June 29, 2012

Mr. Don Shaw
Licensing Manager
Transnuclear, Inc.
7135 Minstrel Way - Suite 300
Columbia, MD 21045

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF AMENDMENT NO. 3 TO THE STANDARDIZED ADVANCED NUHOMS® CERTIFICATE OF COMPLIANCE NO. 1029

Dear Mr. Shaw:

By letter dated December 15, 2011, as supplemented on May 24, 2012, Transnuclear, Inc. (TN) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for Amendment No. 3 to Certificate of Compliance (CoC) No. 1029 for the Standardized Advanced NUHOMS® System. The application proposes to add the NUHOMS® 32PTH2 system, which consists of a new transportable Dry Shielded Canister (DSC) designated the 32PTH2, stored in a modified version of the currently-licensed Advanced NUHOMS® AHSM horizontal storage module, designated the AHSM-HS. In my letter to you dated February 9, 2012, I notified you that the NRC staff had completed its acceptance review of your application and that your application contained sufficient information for staff to perform a detailed technical review. We also provided a proposed schedule for completing the technical review of your application.

The NRC staff has reviewed the information provided and concluded that additional information is needed to complete the technical review of your application. On April 18, 2012, I emailed you a request for the thermal analysis files for vacuum drying. On April 19, a telephone call was held with you to confirm our email request for supplemental information regarding the equation for the determination of fuel assembly decay heat and information regarding design basis source terms. On May 24, 2012, Transnuclear, Inc. submitted the requested information under Revision 2. Further requests for additional information (RAI) are listed in the enclosure. We request that you provide this information by September 7, 2012. If you are unable to meet this deadline, please notify us at least two weeks in advance of the submittal date. The staff will then assess the impact of the new submittal date and notify you of a revised schedule.

This letter confirms our telephone call on June 28, 2012, with respect to the RAI needed and the date for your submittal. If you have any questions regarding this matter, please feel free to contact me at (301) 492-3219 or by email at steve.ruffin@nrc.gov.

Sincerely,

/RA/

Steve Ruffin
Project Manager
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No.: 72-1029
TAC No.: L24607

Enclosure: As stated

D. Shaw

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Request for Additional Information
Transnuclear, Inc
Certificate of Compliance No. 1029
Amendment No. 3

By letter dated December 15, 2011, as supplemented on May 24, 2012, Transnuclear, Inc. (TN) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for Amendment No. 3 to Certificate of Compliance (CoC) No.1029 for the Standardized Advanced NUHOMS® System. The application proposes to add the NUHOMS® 32PTH2 system, which consists of a new transportable Dry Shielded Canister (DSC) designated the 32PTH2, stored in a modified version of the currently licensed Advanced NUHOMS® AHSM horizontal storage module, designated the AHSM-HS. This request for additional information (RAI) identifies information needed by the NRC staff in connection with its review of the application/amendment. The RAIs are organized by chapter numbers and titles as found in the Transnuclear, Inc. safety analysis report (SAR). NUREG-1536, Rev. 1, "Standard Review Plan for Spent Fuel Dry Storage Systems at a General License Facility," was used by the NRC staff in its review of the application.

Each individual RAI describes information needed by the NRC staff to complete its review of the amendment and to determine whether the applicant has demonstrated compliance with the regulatory requirements.

CHAPTER 1 – GENERAL INFORMATION EVALUATION

1-1 Clarify why there are two different definitions for "damaged fuel" and how that impacts handling and storage operations.

List of CoC 1029 - Amendment 3, Technical Specifications - Changes and Justifications, states that existing DAMAGED FUEL ASSEMBLY definition applies to the 24PT1-DSC and 24PT4-DSC only. A separate DAMAGED FUEL ASSEMBLY definition was added for the 32PTH2 DSC only."

Table B.2.1-1 for <u>Physical Parameters/Fuel Class</u>, states that damaged fuel assemblies beyond the definition contained below are not authorized for storage.

Additionally, Section B.12 states the following:

DAMAGED FUEL ASSEMBLY (for 24PT1-DSC and 24PT4-DSC only)

- A DAMAGED FUEL ASSEMBLY is a fuel assembly with known or suspected cladding defects greater than pinhole leaks or hairline cracks or an assembly with partial or missing rods.

DAMAGED FUEL ASSEMBLY (for 32PTH2 DSC only)

- A DAMAGED FUEL ASSEMBLY is a fuel assembly with known or suspected cladding defects greater than pinhole leaks or hairline cracks or an assembly with partial or missing rods. The extent of damage in the fuel assembly is to be limited such that a fuel assembly is able to be handled by normal means.

This information is required to demonstrate compliance with 10 CFR 72.236(a).

ENCLOSURE

CHAPTER 3 – STRUCTURAL EVALUATION

3-1 Provide information regarding plastic analysis for the 32PTH2.

Elastic-plastic stress criteria is generally not acceptable for the closure region (outer top cover plate to shell weld); however, they can be applicable to other regions in a spent fuel canister.

Provide the load cases and plastic stress results (w/design limits) in tabular format for all instances where Appendix F of ASME Code was used for elastic-plastic stress evaluation of the 32PTH2.

Also consider the effects of using elastic-plastic analysis and ASME Code Section XI in the same general location(s).

This information is required to demonstrate compliance with 10 CFR 72.236(d).

3-2 Describe the methodology and criteria to determine if the site qualifies for marine atmosphere environment.

SAR Section B.3.4.1.7 discusses that the AHSM-HS load-bearing support structure components shall be procured of stainless steel or carbon steel with a minimum of 0.20 percent copper content if the Independent Spent Fuel Storage Installation is located in a coastal salt water marine atmosphere.

Describe the method of determining if a site qualifies as marine atmosphere.

This information is required to demonstrate compliance with 10 CFR 72.236(b).

3-3 Justify or correct the discrepancies in SAR Table B.3.5-2 vs. ANSYS (32PTH2 CE 16X16 with M5 75g side drop input file) and LS-DYNA (NUH32PTH2 WE16X16 80" Corner Drop input file).

Upon staff review of the submitted input files, it appears that ANSYS has a Young's Modulus input of $10.74X10^6$ psi, while LS-DYNA has a Young's Modulus input of $9.93X10^6$ psi (justified in B.3.5.3.2.5). It appears that ANSYS has a Poisson's Ratio of 0.404, while LS-DYNA has a Poisson's Ration of 0.404001. It was noted that Poisson's Ratio was not tabulated in Table B.3.5-2.

Staff determines that the effects of these discrepancies to be minimal, however the discrepancies should be discussed and justified, and Table B.3.5-2 revised accordingly.

This information is required to demonstrate compliance with 10 CFR 72.236(c).

3-4 Justify or evaluate the tornado generated loads for the AHSM-HS.

The design basis tornado velocity pressure was calculated from equation 6-15 of ASCE 07-05. However, the current standard, ASCE 07-10, has amended the velocity pressure (ASCE 07-10 equation 30.3-1) and possibly the input factors and coefficients (e.g. K_d, K_z, etc.).

Regulatory Guide 1.76 (April 1974) and NUREG-0800 Section 3.5.1.4 (Rev. 2, July

1981) were used to determine design basis tornado and tornado missiles for the AHSM-HS. Regulatory Guide 1.76 was updated (Rev. 1, March 2007) for new design basis tornado characteristics, and tornado missile characteristics.

The analysis provided in the SAR does not include item (3), a "small rigid missile of a size sufficient to pass through any opening in protective covers," which can be applied as a solid steel sphere per Table 2 of Regulatory Guide 1.76, Rev. 1.

Reevaluate the design basis tornado and tornado missiles for the AHSM-HS, or justify why the methodology used bounds the current technical guidance.

This information is required to demonstrate compliance with 10 CFR 72.236(b).

3-5 Justify the soil density used in the LS-DYNA 32PTH2 DSC Basket model.

SAR Section B.3.6.1.2.2 B. describes that the elastic soil model as referenced in NUREG CR-6608 was used for the analysis.

However, the analysis appears to use a mass density of $2.0368X10^{-4}$ lb sec^2/in^4, which is not consistent with the elastic soil model density.

Justify why the selected mass density is appropriate for this analysis.

This information is required to demonstrate compliance with 10 CFR 72.236(c).

3-6 Clarify discrepancies between friction coefficients and horizontal accelerations used in the seismic evaluation.

SAR Section B.3.1.2.1.3.6 states that the seismic evaluation was performed with a friction coefficient equal to or less than 0.8, and a horizontal acceleration of 1.6g. SAR Section B.3.1.2.1.3.6 also states that the seismic load is consistent with Updated Final Safety Analysis Report (UFSAR) Chapter 3 and Appendix A.3.

ANUH-01.0150 (UFSAR) Section B.1.2.1.3.6 considers a lower horizontal acceleration 1.4g, as well as a lower maximum friction coefficient equal to or less than 0.7.

Justify why the higher maximum coefficient of friction is appropriate for the AHSM-HS loaded with a 32PTH2 DSC, and provide a data source that reflects that this is an acceptable value.

This information is required to demonstrate compliance with 10 CFR 72.236(b).

3-7 Justify the methodology of evaluating the AHSM-HS, including the AHSM-HS roof and base ties, as well as side wall shear keys when loaded with a 32PTH2 DSC.

Per Table B.3.6-23, the earthquake design load (EQ) is specified as a horizontal ground acceleration amplified to 2.25g for the design of the roof to base keys/connections.

However, the SAR does not provide any detailed seismic evaluations for the AHSM-HS, except for the "DSC, rails, cross- braces, extension plates and hold down embedment," per SAR Section B.3.6.2.3.2.

Based on the information provided in the SAR, it is not clear if all the AHSM-HS components, other than what was described in model 2, were evaluated against the EQ design loads. Staff noted that SAR Section B.3.6.2.4 does not provide any additional information.

This information is required to demonstrate compliance with 10 CFR 72.236(b).

3-8 Provide justification as to why the 32PTH2 DSC is not designed and/or tested per ANSI N14.6.

ANUH-01.0150 (UFSAR) Section 9.1.2 discusses why the 24PTH1-DSC is only lifted when the DSC cavity is empty, thus the requirements of N14.6 are not necessary.

However, SAR Section B.9.1.2 does not have the same statement, of requiring that the 32PTH2 be empty while lifted.

Provide confirmation that the 32PTH2 is empty before lifting, or analysis that the 32PTH2 is designed and tested to N14.6.

This information is required to demonstrate compliance with 10 CFR 72.236(b).

3-9 Provide the calculation for Outer Top Cover Plate (OTCP) to shell weld flaw depth calculation.

ASME Code Section XI, Article C-5000 provides a tabular solution (C-5410) and analytical solution (C-5420) for determining allowable flaw depths.

This calculation is needed to determine the weld stress capacity (SAR Table B.3.6-8) and to determine the required weld pass layer thickness consistent with ISG-15 criteria.

This information is required to demonstrate compliance with 10 CFR 72.236(d).

3-10 Clarify the design code for the AHSM-HS reinforced concrete.

Per SAR Table B.3.1-1, the ACI-318 and 349 were used for the codes and standards for fabrication and construction of the AHSM-HS.

However, all of the design characteristics and structural capacities were computed using ACI-349 per SAR Section B.3.6.2.4.1. Chapter 4.3.1 of “Appendix A to Certificate of Compliance No. 1029” (technical specifications) only lists ACI-349-06 as the design requirement for the AHSM-HS.

Provide all the ACI-318 construction references used for the AHSM-HS, and clarify/revise Table B.3-1 as appropriate.

This information is needed to demonstrate compliance with 10 CFR 72.236(b).

3-11 Provide clarification of Report TN E-32402, titled, "Benchmarking of LS-DYNA to Extract Stress Intensity," dated March 9, 2012, for analysis of the 32PTH2 DSC basket assembly. Note this is similar to an RAI on the CoC No. 1004 amendment (AMD) 13 application.

NUREG-1536, Rev. 1 provides details that the NRC has accepted two approaches for analyses regarding the structural capability of the basket to acceptably survive a cask drop during transfer.

The applicant has analyzed the 32PTH2 DSC basket assembly using transient finite element analysis [LS-DYNA] only.

The NRC staff can not determine that a basket stress analysis based solely on transient LS-DYNA is adequate to demonstrate safety without a benchmark of the finite element code capabilities and the applicant's development and use of the code.

NRC staff wrote RAI 3-8 for CoC No. 1004 AMD No. 13 application to require the applicant to benchmark their use of LS-DYNA and LS-DYNA's capability of post-processing section-cut internal stress quantities (i.e. the ability to extract validated stress intensities consistent with ASME code criteria) relevant for a comprehensive structural integrity evaluation of the 37PTH fuel basket assembly. This issue is applicable to the 32PTH2 fuel basket assembly in CoC No. 1029 AMD No. 3 license application.

The applicant responded to RAI 3-8 by providing TN E-32402, "Benchmark of LS-DYNA to Extract Stress Intensity," dated March 9, 2012. Staff reviewed TN E-32402 using Appendix 3A – Computational Modeling Software, of NUREG-1536, Rev. 1 and noted several inconsistencies.

If the applicant chooses to pursue the proposed methodology in the CoC No. 1029, AMD No. 3 application, for the 32PTH2 basket (rather than the two approaches discussed in 3.5.1.4 ii (3) (a), of NUREG-1536, Rev. 1), then a complete discussion of modeling techniques and practices, discussion of computer model development, computer model validation, justification of bounding conditions/scenarios, description of boundary conditions and assumptions, documentation of material properties, description of model assembly, discussion and justification of selected loads and time steps, and sensitivity studies consistent with Appendix 3A must be provided for the application.

Specifically, the staff has the following questions and observations related to TN E-32402 benchmarking report and the side drop analysis:

1. Damping is not discussed. Was there any damping in the benchmark report's rectangular beam models? If not, how is that applied to the side drop scenario? Do the modeled structures exhibit self-damping, and how is it evaluated in LS-DYNA during a side drop scenario? How is the damping between structural contacts (soil, target, transfer cask, DSC shell, DSC basket, etc.) evaluated in LS-DYNA? Why were those values chosen? It was stated in TN-E-32402 that "the robust contact algorithms of LS-DYNA enables to model contact between the different components in the finite element model." How was this statement established?

2. Was friction due to contact and materials incorporated in the benchmark models or side drop analysis in the SAR? A sensitivity study specific to this issue may be warranted.

3. How was the post-processing done in LS-DYNA to isolate the different types of stress intensity limits (e.g. P_M vs. P_B+P_M). Was the load path evaluated and the maximum shear stress applicable to membrane only, extracted, or is primary bending somehow post-processed out? How does the meshing/discretization scheme associated with the result of a sensitivity study govern how stress intensity is extracted? (For example, if a shell element with 5 integration points through the thickness is used to model the basket assembly, then the center gives membrane only (neutral axis – Mid?), while the outer fiber (outer fiber - Max Ipt?) represent membrane plus bending.) Discuss the implication and post-processing of localized and peak stresses.

This information is required to demonstrate compliance with 10 CFR 72.236(c).

3-12 Specify the criteria for temperature testing per Chapter 5.5 in Enclosure 6 to TN E-31647 (Technical Specifications).

The applicant states, “AHSM-HS concrete temperature testing shall be performed whenever there is a “significant change” in the cement, aggregates or water-cement ratio of the concrete mix design.”

The term “significant change” is not sufficient to allow for a quantifiable evaluation. Specify criteria that will provide a quantifiable determination for when the cement, aggregates or water-cement ratio changes from the analyzed condition in SAR Section B.3.6.2.4.1.

This information is needed to demonstrate compliance with 10 CFR 72.236(b).

CHAPTER 4 – THERMAL EVALUATION

4-1 Explain how the ANSYS solution is validated against results presented in Appendix U of the UFSAR Standardized NUHOMS System.

SAR page B.4.1-2 states that the ANSYS model of the OS200FC TC was validated against the results presented in Appendix U, Section U.4.5 of the Standardized NUHOMS® System UFSAR. The staff does not consider this a validation. The staff considers this a code-to-code comparison only and not a solution verification. The ANSYS solution should be validated based on measured experimental data or should be verified by following the methods described in ASME V&V 20-2009: “Standard for Verification and Validation in Computational Fluid Dynamics and Heat Transfer.”

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-2 Clarify why SAR Table B.4.1-1 does not specify temperature limits for all the components included in the table.

SAR Table B.4.1-1 provides the component maximum and minimum temperatures in the NUHOMS 32PTH2 system for normal conditions. However, not all components have a temperature limit specified. See also Tables B.4.1-2, B.4.1-2 where the same clarification is needed.

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-3 Provide spent fuel assembly effective thermal properties that cover the expected material temperature range.

SAR Page B.4.2-1 includes a table for providing the CE 16x16 class fuel assembly effective properties. However, it appears that the axial effective thermal conductivity does not cover the entire temperature range. Revise all material thermal properties provided in the application to make sure the expected temperature range is covered for all thermal conditions.

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-4 Correct the equation to obtain air density. Explain how the thermal results are affected by using the correct equation.

SAR page B.4.2-6 includes the air thermophysical properties. However, the equation to obtain air density, which appears to be the ideal gas law, is incorrect. The following equation is used by TN to calculate the air density:

$\rho = P/RT$, where ρ is the air density, P is the pressure, T is the air temperature, and R is the universal gas constant. The ideal gas law to obtain the density should be $\rho = PM/RT$, where M is the air molecular weight.

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-5 Provide a detailed description of the methodology used in the AHSM-HS airflow analysis.

SAR page B.4.4-2 states that the methodology used in the HSM-H airflow analysis (stack effect calculations) is presented in Appendix P, Section P.4.4.3. However, no description of the methodology used in the AHSM-HS airflow analysis is provided in the SAR.

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-6 Perform a thermal analysis to represent the transfer configuration of the 32PTH2 DSC inside the OS200FC transfer cask to confirm the approach described in the SAR to perform the thermal evaluation during transfer conditions.

SAR page B.4.5-3 states that two separate models are used to perform the thermal evaluation during short term transfer operations. A thermal model of the OS200FC transfer cask (TC) is used to obtain the DSC shell temperatures during steady state and transient conditions for all design load cases described in SAR Table B.4.5-1. A DSC thermal model is then used to calculate the maximum temperatures. A coupled analysis for the bounding case would demonstrate the SAR approach. Except for the fuel regions being modeled as homogenized regions, the coupled calculation should include a detailed modeling of the DSC.

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-7 Perform a computational fluid dynamics (CFD) analysis to confirm the Flow Rate Model results described in the SAR. Verify the CFD solution by using the methods described in ASME V&V 20-2009: "Standard for Verification and Validation in Computational Fluid Dynamics and Heat Transfer."

The Flow Rate Model described in the SAR does not appear to be a reliable approach to capture the heat transfer and flow dynamics that exist for some of the design load cases described in SAR Table B.4.5-1. The CFD analysis should include an explicit representation of the TC and the DSC components (fuel zones, basket, transition rails, etc.). The solution analysis needs to be verified to determine the discretization error.

This information is necessary to demonstrate compliance with 10 CFR 72.236(f).

4-8 Explain why the hottest temperatures in DSC shell are localized in the DSC ends. Clarify why the maximum temperature provided in SAR Table B.4.5-4 is lower than the maximum temperature shown in SAR Figure B.4.5-5.

SAR Figure B.4.5-5 shows the temperature distribution for OS200FC TC with 32PTH2 DSC at 31.2 kW for the normal hot, vertical steady state case. The DSC shell temperature distribution does not appear to be representing the heat DSC transfer characteristics. Also, the maximum temperature shown in this figure is inconsistent with the value provided in SAR Table B.4.5-4. Check also inconsistencies between SAR Figure B.4.5-7 and SAR Table B.4.5-6.

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-9 Verify that the surface area of the basket assembly model is calculated correctly.

From SAR page B.4.6-11, it appears that the calculation of this area is performed assuming a circular area. The equation used to calculate the area seems to be incorrect (i.e., the numerator should be divided by four, not by eight).

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-10 Explain why the value of the slice model used to calculate the radial effective thermal conductivity is divided by two. Explain how the analysis results are affected.

From SAR page B.4.6-14, it appears that only half of the slide model is used in the calculations.

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-11 Explain why the thickness of the model used to calculate the effective thermal conductivity for plates and gaps within the 32PTH2 DSC basket assembly does not correspond to the thickness obtained by adding the plates and gaps.

SAR Tables B.4.6-3 through B.4.6-6 includes the thickness of each component and the model thickness. However, the addition of individual components does not add up to the model thickness. The SAR does not state why this approach is acceptable (i.e., the values used in the calculation, result in conservative effective properties).

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-12 Verify that the calculated effective thermal conductivity for plates and gaps within the 32PTH2 DSC basket assembly covers the expected temperature range.

SAR Tables B.4.6-3 through B.4.6-6 provide these conductivities. However, it does not appear some of the values provided in these tables will cover the expected temperature range.

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4-13 Verify that during loading/unloading operations, the analysis is based on a realistic temperature of the water in the annulus between the DSC and the TC.

SAR page B.4.8-1 states that presence of water within the annulus maintains the maximum DSC shell temperature below the boiling temperature of water in open atmosphere. With water being replenished, this implies water will be at the boiling point at the water surface (212°F). However, the DSC shell temperature will be higher. In order to provide a bounding analysis, the applicant should calculate the water temperature at the hottest point and use this value in the analysis. Otherwise, the operating procedures should indicate that the DSC temperature is monitored and some actions are implemented in order to avoid exceeding 212°F at the DSC shell.

This information is needed to demonstrate compliance with 10 CFR 72.236(f).

4.14 Obtain the analysis discretization error for the bounding case (the considered case should correspond to the model used to perform the thermal evaluation, not just a piece of the model as described in SAR Section B.4.6.7) by calculating the grid convergence index (GCI) following the procedure described in American Society of Mechanical Engineers Verification and Validation 20-2009 (ASME V&V 20-2009), “Standard for Verification and Validation in Computational Fluid Dynamics and Heat Transfer”.

Per ASME V&V 20-2009, when using the GCI method to estimate the discretization error, the following criteria should be met:

- The solution from the different grids used display monotonic convergence.
- The solution from the different grids used should be in the asymptotic range.

The calculations should demonstrate that all following criteria are met:

- A minimum of four grids is required to demonstrate that the observed order of accuracy p is constant for a simulation series. In fact, it may require more than four grids to convincingly demonstrate asymptotic response in difficult problems, possibly five or six grid resolutions in cases where the convergence is noisy. (ASME V&V 20-2009).
- The observed order of accuracy p has to be comparable to the expected order of accuracy of the method.
- If order of accuracy p is not consistent, then the factor of safety (F_s) should be equal to 3.

Provide the calculation package describing in detail how the GCI is obtained. Provide all analysis files generated as a result of the GCI calculation.

Response to Thermal Observation dated February 24, 2012, references UFSAR Section B.4.6.7 where the applicant performed a mesh sensitivity study. However, no details of the calculation are included, just a table with calculated parameters. The model used for the sensitivity study is based on a 30-inch slice three-dimensional finite element model of the 32PTH2 DSC which does not correspond to the analyzed geometry for the bounding conditions. Also, the refinement factor appears to be low. Per the ASME requirements, a minimum of four grids are required to demonstrate that the observed order of accuracy p is constant for the simulation series. The observed order of accuracy should be comparable to the order of accuracy of the analysis method. The response did not include a comparison of these two parameters. When developing the different grids, the mesh should be refined uniformly in all directions (e.g., for a three-dimensional model, the refinement should be uniform in the x, y, and z directions.).

This information is necessary to demonstrate compliance with 10 CFR 72.236(f).

CHAPTER 5 – SHIELDING EVALUATION

5-1 Clarify how the fuel assembly decay heat equation provided on Technical Specifications (TS) Table 3-7 is verified.

Table 3-7 equation is expressed as a function of fuel assembly average burnup (MWd/MTU), average initial enrichment (weight % of U-235), and cooling time (years). However, no explanation or bases are provided of how this equation was obtained. (For example, was the equation verified by comparing its predictions against a source code like ORIGEN-S?)

This information is needed to demonstrate compliance with 10 CFR 72.236(d).

CHAPTER 6 – CRITICALITY EVALUATION

6-1 (a) Provide the maximum initial enrichment limit rather than the maximum planar average initial enrichment of the allowable spent fuel for the NUHOMS® 32PTH2 system.

(b) Provide justification for the need for the maximum allowable enrichment in excess of 5.0% for the spent fuel to be stored in the spent fuel storage system.

As shown in Tables 3-4, 3-5 and 3-6 of the SAR, the applicant requested a maximum planar average enrichment of 5.1 wt% U-235 as the allowable spent fuel to be stored in the NUHOMS® 32PTH2 system. The applicant also specified a maximum planar average enrichment of 5.1 wt% U-235 in Tables B.6.6-2 and B.6.6-3 of the SAR. It is not clear to the staff what the maximum enrichment is for the allowable fuel. Normally, the maximum enrichment is used as the enrichment of the fuel assembly for conservatism. The staff requests the applicant to revise the SAR to define the fuel with maximum fuel enrichment rather than maximum average enrichment.

The staff also notes that this enrichment is beyond the maximum of 5.0 wt% allowed by 10 CFR 50.68(b)(7) for power reactors. Explain the basis for a maximum allowable enrichment in excess of 5.0 wt% for the spent fuel to be stored in the spent fuel storage system.

The staff needs this information to demonstrate if the NUHOMS® 32PTH2 system meets the regulatory requirements of 10 CFR 236(a) and 72.2(a).

CHAPTER 8.0 – OPERATING PROCEDURES EVALUATION

8-1 State in the applicable section of Operating Procedures that if needed, the forced cooling system should be operable.

SAR page B.8-1 states that if the use of the OS200FC Transfer Cask (TC) forced-cooling blowers is the anticipated action in the case of approaching 32PTH2 DSC transfer time limits, the forced cooling system should be verified to be ready to install/operate if needed. However, the operating procedures should have the applicable section that the system should be operable provided some conditions are met.

This information is needed to demonstrate compliance with 10 CFR 72.236.

8-2 Clarify how helium is retained in DSC cavity during the removal of 500 gallons of water.

Step 6 of SAR Section B.8.1.1.3 states that Helium at 1-3 psig is used to backfill the 32PTH2 DSC as water is being removed from the 32PTH2 DSC. However, it is not clear how helium is retained in an unsealed DSC.

This information is needed to demonstrate compliance with 10 CFR 72.236.

8-3 Clarify how the water level in the Transfer Cask (TC)/DSC annulus is monitored.

Step 11 of SAR Section B.8.1.1.3 states that TC/32PTH2 DSC annulus should be covered to prevent debris and weld splatter from entering the annulus. However, it is not clear how the water level can be monitored if it is covered.

This information is needed to demonstrate compliance with 10 CFR 72.236.

CHAPTER 9 – ACCEPTANCE TESTS AND MAINTENANCE PROGRAM EVALUATION

9-1 Propose an adequate test to validate the thermal design of the OS200FC TC forced-cooling blowers used during the case of approaching 32PTH2 DSC transfer time limits.

The transfer of the DSC in the OS200FC TC includes an analysis of Load Case T8 (Off-Normal Hot, Horizontal, Steady-State, Air Circulation) to demonstrate that the maximum component temperatures for the OS200FC TC and 32PTH2 DSC remain below the allowable limits if the air circulation as the recovery operation is initiated. The staff needs to have assurance the air circulation system will provide enough cooling, as described by the thermal design, to keep material temperatures below allowable limits.

This information is needed to demonstrate compliance with 10 CFR 72.236.

CHAPTER 10 – RADIATION PROTECTION EVALUATION

10-1 Clarify if the estimated dose during the loading campaign of a single DSC containing 32 CE 16x16 with a maximum heat load of 37.2 kW for this new canister will remain under 400 person-mrem. If not, provide a reevaluation for the estimated dose during the loading campaign of a single DSC containing 32 CE 16x16 with a maximum heat load of 37.2 kW for this new canister and a revised Chapter 11 to adequately capture the estimated dose for the operation of this new canister design.

In Section 10.3.1.1 of the UFSAR, the applicant states that for NUHOMS® DSCs containing 32 PWR spent fuel assemblies and heat loads up to 33 kW per DSC, total operational exposure to load a single DSC is generally under 400 person-mrem. However, the maximum heat load for this amendment is up to 37.2 kW per DSC. Given this higher decay heat load, it is expected that the dose rates at the various points surrounding the DSC and the transfer cask will increase accordingly. For this reason, the estimated dose for operation of the canister may be different from previous estimates that were based on a lower decay heat load canister.

This information is needed to demonstrate compliance with 10 CFR 72.236 and 10 CFR 72.104.

CHAPTER 12 – TECHNICAL SPECIFICATIONS AND OPERATING CONTROLS AND LIMITS EVALUATION

12-1 Clarify how the fuel assembly decay heat equation provided on Technical Specifications (TS) Table 3-7 is verified.

Table 3-7 equation is expressed as a function of fuel assembly average burnup (MWd/MTU), average initial enrichment (weight % of U-235), and cooling time (years). However, no explanation or bases are provided of how this equation was obtained (for example, was the equation verified by comparing its predictions against a source code like ORIGEN-S?).

This information is needed to demonstrate compliance with 10 CFR 72.236.

12-2 Provide a detailed description of the type of corrective actions that should be implemented if the maximum air temperature rise in the Advanced Horizontal Storage Module High Burnup and High Seismic (AHSM-HS) is larger than 90°F.

TS Section 5.2.5 on page 5-6 states that if the air temperature differential is greater than 90°F, the air inlets and exits should be checked for blockage. If after removing any blockage found, the temperature differential is still greater than 90 ºF, corrective actions and analysis of existing conditions will be performed in accordance with the site corrective action program to confirm that conditions adversely affecting the concrete or fuel cladding do not exist. However, no specific corrective actions are stated. The staff needs to have assurance that corrective actions are capable of precluding material temperature limits from being exceeded.

This information is needed to demonstrate compliance with 10 CFR 72.236.