is difficult to get agreement among metallurgists TN has spoken to on a clear distinction between metallurgical and mechanical bonding. This statement is not essential because the explicit requirement is provided by the minimum density and maximum interconnected porosity test requirements which along with boron carbide particle size provide a clear distinction between MMCs and BORAL®. Also in Section 9.1.7.2, a change is made which changes "typically have an average size in the range 10-40 microns, though the actual specification may be by mesh size, rather than by average particle size" to "shall have an average size of 40 microns or less." This changes a vague description to a clear requirement, and deletes excess verbiage. There is no design basis reason to establish a minimum particle size for boron carbide – from a neutron attenuation point of view, smaller particles are a better approximation to a homogeneous dispersion, and are therefore preferred.

List of Changed Pages and Discussion of Changes for CoC 1030 Amendment 1 Application Revision 7

Page	Discussion
UFSAR Page 9-4 (continued)	In Section 9.1.7.3, a change is made which replaces the sentence "The average size of the boron carbide particles in the finished product is approximately 50 microns after rolling." with "Before rolling, at least 80% by weight of the B_4C particles in BORAL® shall be smaller than 200 microns." a. "Approximately 50 microns" is not a clear requirement. b. The boron carbide particle size after rolling BORAL® is a function of the initial boron carbide particle size, the boron carbide loading in the core, and the final thickness of the sheet. It will vary depending on the specific BORAL® sheet specified. c. Even given a specific BORAL® sheet specification, there is no way to closely control the final average boron carbide particle size, that is, the particle size distribution cannot be adjusted after rolling to achieve a specific target. d. Boron carbide particle size is not essential to the performance of the criticality safety functions of BORAL®. The criticality safety analysis assumes a large boron carbide particle size in BORAL®, and to compensate for any neutron streaming or self-shielding effects, uses only 75% of the specified ^{10}B content of the BORAL®.
UFSAR Pages 9-7 and 9-8	In Section 9.5.1, changes are made to the actions necessary for thermal conductivity results below the specified minimum. These changes are made in order to maintain consistency with other currently ongoing licensing actions.

Enclosure 2 to TN E-29703

NUHOMS® HD Amendment 1 Application Revision 7, Changed Proposed Technical Specifications and Proposed Updated Final Safety Analysis Report Pages

Table of Contents **Page**

List of Tables

List of Figures

9.1.7 Neutron Absorber Tests

CAUTION

Sections 9.1.7.1 through 9.1.7.4 below are incorporated by reference into the NUHOMS® CoC 1030 Technical Specifications (paragraph 4.3.1) and shall not be deleted or altered in any way without a CoC amendment approval from the NRC. The text of these sections is shown in bold type to distinguish them from other sections.

The neutron absorber used for criticality control in the DSC basket may consist any of the following types of material:

(a) Boron-aluminum alloy (borated aluminum)

(b) Boron carbide / *A*luminum metal matrix composite *(MMC)*

(c) Boral®

The 32PTH DSC safety analyses do not rely upon the tensile strength of these materials. The radiation and temperature environment in the cask is not sufficiently severe to damage these metallic/ceramic materials. To assure performance of the neutron absorber's design function only the presence of B10 and the uniformity of its distribution need to be verified, with testing requirements specific to each material. The boron content of these materials is given in Table 9-1.

References to metal matrix composites throughout this chapter are not intended to refer to Boral®.

9.1.7.1 Boron Aluminum Alloy (Borated Aluminum)

See the Caution in Section 9.1.7 before deletion or modification to this section.

The material is produced by direct chill (DC) or permanent mold casting with boron precipitating *primarily* as a uniform fine dispersion of discrete AlB_2 or TiB_2 particles in the matrix of aluminum or aluminum alloy *(Other boron compounds, such as AlB_{12}, can also occur)*. For extruded products, the TiB_2 form of the alloy shall be used. For rolled products, either the AlB_2, the TiB_2, or a hybrid may be used.

Boron is added to the aluminum in the quantity necessary to provide the specified minimum B10 areal density in the final product. The amount required to achieve the specified minimum B10 areal density will depend on whether boron with the natural isotopic distribution of the isotopes B10 and B11, or boron enriched in B10 is used. In no case shall the boron content in the aluminum or aluminum alloy exceed 5% by weight.

The criticality calculations take credit for 90% of the minimum specified B10 areal density of borated aluminum. The basis for this credit is the B10 areal density acceptance testing, which shall be as specified in Section 9.5.2. The specified acceptance testing assures that at any location in the material, the minimum specified areal density of B10 will be found with 95% probability and 95% confidence.

9.1.7.2 Boron Carbide / Aluminum Metal Matrix Composites (MMC)

See the Caution in Section 9.1.7 before deletion or modification to this section.

The material is a composite of fine boron carbide particles in an aluminum or aluminum alloy matrix. The material shall be produced by either direct chill casting, permanent mold casting, powder metallurgy, or thermal spray techniques. The boron carbide content shall not exceed 40% by volume. ***The boron carbide content for MMCs with an integral aluminum cladding shall not exceed 50% by volume.***

The final MMC product shall have density greater than 98% of theoretical density demonstrated by qualification testing, with no more than 0.5 volume % interconnected porosity. For MMC with an integral cladding, the final density of the core shall be greater than 97% of theoretical density demonstrated by qualification testing, with no more than 0.5 volume % interconnected porosity of the core and cladding as a unit of the final product.

Boron carbide particles for the products considered here shall have an average size of 40 microns or less. No more than 10% of the particles shall be over 60 microns.

Prior to use in the 32PTH DSC, MMCs shall pass the qualification testing specified in Section 9.5.3, and shall subsequently be subject to the process controls specified in Section 9.5.4.

The criticality calculations take credit for 90% of the minimum specified B10 areal density of MMCs. The basis for this credit is the B10 areal density acceptance testing, which is specified in Section 9.5.2. The specified acceptance testing assures that at any location in the final product, the minimum specified areal density of B10 will be found with 95% probability and 95% confidence.

9.1.7.3 Boral®

See the Caution in Section 9.1.7 before deletion or modification to this section.

This material consists of a core of aluminum and boron carbide powders between two outer layers of aluminum, mechanically bonded by hot-rolling an "ingot" consisting of an aluminum box filled with blended boron carbide and aluminum powders. The core, which is exposed at the edges of the sheet, is slightly porous. ***Before rolling, at least 80% by weight of the B_4C particles in BORAL® shall be smaller than 200 microns.*** **The nominal boron carbide content shall be limited to 65% (+ 2% tolerance limit) of the core by weight.**

The criticality calculations take credit for 75% of the minimum specified B10 areal density of Boral®. B10 areal density will be verified by chemical analysis and by certification of the B10 isotopic fraction for the boron carbide powder, or by neutron transmission testing. Areal density testing is performed on a coupon taken *from* the sheet produced from each ingot. If the measured areal density is below that specified, all the material produced from that ingot will be either rejected, or accepted only on the basis of alternate verification of B10 areal density for each of the final pieces produced from that ingot.

C. The transfer cask is placed on the transfer trailer, which is moved to the ISFSI aligned with an HSM-H. Compatibility of the transfer trailer with the transfer cask, verification of the transfer route to the ISFSI, and maneuverability within the confines of the ISFSI are verified.

D. The transfer trailer is aligned and docked with the HSM-H. The hydraulic ram is used to insert the 32PTH DSC loaded with mock-up fuel assemblies into the HSM-H and then to retrieve it. Transfer of the 32PTH DSC to the HSM-H will verify that the support skid positioning system and the hydraulic ram system operate safely for both insertion and retrieval.

E. A weld mockup, typically a shortened 32PTH DSC mockup modeling the top end, covers, and drain tube, is used to demonstrate closure welding, draining, drying, backfill, re-flooding, and canister opening operations.

F. The dry run is deemed successful if the expected results are achieved safely and without damage to any of the components or associated equipment.

G. Should any equipment or components require modification in order to achieve the expected results, it will be retested, as necessary, to confirm that the modification is adequate. Should the dry run indicate that procedures require change in order to achieve the expected results, the changes will be incorporated into the appropriate operating procedures prior to use for fuel transfer.

9.5 Specification for Neutron Absorbers

9.5.1 Specification for Thermal Conductivity Testing of Neutron Absorbers

Testing shall conform to ASTM E1225[1], ASTM E1461[2], or equivalent method, performed at room temperature on coupons taken from the rolled or extruded production material. Previous testing of borated aluminum and metal matrix composite, Table 9-2, shows that thermal conductivity increases slightly with temperature. Initial sampling shall be one test per lot, defined by the heat or ingot, and may be reduced if the first five tests meet the specified minimum thermal conductivity.

If a thermal conductivity test result is below the specified minimum, *at least four* additional tests *shall* be performed on the material from that lot. If the mean value of those tests, *including the original test,* falls below the specified minimum, the associated lot shall be rejected.

After twenty five tests of a single type of material, with the same aluminum alloy matrix, the same boron content, and the same *primary boron* phase, e.g., B_4C, TiB_2, or AlB_2, if the mean value of all the test results less two standard deviations meets the specified thermal conductivity, no further testing of that material is required. This exemption may also be applied to the same type of material if the matrix of the material changes to a more thermally conductive

[1] ASTM E1225, "Thermal Conductivity of Solids by Means of the Guarded-Comparative-Longitudinal Heat Flow Technique"

[2] ASTM E1461, "Thermal Diffusivity of Solids by the Flash Method"

alloy (e.g., from 6000 to 1000 series aluminum), or if the boron content is reduced without changing the boron phase.

The thermal analysis in Chapter 4 assumes a 3/16 inch thick neutron absorber paired with a 5/16 inch aluminum 1100 plate. The specified thickness of the neutron absorber may vary, and the thermal conductivity acceptance criterion for the neutron absorber will be based on the nominal thickness specified. The minimum thermal conductivity shall be such that the total thermal conductance (sum of conductivity * thickness) of the neutron absorber and the aluminum 1100 plate shall equal the conductance assumed in the analysis, *4.774 BTU/hr.F,* as shown in Table 9-3, where the acceptance criterion is highlighted.

The aluminum 1100 plate does not need to be tested for thermal conductivity; the material may be credited with the values published in the ASME Code Section II part D. The neutron absorber material need not be tested for thermal conductivity if the nominal thickness of the aluminum 1100 plate is 0.425 inch or greater. This case is examined explicitly in chapter 4, where no credit is taken for the thermal conductivity of Boral®.

9.5.2 Specification for Acceptance Testing of Neutron Absorbers by Neutron Transmission

CAUTION

Section 9.5.2.a and portions of 9.5.2.b are incorporated by reference into the NUHOMS® CoC 1030 Technical Specifications (paragraph 4.3.1) and shall not be deleted or altered in any way without a CoC amendment approval from the NRC. The text of information incorporated by reference in these sections is shown in bold type to distinguish it from other sections.

a. **Neutron Transmission acceptance testing procedures shall be subject to approval by the Certificate Holder. Test coupons shall be removed from the rolled or extruded production material at locations that are systematically or probabilistically distributed throughout the lot. Test coupons shall not exhibit physical defects that would not be acceptable in the finished product, or that would preclude an accurate measurement of the coupon's physical thickness.**

A lot is defined as all the pieces produced from a single ingot or heat *or from a group of billets from the same heat.* If this definition results in lot size too small to provide a meaningful statistical analysis of results, an alternate larger lot definition may be used, so long as it results in accumulating material that is uniform for sampling purposes.

The sampling rate for neutron transmission measurements shall be such that there is at least one neutron transmission measurement for each 2000 square inches of final product in each lot.

The B10 areal density is measured using a collimated thermal neutron beam of *no more than 1 inch* diameter.

The neutron transmission through the test coupons is converted to B10 areal density by comparison with transmission through calibrated standards. These standards are composed of a homogeneous boron compound without other significant neutron absorbers. For example, boron carbide, zirconium diboride or titanium diboride