

TRANSNUCLEAR INC.

DOCKET NO. 72-1004

REQUEST FOR ADDITIONAL INFORMATION

RELATED TO AMENDMENT 11 TO THE

STANDARDIZED NUHOMS® SYSTEM

By application dated April 10, 2007, Transnuclear Inc. (TN) requested approval of an amendment to Certificate of Compliance (CoC) No. 1004. This amendment proposes to add several items to the CoC including:

- Convert the Technical Specifications (TS) to the format contained in NUREG-1745, "Standard Format and Content for Technical Specifications for 10 CFR Part 72 Cask Certificates of Compliance."
- Certain aspects associated with the light-weight transfer cask designated as the OS-197L.

This request for additional information (RAI) identifies additional information needed by the U.S. Nuclear Regulatory Commission (NRC) staff in connection with its review of the amendment. The requested information is listed by chapter number and title in the staff's draft safety evaluation report. NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems," was used by the staff in its review of the amendment application.

Each individual RAI section describes information needed by the staff to complete its review of the application and the Safety Analysis Report (SAR) and to determine whether the applicant has demonstrated compliance with the regulatory requirements.

CHAPTER 2 Structural Evaluation

- 2-1 Reconsider the response to RAI 2-9 and the interpretation provided by TN for the "cask system" and provide the type of information requested that was considered by the NRC staff to be missing for the transfer cask.

The normally short time of use of the transfer cask does not provide a reason for excluding the listing of the design codes and standards alternatives that apply to the design and fabrication of the transfer cask. The following statement is contained in NUREG-1745 relative to the SPENT FUEL STORAGE CASKS (SFSCs): "The [XXXX] SFSC System consists of the OVERPACK and its integral CANISTER." The fact is that the canister cannot be placed into the overpack without the transfer cask, and because of this the transfer cask is considered part of the cask system. The transfer cask is considered within the scope of the definition provided in NUREG-1745.

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

- 2-2 Clarify the response provided to RAI 9-14 to be consistent with a potentially revised proposed technical specification 5.5.

The proposed change to technical specification 5.5 associated with the response to RAI 9-14, does not provide the specificity requested for the frequency of testing and location of the high temperature zones that may reach or exceed 350 degrees F. There appears to be confusion between temperature testing during the construction and fabrication process of the concrete of the HSM-H and the temperatures associated with the thermal operating conditions for the HSM-H storage modules once the loaded DSCs have been inserted. The current proposed technical specification, while addressing temperature testing during fabrication and an inspection for spalling and cracking of the concrete, does not appear to be internally consistent. The 350 degrees F thermal condition should apply to the completed concrete components of the HSM-H, not during the fabrication stage as is stated.

The technical specification should identify the location(s) of the expected high concrete temperatures for the conditions under a minimum of 40 hours of blocked vent condition that are to be monitored. This could, for example, be described as including a zone on the roof section or other appropriate areas based on the predicted temperatures. Prior to the start of the test, the zone of interest should be inspected for surface conditions and the records of the concrete compressive strength for that component verified as meeting the design requirements. The inspection after the 40 hours duration of the blocked vent condition of the loaded storage module would consist of visual observation of the exterior surface for spalling and cracking, and if these conditions are observed data collected to describe the extent of the conditions.

The above testing and observations should be performed at each ISFSI site where the HSM-H is used with the fuel storage conditions that produced the highest predicted concrete temperatures. If the HSM-H units to be used at a specific ISFSI site are constructed with concrete containing significant changes in cement, aggregates or water-cement ratio of the concrete mix than that used in a previously tested HSM-H module, then the first module should undergo testing and observation using the changed concrete mix.

This information is needed by the staff to confirm compliance with 10 CFR 72.236(b) and 72.236(l).

Chapter 3 Thermal Evaluation

- 3-1 Justify that the assumption of a uniform heat flux at the transfer cask outer shell is a conservative representation of DSC/TC system within the supplemental shielding, and demonstrate that it can produce a conservative estimate of the temperature distribution on the transfer cask outer shell.

In the FLUENT model of the OS197L on the transfer skid enclosed within the supplemental shielding, the assumption of a uniform heat flux at the transfer cask outer shell is a significant simplification in the boundary conditions. It does not account for the variation in heat transfer on the transfer cask shell, due to variation in the surface heat transfer coefficient around the circumference of a horizontal cylinder. It also assumes that the heat flux is uniform along the entire 183.85-inch axial length of the neutron shield, as well as around the circumference of the 40.18-inch diameter neutron shield. (Note that this temperature distribution provides boundary conditions for the next step in the analysis, using a 2D ANSYS model of the OS197L transfer cask.)

This information is needed to satisfy the provisions of 10 CFR 72.236(f).

- 3-2 Justify that a uniform heat flux at the inner surface of the DSC outer shell is a conservative representation of the heat flux from the DSC, and show that it can produce a conservative estimate of the temperature distribution on the DSC outer shell.

In the 2D ANSYS model of the OS197L on the transfer skid enclosed within the supplemental shielding, the assumption of a uniform heat flux at the inner surface of the DSC outer shell is a significant simplification in the boundary conditions. It is physically unrealistic, in that it ignores the effect of the non-uniform gap between the DSC outer shell and the TC inner shell and variation in heat transfer on the DSC inner shell (which is due to variation in the thickness of the R90 and R45 basket support rails around the circumference of the DSC and the non-uniform decay heat loading configuration within the basket.) It is also physically unrealistic in the assumption that the heat flux is uniform along the entire 186.2-inch axial length¹ of the DSC, since the active fuel extends only over 144 inches within the DSC inner cavity, which is only 169.6 inches long. (Note that this temperature distribution provides boundary conditions for the final step in the analysis, using a 3D ANSYS model of the 32PT DSC. This model is used to calculate the peak component temperatures, including the peak cladding temperature.)

This information is needed to satisfy the provisions of 10 CFR 72.236(f).

- 3-3 Justify by means of mesh sensitivity studies, or other relevant evaluations, that the fluid mesh in the FLUENT model of the OS197L transfer cask within the supplemental shielding provides adequate distance for a transition to true ambient to occur.

The size of the exterior fluid mesh in the FLUENT model of the OS197L transfer cask within the supplemental shielding may not be sufficient to extend to true ambient temperature. The mesh extends only about 1.5 to 2 L/D beyond the outer surface of the supplemental shielding into the surrounding air. Typically, the transition length is on the order of 5 to 10 L/D for thermal and velocity gradients in an infinite medium. The effect of truncating the distance to ambient would be non-conservative; it would overstate the steepness of the temperature gradient to ambient, resulting in a higher heat transfer rate than can actually be obtained.

This information is needed to satisfy the provisions of 10 CFR 72.236(f).

- 3-4 Justify that the analysis results presented in Figures W.4-5 and W.4-9 result from a conservative representation of DSC/TC system within the supplemental shielding, and demonstrate that this is a conservative estimate of the temperature distribution on the transfer cask outer shell.

The temperature graphics in Figures W.4-5 and W.4-9 show an off-set peak temperature location on the TC outer shell that does not appear to be consistent with natural convective heat transfer or with the flow field velocity vectors shown in Figures W.4-7 and W.4-8. (Note that this temperature distribution provides boundary conditions for the next step in the analysis, using a 2D ANSYS model of the OS197L transfer cask.)

¹ The value of 186.2 inches for the DSC exterior axial length comes from Appendix M (Section M.4.4.1.6, page M.4-16), in the description of the OS197/OS197H transfer cask thermal model.

This information is needed to satisfy the provisions of 10 CFR 72.236(f).

- 3-5 Describe in detail the representation of the thermal conductivity of the steel basket, aluminum liner plates, neutron poison plates, and aluminum poison plate covers in the detailed ANSYS model of the 32PT DSC.

Because heat transfer through the basket is the primary means of heat removal from the fuel assemblies within the basket, it is necessary for the staff to have a complete understanding of the thermal properties of the basket in order to properly determine, for comparison to staff confirmatory analyses, peak component temperatures, including peak cladding temperature.

This information is needed to satisfy the provisions of 10 CFR 72.236(f).

CHAPTER 5 Shielding Evaluation, and CHAPTER 8 Radiation Protection Evaluation

The requested addition of the light-weight OS197L transfer cask to the Standardized NUHOMS system presents some unique shielding and radiation protection considerations, given that this transfer cask must be used in conjunction with supplemental shielding and remote operations in order to conduct transfer operations in a safe manner. This is a new, first-of-a-kind review given the operational challenges associated with use of this very high-dose-rate transfer cask.

Normally, transfer casks provide sufficient biological radiation shielding such that workers may safely be in the vicinity of the transfer cask. This is not the case with the light-weight OS197L design. The staff is not only concerned about occupational doses during normal, off-normal, and accident conditions, but also public doses. Given that the amendment to the CoC is not limited to a specific site, the staff must ensure that enough warnings and controls are in place to provide reasonable assurance that both the public and occupational dose limits in 10 CFR Parts 72 and 20 are not exceeded, regardless of where the high-dose rate transfer cask is used.

The following RAIs are geared towards obtaining enough information so that the staff may make a determination regarding whether there is reasonable assurance that the OS197L may be used safely and in accordance with the regulations. The staff is particularly concerned about a potential off-normal event involving either the hangup of the crane or a malfunction of the remote handling equipment. Crane hangups are not uncommon, especially when cranes are loaded with weights approaching their capacity limits. Additionally, the staff is asking for clarification and/or additional information to ensure that the CoC, TS, and SAR each contain the appropriate level of information needed to control the design basis for this unique transfer cask.

During its review of the TN Standardized NUHOMS® Amendment No. 11, the staff, in addition to the technical issues identified in the attached RAIs, identified numerous quality-related problems which reflected inattention to detail on the part of the preparers and reviewers of the SAR. These quality-related problems are documented in RAI 5-35 through RAI 5-49. TN is requested to document these quality-related problems in their corrective action system, identify the cause of these conditions, and identify the corrective action(s) taken to prevent repetition.

5-1 Provide suggested text to revise the description of the OS197L TC in the CoC.

Provide suggested text to revise the CoC to include the material of construction and the corresponding thickness of the OS197L TC. The staff's technical position is that for high dose rate transfer casks, such as the OS197L, the CoC must specify the materials of construction, along with their minimum thicknesses, considering manufacturing tolerances. The CoC should state, at a minimum, that the nominal loaded weight of the OS197L transfer cask is approximately 75 tons, and should specify the minimum thicknesses of the steel shell, the two-piece neutron shield, and the thickness of water inside the neutron shield. Given the high dose rates from the bare transfer cask, this level of detail is warranted in the CoC.

Further, include the description of the OS197L TC system as written in section W.8 in the CoC. Page W.8-4 states "... the OS197L TC system consists of the bare cask and the upper and lower cask shielding utilized in the decontamination area and the additional shielding provided on the cask support skid." Add this description to section 3.b in the Certificate of Compliance. Due to the very high dose rates from the loaded, bare OS197L TC, the TC may not be used without the supplemental shielding in the decontamination area and on the transfer trailer. Furthermore, this level of detail is consistent with the guidance in NUREG-1745.

In sections 3.c and 3.d of the CoC, add Appendix W to the list of referenced FSAR sections.

Additionally, provide suggested text to revise either the CoC or the TS to limit use of the OS197L TC to DSCs with a heat load less than or equal to 24 kW, and to specify that the OS197L TC may only be used with the 52B, 24P, 61BT, 32PT, and 24PHB DSCs. Specification of both the 24 kW heat load limit and the allowed DSCs ensures that dose rates in the OS197L TC are limited to those that were reviewed as part of this amendment.

With respect to the OS197 TC, provide suggested text to revise the CoC to include the materials of construction and the basic structure of the OS197 TC in the TC description. The CoC should state, at a minimum, that the nominal loaded weight of the OS197 transfer cask is approximately 100 tons, and the vertical walls have a steel-lead-steel composition.

This information is requested to satisfy the requirements of 10 CFR 72.236(d).

5-2 Provide suggested text to revise Insert A of the CoC.

- Provide suggested text to revise Insert A of the CoC to include use of the remote crane operations and optical targeting system in the Loading Operations section during the dry run when the OS197L TC is used.
- Provide suggested text to revise Insert A of the CoC to direct the user to practice the manual crane operations, similar to those that would be used in the event of a crane hangup or other off-normal event, during the dry run when the TC is not loaded with fuel. Inclusion of this in the dry run will assure that the licensee can effectively operate the crane manually in a high dose rate environment. Additionally, inclusion of manual crane operations in the dry run will inform the

licensee's predictions of potential worker dose in the event of a crane hangup or other off-normal condition.

These revisions are necessary to ensure compliance with 10 CFR 72.236(d).

5-3 Provide suggested text to revise the definitions in TS 1.1:

- Specify whether placement of the supplemental trailer shielding is considered part of the Loading Operations or the Transfer Operations.
- Remove the words "governed by the 10 CFR 50 regulations" from the definition of the Fuel Building. While it is true that the regulations in 10 CFR Part 50 apply in the fuel building, the regulations of 10 CFR Part 72 also apply in the fuel handling building. This statement must be removed so as to prevent the implication that Part 72 does not apply within the fuel building.
- Define the "Cask handling area." This term is referred to in TS 4.4.4, but is not defined anywhere in the TS.

These revisions are necessary to ensure compliance with 72.236.

5-4 Provide suggested text to revise TS 2.1 as follows:

- Add a table showing which DSCs may be loaded into each HSM design.
- Add a table showing which DSCs may be loaded into each TC design.

This information is necessary due to the complexity of the Standardized NUHOMS system, and to ensure compliance with 10 CFR 72.236(a-b).

5-5 Provide suggested text to revise TS 4.4 to address the following:

- Provide suggested text to revise TS 4.4.2 to better describe the TC temporary shielding, including the decontamination area shielding as well as the transfer trailer shielding. Alternatively, provide suggested text to revise the definitions in TS 1.1 to define the TC temporary shielding.
- If the definition of "Cask handling area" added to TS 1.1 (in response to RAI 5-3) extends outside of the fuel building, provide suggested text to revise TS 4.4.4 to specify that the interim cask cover may not be used outside of the fuel building.
- Provide suggested text to revise TS 4.4.5 to specify that, if placement of the outer top shield of the transfer trailer shield is delayed due to building load limits, placement of the outer top shield must occur as soon as the Transfer Trailer has been moved to an area with acceptable load limits. Additionally, specify that the user must plan accordingly to minimize, to the greatest extent practicable, the delay of the placement of the Outer Top Shield.

This information is necessary to ensure compliance with 72.236.

- 5-6 Provide suggested text to revise TS 5.1.1 to include TS 5.2.4(b, d, and e) in the list of technical specifications in the last sentence.

TS 5.1.1 addresses loading, unloading, and preparation of the DSC, and lists several LCOs that should be addressed in the user's program for implementing the FSAR requirements. TS 5.2.4(b, d, and e) have requirements for DSC closure welds, DSC smearable surface contamination levels, and transfer cask dose rates, respectively. These are all integral to a DSC loading and preparation program.

This revision is necessary to ensure compliance with 10 CFR 72.236(d).

- 5-7 Provide suggested text to revise TS 5.2.1 to clarify that any changes to the SAR, including the TS Bases, shall be provided to the NRC in accordance with 10 CFR 72.48.

The last paragraph of TS 5.2.1 states: "Changes to the Technical Specification Bases implemented without prior NRC approval shall be provided to the NRC..." Provide suggested text to revise this statement to clarify that all licensing basis documents, including the technical specification bases, that are implemented without prior NRC approval must be provided to the NRC in accordance with the requirements of 10 CFR 72.48.

This revision is necessary to ensure compliance with 10 CFR 72.48.

- 5-8 Provide suggested text to revise TS 5.2.4 to address the following:

- Provide suggested text to revise TS 5.2.4a, in the section pertaining to the user's ALARA assessment for the OS197L TC, to require an assessment of public doses considering the anticipated number of hours the OS197L TC will remain unshielded during the entire ISFSI loading campaign. The staff notes that, for some site conditions, only a limited number of HSMs may be loaded in a year such that the OS197L TC may be used without risk of exceeding the dose limits in 10 CFR Part 20. Users are expected to meet the normal dose limits in 10 CFR Parts 20 and 72 during off-normal conditions (i.e., the accident dose rates only apply to accident conditions).
- Revise the next-to-last paragraph of TS 5.2.4a to read: "For the OS197L, approved written procedures shall be developed and followed that address normal, off-normal, and accident conditions. Specifically, these procedures shall address the impact on plant operations due to potentially-increased radiation levels from the unshielded loaded OS197L. These may include operator actions required by 10 CFR Part 50 TSs, security guard actions, control room habitability, and response to alarms set off by the loaded OS197L."
- The last paragraph of TS 5.2.4a states: "Remote operations or appropriate ALARA practices shall be used due to very high dose rates during movement of the loaded OS197L TC..." Revise the "or" to an "and" such that the TS requires both remote operations and appropriate ALARA practices.
- Provide suggested text to revise the last sentence of the last paragraph of TS 5.2.4a so that it provides more specific guidance regarding the remote operations necessary when the OS197L is unshielded. The staff suggests replacing the

existing sentence with the following: “When remote operations are used, approved written procedures shall be in place to govern these operations. These procedures shall address such topics as redundancy of equipment, calibration, maintenance, operability, operator training and qualification, recovery/equipment malfunction plans, and lessons learned from past loading campaigns.”

- Provide suggested text to revise TS 5.2.4e to require measurements to be taken at the surface (instead of 3 feet from the surface) of the TC. Historical considerations aside, this amendment request is proposing to update the TS to be consistent with the standardized TS as described in NUREG-1745, which calls for surface dose rates. Therefore, this TS needs to be appropriately updated to be consistent with the guidance in NUREG-1745. The staff notes that the licensee’s radiation protection personnel will be making multiple measurements during cask loading operations; therefore, measurements that verify compliance with TS dose rate limits will be among those performed by these personnel and will thus be readily available. The applicant should properly justify selection of the dose rate limits, the number and locations of the associated measurements and the cask configuration for the TS Radiation Protection Program. Surface dose rate limits should be provided for each allowable TC/DSC combination. The dose rate limits for each TC/DSC configuration will ensure that licensees meet 10 CFR 72.104(b), 20.1101(b), and 20.1301 requirements.
- Provide suggested text to revise TS 5.2.4e to include axial surface dose rate limits for the TC. Dose rate limits at the top surface of the TC serves as an important check against mis-loading of the DSCs; assemblies in the DSC basket periphery locations will not shield assemblies in the interior from the confirmatory measurements for these surface limits. Further, these limits also serve to ensure proper performance of the top areas of the cask system such that 10 CFR 72.104(b) and (c) will be met per 10 CFR 72.236(d) for worker dose during operations with the TC. Thus, limits on the TC side alone are not sufficient. Dose rate limits for the wet welding configuration at the location(s) of the maximum dose rates based upon the shielding analysis would fulfill these objectives. The TS should specify the locations of both the measurements, which the applicant should demonstrate are the locations identified by the shielding analysis to have the highest dose rates.
- Justify the chosen dose rates in TS 5.2.4.e, and provide suggested text to revise the TS and/or bases, as appropriate, to clarify the TC/DSC configuration assumed when determining the TS dose rate limits. The bases for TS 5.2.4.e state that the dose rates are based on the shielding analysis for the various DSCs included in the UFSAR and its appendices, with some added margin for uncertainty. Discuss the added margin and justify its appropriateness. The staff notes that the current dose rates in TS 5.2.4.e are not clearly derived from the SAR. These dose rates should be revised, if necessary, to reflect the analyses presented in the SAR. If the dose rate values in the TS include extra margin beyond the conservatisms present in the shielding analyses, revise the TS bases to discuss the added margin with specificity – i.e., what percent and why that percentage is appropriate. Additionally, provide suggested text to revise the TS and/or bases, as appropriate, to clarify the TC/DSC configuration assumed when determining the dose rates. Specifically, address whether water is assumed to

be present in the neutron shield (for the designs with a liquid neutron shield) and in the DSC/TC annulus.

- Provide suggested text to revise TS 5.2.4e to require the licensee to establish a set of TC dose rate limits which are to be applied to DSCs used at the site to ensure the limits of 10 CFR Parts 20 and 72 are met. Specify both axial and radial locations where the licensee should set limits.
- Provide suggested text to revise the last paragraph in TS 5.2.4e to add text requiring the user to verify compliance with the dose limits in 10 CFR 72.104 and 10 CFR 20.

These revisions are necessary to ensure compliance with 72.236.

- 5-9 Provide suggested text to revise TS 5.3.1 to clarify that the stated distinction between the applicability of 10 CFR 72 and 10 CFR 50 is valid only with respect to lifting/handling height limits and to address the lift height restriction for the bottom most part of the body of the outer top shield.

The last paragraph of TS 5.3.1A states, "The requirements of 10 CFR Part 72 apply when the TC/DSC is in horizontal orientation on the transfer trailer. The requirements of 10 CFR 50 apply when the TC/DSC is being lifted/handled using the cask handling crane/hoist." Provide suggested text to revise this paragraph to clarify that these statements are applicable only to lifting/handling height limits.

Additionally, provide suggested text to revise TS 5.3.1 to specify that the bottom most part of the body of the outer top shield shall not be hoisted by the crane more than 4 inches above the top horizontal plate of the inner top shield. While the operating procedures have been modified to include this lift height restriction, it is also necessary to include this in the technical specifications. The shielding analysis for accident conditions is based in part on the assumption that this lift height restriction will be met. Therefore, to ensure compliance with the accident dose limits, this restriction needs to be included in the technical specifications.

These revisions are necessary to comply with 72.236(d).

- 5-10 Provide suggested text to revise TS 5.3.4 to require inspection of the supplemental shielding following an accidental drop of the supplemental shielding.

TS 5.3.4 requires inspection of the DSC and the OS197L TC following an accidental drop of the supplemental shielding onto the OS197L TC. As the supplemental shielding is relied upon for radiological protection of the workers and the public, it is imperative that any damage to the supplemental shielding accrued from an accidental drop is identified. If the supplemental shielding is damaged such that there is a potential increase in radiological dose, the licensee must take mitigative measures to keep doses ALARA and, depending on the extent of the damage, to avoid exceeding dose limits in 10 CFR Parts 72 and 20.

This revision is necessary to ensure compliance with 10 CFR 72.236(d).

- 5-11 Revise TS 5.4.1a to delete the text "or 3 feet from the HSM front surface," and provide suggested text to revise TS 5.4.2 to require surface dose rates (vice 3 feet from the surface) for all DSCs loaded in the HSM.

The staff notes that casks are operated in accordance with the amendment under which they are loaded. Therefore, the fact that some DSCs have been loaded using the older TS that specified dose rates at 3 feet from the HSM front surface has no bearing on changing the TS now to specify dose rates at the front surface.

Provide suggested text to revise TS. 5.4.1 and 5.4.2 to require surface dose rates (vice 3 feet from surface) for all DSCs loaded in the HSM. Additionally, remove the footnote from the table allowing dose rate measurements at 3 feet from the HSM front surface. Historical considerations aside, this amendment request is proposing to update the TS to be consistent with the standardized TS as described in NUREG-1745, which calls for surface dose rates. Therefore, this TS needs to be appropriately updated to be consistent with the guidance in NUREG-1745. The staff notes that the licensee's radiation protection personnel will be making multiple measurements during cask loading operations; therefore, measurements that verify compliance with TS dose rate limits will be among those performed by these personnel and will thus be readily available. The applicant should properly justify selection of the dose rate limits, the number and locations of the associated measurements and the cask configuration for the TS Radiation Protection Program. Surface dose rate limits should be provided for each allowable HSM/DSC combination. The dose rate limits for each HSM/DSC configuration will ensure that licensees meet 10 CFR 72.104(b), 20.1101(b), and 20.1301 requirements.

These revisions are necessary to ensure compliance with 10 CFR 72.236(d).

- 5-12 Revise section B.10.5.2.4d to include the justification as to why checking only the top one foot of the DSC is acceptable, and how the survey is to be accomplished.

The goal of this TS is to evaluate the level of contamination on the DSC surface. Surveying the top one foot is meant to provide a representative sample of the entire surface. Therefore, the measurement must be taken before any effort is made to decontaminate the area to be assessed in the smear survey. Additionally, if decontamination is necessary, then it must be applied to the whole DSC, not just the top foot.

This revision is necessary to ensure compliance with 10 CFR 72.104.

- 5-13 Revise Table W.2-1 as originally requested in RAI 5-25 (in the first-round RAI) and make conforming changes as needed in the text, tables, figures, and drawings.

The applicant has incorrectly interpreted the applicability of 10 CFR 72.104 and Interim Staff Guidance 13. These requirements apply to the TC, regardless of its location. In 10 CFR 72.236, the regulations state "radiation shielding and confinement features must be provided sufficient to meet the requirements in 72.104 and 72.106." The requirements of 10 CFR 72.236 make no exceptions for the TC if it is located within the Part 50 building. The applicant must therefore ensure that the cask design is such that the dose limits in 10 CFR 72.104 and 72.106 will be met. The staff notes that only the NRC's Office of the General Counsel (OGC) may interpret the regulations in Part 72.

Therefore, the applicant's justification for their response to RAI 5-25 is invalid. Provide the information and revisions originally requested in RAI 5-25. Be sure to include any code alternatives, etc. in TS 4.2.3, as necessary. Additionally, provide suggested text to revise TS 4.3.3, item 6 to add a statement or a note cautioning that, depending on the layout of the licensee's site, it may be necessary to limit the number of HSMs loaded in a year or take other actions to limit potential doses due to the requirements of 10 CFR 72.104(a) and 10 CFR 20.1301.

This information is necessary to satisfy the requirements of 10 CFR 72.236 and 10 CFR 20.1301.

5-14 Clarify section W.2.3.5 of the SAR.

Clarify the following statement: "Therefore, with the use of remote handling and the supplemental shielding features of the OS197L TC to protect occupational workers and members of the public against direct radiation and releases of radioactive material and to minimize dose following any off-normal or accident condition are the same as those for the OS197 TC System." Dose rates for the OS197L TC system by far exceed (by orders of magnitude) the dose rates of the OS197 TC system following any off-normal or accident condition. It is incorrect to state that the shielding features of the OS197L TC are the same as the shielding features of the OS197 TC. This statement needs to be clarified to avoid the misperception that the dose following off-normal or accident conditions are comparable between the OS197L TC and the OS197 TC.

This revision is necessary for compliance with 10 CFR 72.236(d).

5-15 Clarify Section W.5.2.2 and provide suggested text to revise the Technical Specifications and Sections W.5.2.1 and W.5.2.2 as appropriate.

- The first bullet in Section W.5.2.2 states: "The response function results determined in Section W.5.2.1 indicate..." However, Section W.5.2.1 does not contain any response functions; rather Section W.5.2.1 states that response functions were developed for two bounding configurations, and that the functions were "similar to that documented in Appendix M, Section M.5.2.4." However, only limited further discussion is provided regarding the similarities and differences between the response functions determined for the OS197L TC and those presented in Section M.5.2.4. Section W.5.2.1 seemingly indicates a change may be necessary to Figures 1-2 through 1-7 in the Technical Specifications as it states that the design basis source terms for the inner assemblies are different for the 32PT DSC loaded in the OS197L TC.

Justify, from both a thermal and radiological perspective, that the heat load zoning configurations in the technical specifications (Figures 1-2 through 1-7) are bounding for the 32PT DSC when loaded in the OS197L TC.

- The third bullet in Section W.5.2.2 states that the total gamma source terms of the design basis 32PT DSC and 24PHB fuel assemblies are "not significantly different." However, the fourth bullet states that "the gamma surface dose rates for the OS197 TC with the 32PT DSC are higher than that of the 24PHB DSC." Clarify why the gamma dose rates for the OS197L TC loaded with the 32PT DSC

are higher than the dose rates for the OS197L TC loaded with the 24PHB, when the total source terms are "not significantly different."

This information is necessary to satisfy the requirements of 10 CFR 72.236.

- 5-16 Clarify the assumptions used to determine the dose rates presented in the tables in Section W.5 of the SAR, and revise Section W.1 to include a drawing of the interim top cask cover.
- Clarify in Section W.5.4.7 whether the MCNP models include water inside the DSC.
 - Revise Figure W.5-5 to clarify what material was modeled (air or void) between the 0.19" thick neutron shield panel and the 2.5" thick inner top supplementary trailer shielding. Similarly, clarify what material was modeled in the DSC/TC annulus.

This information is necessary to ensure compliance with 10 CFR 72.236.

- 5-17 In Section W.5.4.7, clarify that shielding configurations 3, 5, and 8 represent normal conditions.

Section W.5.4.8 states that normal conditions consider the 32PT DSC in the OS197L TC with water in the neutron shield and 5.5 inches of supplemental trailer shielding. However, the conditions described in shielding configurations 3, 5, and 8 are unavoidable during normal operations of the OS197L TC with the 32PT DSC.

Further, Table W.5-1 should be revised to reflect that under normal conditions, when the neutron shield is drained and the interim cask cover installed, for the evolution of the OS197L TC from the decontamination area to the transfer trailer, the surface dose rate of the bare OS197L TC will be 87 rem/hr.

This information is necessary to ensure compliance with 72.236.

- 5-18 Define the terms "normal accident," "off-normal accident," "design-basis accident," (an implied term) and "beyond-design basis accident" used in Section W.5.4.9.

These terms do not have any regulatory significance. The use of "normal," "off-normal," and "beyond-design basis" seem to imply some risk significance associated with the conditions these terms are used to describe. Clarify the meaning of these terms, and state whether their use indicates that a risk assessment was performed.

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

- 5-19 In Section W.5.4.9, clarify that the loss of neutron shield is a normal condition that describes the evolution of the OS197L TC transfer cask from the decontamination area to the transfer trailer, when loaded with the 32PT DSC.

The first configuration discussed in Section W.5.4.9 describes the loss of water in the neutron shield. This configuration is encountered during normal operations involving the OS197L TC during the movement from the decontamination area to the transfer trailer.

However, this configuration is presented only as an accident condition. If this condition is to be treated as one of the accident conditions analyzed, a disclaimer must be inserted into Section W.5.4.9 stating that this configuration is also encountered during normal operations.

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

5-20 Clarify the discussion in Section W.5.4.10.4.

- Clarify whether the temporary cask lid may be used only on the 32PT DSC or on the other DSCs as well. Based on the assumptions and statements in the calculations provided by the applicant, the staff believes that the temporary cask lid is only to be used with the 32PT DSC.
- Section W.5.4.10.4 discusses Tables W.5-6 through W.5-9, which list both radial and axial dose rates. The text states that the axial dose rates were determined assuming the DSC/TC annulus and the neutron shielding are both drained, but does not state what configuration was assumed for estimating the radial dose rates. Clarify whether the DSC/TC annulus and the neutron shielding were assumed to be filled or drained for the radial dose rates listed in Tables W.5-6 and W.5-7.

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

5-21 Clarify Figure W.5-2 and the associated discussion in section W.5.4.7.

Revise Figure W.5-2 to clarify whether both neutron and gamma dose rates are included in the figure. Modify the discussion and the figure to specify both the shielding configurations and the locations being modeled. Additionally, explain why the above-cask-support-skid dose rate increases from 0 to 1 meter. It may be necessary to provide a figure to describe the dose rate location that was being modeled.

This information is required for compliance with 72.236(d).

5-22 In Section W.8, clarify whether water may be pumped out during the lift from the fuel pool for any DSCs other than the 32PT DSC. Additionally, clarify the required minimum amount of water to be pumped out for weight considerations.

As written, it is unclear on p. W.8-4 whether water may be pumped out during the lift from the fuel pool for other DSCs certified for transfer in the OS197L TC. Additionally, it is unclear that there is a minimum amount of water that must be pumped out when lifting the 32PT DSC with the OS197L TC from the fuel pool. It is the staff's understanding that a minimum amount of water must be pumped out to achieve the 75-ton weight limit.

These revisions are required for compliance with 10 CFR 72.236.

5-23 Place warnings, as appropriate in Section W.8 of the SAR to alert the user that the OS197L TC dose rate may be as high as 87 rem/hr in the event that the neutron shield is to be drained to reduce weight during the transfer from the decontamination area to the transfer trailer.

The dose calculations in Section W.5 indicate that the already very high dose rate on the surface of the OS197L TC (when loaded with design-basis fuel in the 32PT DSC) will become as high as 87 rem/hr when the neutron shield is drained for weight considerations during the lift from the decontamination area to the transfer trailer. This very high dose rate poses occupational hazards and should be pointed out in the operating procedures for the system. Furthermore, it is important to highlight the very high dose rates associated with this evolution so that the user of the system can ensure compliance with Part 20 dose limits and have proper ALARA planning in place in case of an off-normal condition such as a crane hang-up.

This information is required for compliance with 10 CFR 72.236.

- 5-24 Clarify whether spraying the TC with water as it is lifted from the pool may be accomplished remotely.

Step 19 of Section W.8.1.2 directs the user to lift the TC from the pool and spray the cask as it is raised from the pool. However, step 18 requires personnel to evacuate the area, due to the high dose rates from the loaded TC. Clarify whether this step may be performed remotely; if so, describe any role of the decontamination area shielding (describe any spray or other systems built into the decontamination area shielding). If this step may not be performed remotely, revise the worker doses anticipated in section W.10 of the SAR accordingly.

This information is required for compliance with 10 CFR 72.236 and to assure compliance with the worker dose limits in 10 CFR Part 20.

- 5-25 Justify the assertions that there are no necessary changes in sections W.8.3, W.8.4, W.8.5, W.8.6, W.8.7, or W.8.8. Additionally, if indeed no changes are necessary, provide clarification as to what is not being changed (e.g., no changes are necessary to SAR section 5.6).

Sections W.8.3, W.8.4, W.8.5, W.8.6, W.8.7, and W.8.8 appear to refer to various parts of Section 5, which contains procedures for using a full-weight TC. It appears that there is a need for several changes to these sections to address use of the light-weight TC. For instance, Section W.8.4 appears to refer to Section 5.2 in the SAR. Either Section 5.2 needs to be revised to be consistent with the OS197L, or it needs to refer the reader to section W.8.4 in Appendix W, and that section needs to be revised to contain the appropriate information for the OS197L. Additionally, it seems unlikely that the first frame of the continuation of Figure 5.2-1 on page 5.2-5 is a correct depiction of how the decontamination of the OS197L should be handled. Ensure that any figures that are provided for Section W.8.4 correctly reflect modifications needed due to the high dose rates near the OS197L.

In addition to addressing the discrepancies between Section 5.2 and Section W.8.4, justify that there are no changes needed for Sections W.8.3, W.8.5, W.8.6, W.8.7, and W.8.8. Alternatively, change the appropriate parts of Section 5 to address the operational considerations for the light-weight TC.

If there are truly no changes to any of these sections, clarify what is not being changed so that it is clear to which part of the SAR the reader is being referred (i.e., Section 5 of the base SAR vs. the operating systems section of Appendix M). For example, revise the

text in section W.8.8 to read "No change needed from information provided in SAR section 5.6."

This information is necessary for compliance with 10 CFR 72.236(d).

- 5-26 Clarify and justify the assumptions supporting the analysis of the representative malfunction scenarios described in section W.10.1.
- Scenario 3 is described as "same as previous with more bounding assumptions for distances." It is unclear if "same as previous" refers to scenario 1 or 2. Additionally, clarify the assumptions used to determine worker dose, including the assumed axial and radial distance of the workers from the transfer cask and the amount of time each worker is assumed to be at each position.
 - Clarify the second bullet on p. W.10-2, which states: "These dose rates are conservative for scenario 1 since water is present in the neutron shield and in the DSC." It is more conservative if water is not present in the neutron shield and in the DSC. Furthermore, the operating procedures require draining of some water from the DSC to meet the 75-ton weight requirement. Justify that it is conservative to have modeled water in the neutron shield and the DSC for this scenario.
 - Justify the statement "[t]hese three scenarios conservatively bound all other postulated malfunctions involving remote handling equipment..." Specifically, address why the TC in the horizontal position conservatively bounds the scenario where the crane hangs up while the TC is at an angle as it is being lowered onto the transfer trailer.
 - Clarify for which scenario the table on p. W.10-3 is applicable. Additionally, clarify what configuration was assumed for determining the radial and axial dose rates in this table. The dose rates presented here seemingly contradict the dose rates presented in section W.5 of the SAR (tables W.5-5, W.5-8, and W.5-9), which state that the radial surface dose rate with water in the neutron shield is 53 rem/hr (versus 0.192 rem/hr reported in section W.10). Section W.5 of the SAR does not provide axial dose rates with water in the neutron shield; however the dose rates in the table on p. W.10-3 do not seem to be supported by the axial dose rates presented in section W.5.

This information is necessary for compliance with 72.236(d).

- 5-27 Justify the method of analysis used to determine the 100-meter dose rate of 144 mrem for the OS197L TC in SAR section W.11 (and also in NUH06L-0501).

Section W.11.1.4 (page W.11-4) states that the 100-meter dose for the OS197L TC was determined assuming that the OS197L TC was loaded with the 32PT DSC. Section W.11.1.4 also states that the 24PHB is expected to result in a higher 100-meter dose rate under accident conditions, based on the fact that the 24 PHB resulted in the highest 100-meter dose rate in the full-weight OS197 TC. Rather than calculating the accident dose rates for the OS197L loaded with the 24PHB, section W.11.1.4 uses ratios to scale the accident dose rates obtained for the OS197L TC loaded with the 32PT in order to obtain the doses that may be expected for the OS197L loaded with the 24PHB.

The ratio method scales the dose rates for the OS197L loaded with the 32PT DSC (OS197L-32PT) as follows:

$$\frac{\text{OS197} - 24\text{PHB} \times \text{OS197L} - 32\text{PT}}{\text{UFSAR} - 32\text{PT}}$$

Justify that this ratio method is appropriate, and be sure to address the different methodologies used to determine the OS197 TC dose rates and the OS197L TC dose rates. Further, discuss the difference in the quality of radiation between the 24 PHB and the 32 DSC. In the 32PT DSC, gamma radiation accounts for 83% of the source term, whereas in the 24PHB DSC, gamma radiation only accounts for 60% of the source term.

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

- 5-28 Justify assumption 4.5 used to determine worker doses for crane failure in calculation NUH06L-0503.

Assumption 4.5 states that typical distances between the workers and the cask are assumed to be on the order of 10 meters, and that these distances are justified since this represents approximately twice the length of the cask. Explain why the length of the cask impacts the assumption of where the workers may be with respect to the cask.

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

- 5-29 Revise Section 10 of the SAR to include the additional considerations for enhancing radiation protection that are listed in section 6.0 of calculation NUH06L-0503.

The third paragraph of Section 6.0 of calculation NUH06L-0503 states some additional considerations for enhancing radiation protection. This paragraph should be reflected in Section 10 of the SAR, to help ensure that plant personnel take all necessary precautions when using the high-dose rate OS197L TC.

This information is necessary to ensure compliance with 10 CFR 72.236(d).

- 5-30 Justify the use of 50.8 meters for determining at what distance the axial maximum and the averaged value of angular dependent dose rates are equivalent.

In calculation NUH06L-0500, it was determined that there would be no difference between the axial maximum and the averaged value of the angular dependent dose rate distribution at distances greater than 50.8 meters. However, this distance (50.8 meters) was determined based on calculations for Configuration E. Configuration E surface dose rates are more than two orders of magnitude lower than the OS197L surface dose rates. Justify that the dose rate distribution is not angular-dependent at distances greater than 50.8 meters for the OS197L.

This information is necessary to ensure compliance with 10 CFR 72.236(d).

- 5-31 In Calculation NUH06L-0503, clarify/revise the tables and discussions on pages 17 - 21 relating to scenarios 1 and 2.

The discussions indicate that scenario 2 results in higher doses than scenario 1, but the doses shown in the tables and text do not support this statement (specifically, 970 for scenario 1 is greater than the 956 given for scenario 2). Additionally, provide further explanation for how the backscatter correction factors were chosen. It is not inherently clear that the selected backscatter factors are appropriate. Further, clarify the discussion to expand on the assumptions used for calculating worker doses presented in Tables 5-4, 5-5, and 5-6. It is not clear what assumptions were made regarding the location of the workers, particularly for the steps involving traversing to the crane bridge and to the crane. Provide a fuller explanation of the assumptions used to determine what dose rates the workers were exposed to and for what periods of time.

This information is necessary to ensure compliance with 10 CFR 72.236(d).

- 5-32 Justify the use of Configuration K axial dose rates to estimate Configuration B axial dose rates in Table 9-1 in calculation NUH06L-0504.

Table 9-1 states: "Configuration K dose rates are used because of poor convergence of tallies for top dose rates from Configuration B MCNP model in the current analysis. Such a usage is justified in a discussion of Section 5 suggesting that dose rates on Top of the TC within radial dimensions less than radius of TC are not dependent on shielding configuration types." Section 5 does not readily present an analysis supporting this conclusion, especially for distances greater than 0 from the TC top lid. Justify the use of Configuration K dose rates to determine Configuration B dose rates. If the applicant chooses to continue to make such a substitution rather than improving the MCNP model for Configuration B so that it converges appropriately, further discussion is needed to support the use of this method, especially at distances greater than the TC radius.

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

- 5-33 Revise SAR Appendix W to remove all instances of the statement "currently licensed DSCs."

The NUHOMS system is quite complex, with several types of DSCs and TC designs. Given the ambiguity in the text regarding the definition of the "OS197 type TC" and the "standard TC," the SAR should clearly state which DSCs the OS197L TC is licensed to transfer. The staff notes in particular that the text on SAR p. W.3-1 should be revised, but emphasizes that the applicant is responsible for identifying other instances of similarly ambiguous text.

This revision is necessary for compliance with the requirements of 10 CFR 72.236.

- 5-34 Clarify the discussion in the second paragraph of Section W.5.4.8.3.

It is not clear from this discussion that the neutron streaming through the seams of the OS197L neutron shield is adequately analyzed. The discussion seemingly refers to a model that utilizes temporary shielding in addition to the OS197L TC. Clarify the configuration that was modeled to determine the increased neutron dose through the seams of the neutron shield.

This information is necessary to verify compliance with 10 CFR 72.236(d).

The following RAIs reflect staff Quality Assurance concerns and questions.

5-35 Provide suggested text to revise TS 5.2.4 to address the following:

Revise 5.2.4a2 to indicate that the dose rates to be included are those on the surface, at the controlled area boundary, and in the most affected unrestricted area (if any). These values are needed to evaluate the impact on 10 CFR 72.104 and 10 CFR 20.1301(a)(2) dose limits.

This revision is necessary to ensure compliance with 10 CFR 72.236.

5-36 Revise SAR section 3.1.2.1 to include the remote handling and optical targeting system equipment in the first paragraph, which describes equipment required to implement the NUHOMS[®] system. Additionally, Table 3.1-7 should be revised as necessary.

While it is stated later in this section that the OS197L TC is described in detail in Appendix W, the opening paragraph in this section is generic to the NUHOMS[®] system. This paragraph should be revised to either address that additional handling and transfer equipment for the OS197L TC is discussed in Appendix W, or to mention the remote handling and laser/optical targeting system required for safe use of the OS197L TC.

This revision is necessary to satisfy the requirements of 10 CFR 72.236(d).

5-37 Revise SAR Section 4.2.3.3 to address the following:

- Clarify that for the OS197L TC, the principal biological shielding is provided by the supplemental shielding used in the decontamination area and on the transfer trailer. Section 4.2.3.3 of the SAR states: “The transfer cask provides the principal biological shielding and heat rejection mechanism for the DSC and SFAs during handling in the fuel/reactor building...” This statement is not true for the OS197L TC, which requires the use of remote operations and supplemental shielding to provide sufficient biological shielding for safe handling. This statement needs to be revised to accurately reflect all the TCs included in the NUHOMS[®] system.
- Clarify the various terms used for the TC. SAR section 4.2.3.3 refers to the “NUHOMS[®] TC,” the “standardized TC,” and the “OS197.” It is not clear what is meant by the various terms; they seem to be used interchangeably for the same TC, but it is not evident that such an interpretation of the terms is valid.
- Revise the first sentence in the third paragraph of SAR section 4.2.3.3 to clarify that the OS197L is not documented in Appendix E, but is described in Appendix W.
- Revise the third paragraph on p. 4.2-10 in SAR section 4.2.3.3 to also discuss that remote operations and a laser/optical targeting system are used in conjunction with supplemental shielding to compensate for the lack of lead shielding.

This revision is necessary to satisfy the requirements of 10 CFR 72.236(d).

5-38 Revise SAR section 4.7.3.2 to clarify the following:

- On p. 4.7-5, clarify what is meant by the “typical transfer cask.” Additionally, clarify what specific TC designs are encompassed by the “standardized/OS197 type casks.” Revise the text to clarify that the OS197L TC, despite what its name may indicate, is not the “typical” TC as it provides much less radiological shielding and requires the use of remote handling equipment and supplemental shielding for safe operations. Make this revision in any other applicable place in the SAR, e.g., p. 4.2-9 refers to the “OS197 type cask” and the “standardized cask.”
- On p. 4.7-5, revise the text to state that the OS197L TC does not contain any lead shielding. Section 4.7.3.2 describes the “standardized/OS197 type casks” as steel-lead-steel designs. This section then describes the OS197L TC but does not mention that the lead shielding is removed.
- Revise the text at the bottom of page 4.7-6 that states, “The transfer cask is designed to provide adequate shielding to maintain the maximum radiation surface dose to less than 5 R/hr combined gamma and neutron for a cask drop accident event assuming a complete loss of neutron shielding.” This statement is not true for the OS197L TC, which has a surface dose rate exceeding 100 rem/hr for the complete loss of neutron shielding event. Additionally, to be accurate, the dose rate described should be in rem per hour, not R per hour.

These revisions are necessary to satisfy the requirements of 10 CFR 72.236(d).

5-39 Revise SAR Section 7.1.2 (specifically items C and D) so it appropriately accounts for the OS197L TC.

Items C and D have not been revised to reflect the significant differences between the OS197 and OS197L TCs. The OS197L transfer cask is not heavily shielded, as item C describes the transfer cask to be. Additionally, the fuel loading procedures are unique for the OS197L TC, which requires item D to be revised accordingly to accurately describe the NUHOMS system.

These revisions are necessary to satisfy the requirements of 10 CFR 72.236(d).

5-40 Correct the apparent discrepancies in SAR section 10:

- Table 10-2 states that the bases for TS 5.2.4e are located in B 10.5.2.4e. While this part of the bases does address TS 5.2.4e, the transfer cask dose rate evaluation program is also discussed in bases B 10.5.3.4. However, TS 5.3.4 discusses the supplemental shielding drop onto the OS197L TC. It does not appear that bases exist for TS 5.3.4.
- Bases B 10.5.3.4 discusses the transfer cask dose rate evaluation program. TS 5.2.4e provides transfer cask dose rates for the OS197L TC. These dose rates are discussed in Appendix W. However, B 10.5.3.4 does not list Appendix W.

- Add Appendix W to the list of bases in SAR section 10.

Correction of these apparent discrepancies is necessary for compliance with the requirements of 10 CFR 72.236(d).

- 5-41 Clarify the assumptions used to determine the dose rates presented in the tables in Section W.5 of the SAR, and revise Section W.1 to include a drawing of the interim top cask cover.

- Clarify the assumed thickness and material used to model the interim top cask cover. Section W.3.9 states that the interim top cask cover is a 1-inch-thick aluminum plate. Sections W.5.4.6.2 and W.5.4.10.4 state that the interim top cask cover was modeled as a 2-inch-thick aluminum plate. Figure W.5-5 on p. W.5-30 shows that the interim cask lid is 1.5 inches thick. Figure W.5-5 on p. W.5-31 shows that the interim cask lid is stainless steel, and implies that the modeled thickness was 2 inches. Correct the text and figures as necessary to clarify what thickness (1, 1.5, or 2 inches) was actually modeled, as well as what material (aluminum or steel).

This information is necessary to ensure compliance with 10 CFR 72.236.

- 5-42 Clarify and explain apparent discrepancies in the tables in Section W.5.

- Clarify whether the dose rates listed for the OS197L TC were calculated assuming that the interim (aluminum) cask lid was installed in Table W.5-2.
- Clarify in Table W.5-2 that the dose rates listed occur under normal conditions for when the OS197L TC, loaded with the 32PT DSC, is moved from the decontamination area to the transfer trailer.
- Explain the apparent discrepancies between the dose rates reported in Table W.5-7 and the dose rates listed in Tables W.5-5 and W.5-6. The radial surface dose rates listed for the bare OS197L TC (with and without water in the neutron shield) are significantly lower than the radial surface dose rates listed in Tables W.5-5 and W.5-6. Justify why there is such a large difference in these dose rates. Additionally, clarify what dose rates were used in the worker dose assessment in SAR section 10.
- Discuss the distinction between the “absolute maximum” and the “maximum” radial positions/dose rates listed in Table W.5-8.
- Clarify the location of the dose rates listed in Tables W.5-12, W.5-13, and W.5-14.

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

- 5-43 Correct the text in Technical Specification 5.2.4 and in Sections W.8.1.2 and W.8.1.5 so that both remote operations and other mitigating ALARA practices are required.

The use of remote operations is required by Technical Specification 4.4.3, which states “The bare OS197L (Light Weight, 75 ton Version) TC shall be handled using remote

operations...” Technical Specification 5.2.4 and Sections W.8.1.2 and W.8.1.5 state: "Licensee [sic] shall use remote operations or other mitigating ALARA practices...” Revise the text to change the "or" to "and," such that the use of remote operations is not optional, and to avoid non-compliance with Technical Specification 4.4.3. Remote operations are essential for keeping doses to an acceptable level when using the OS197L TC, and are required per the technical specifications.

Ensure that this revision is made in any other sections of the SAR, CoC, and TS, as necessary.

This revision is necessary for compliance with 10 CFR 72.236(d).

5-44 Clarify and make any necessary corrections to sections W.8.1.2 and W.8.1.6:

- Step 21 of Section W.8.1.2 (page W.8-17) states, “Placement of the shielding bell shall be **periodically (every hour) performed ...**” (Emphasis added.) It seems unlikely that the shielding bell needs to be placed more than once, so it seems that some text may have been omitted, or otherwise incorrectly edited.
- Step 20 of section W.8.1.6 (page W.8-27) states, “Install the DSC **axial in retainer through** the HSM door opening.” It appears that extra text has been added or text has been incorrectly edited.

These revisions are necessary to ensure compliance with 10 CFR 72.236(d).

5-45 Clarify, by revising the drawing of the decon area cask shielding assemblies and/or the steps in section W.8.1.3, how the decontamination and evaluation of contamination levels can be accomplished.

Step 1 of Section W.8.1.3 refers to the DSC removable contamination limits in TS 5.2.4d. This is being applied to the TC. It is not clear to staff how either the decontamination or surveys will be accomplished with the TC and DSC inside the supplemental shielding.

Step 4 of Section W.8.1.3 refers to the exposed surfaces of the DSC shell. It is not clear to staff what surfaces of the DSC shell will be exposed and how either the decontamination will be accomplished or the TC/DSC annulus seal removed with the TC and DSC inside the supplemental shielding.

This revision is necessary for compliance with 10 CFR 72.236(d).

5-46 Clarify and justify the assumptions supporting the analysis of the representative malfunction scenarios described in section W.10.1.

This information is necessary for compliance with 10 CFR 72.236(d).

5-47 Revise the wording on Page W.11-3 as originally requested in RAI 5-54 (of the first round of RAIs) to indicate that the total dose at 100 meters is at the controlled area boundary, not the "site boundary." Note that this was corrected in the first instance where it appeared, but not the second.

Page W.11-3 reports the total dose at the "site boundary," which is a term defined in 10 CFR Part 20 and is not necessarily the same as the controlled area boundary, which is defined in 10 CFR Part 72.

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

5-48 Clarify/justify the values in the tables in calculation NUH06L-0504 and include discussion as appropriate in SAR section W.5, especially as pertains to the tables.

- Explain the apparent discrepancy between the total dose rate values and the gamma plus neutron dose rates. In several of the tables in this calculation, the value given for total radiation dose rate is not equal to the sum of the gamma plus neutron dose rates.
- Explain the apparent discrepancy in the relative errors for the total dose rate values. The value for the relative error of the total dose rate is often less than the value of one or both of the relative errors that were presumably used in its calculation.

This information is necessary to ensure compliance with 10 CFR 72.236(d).

5-49 Provide clarification regarding the response to (original) RAI 5-16.

- Explain the apparent discrepancy regarding the rejection of a three shell (steel, lead, steel) configuration. This is precisely the construction of the standard OS197 transfer cask. The response to RAI 5-16, as well as calculation NUH06L-0501, stated, "... use of a three shell configuration (inner, lead and outer) results in the degradation of the thermal performance of the TC due to introduction of additional thermal resistance..." The OS197 TC is a three shell configuration (steel-lead-steel), and is used for the same DSCs that are proposed for use in the OS197L TC. Why is the three-shell configuration problematic for the OS197L with respect to thermal performance, but not for the OS197?
- Explain the apparent discrepancy regarding the weight of Configuration C. The response to RAI 5-16 states that Configuration C did not meet the 75 ton weight requirement. However, calculation NUH06L-0500 indicates that Configuration C is within the 75-ton weight limit. Calculation NUH06L-0501 states that Configuration C was not considered because the design did not meet structural performance requirements, and does not mention weight as a concern. Clarify the apparent discrepancies between the statements in the response to RAI 5-16 and the statements in calculations NUH06L-0500 and NUH06L-0501.

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

The following RAIs are editorial.

- 5-50 Correct the typo in TS 5.2.4e: "TRANSFSR CASK (TC)" should be "TRANSFER..."
- 5-51 Correct the typo in TS 5.3.4: "damaged" should be "damage".
- 5-52 Revise section 5 of the SAR to add a statement at the beginning of the section indicating that the operating procedures for the OS197L TC are in Appendix W.

The text is not currently clear in that the operating procedures for use of the OS197L TC are significantly different and are captured in Appendix W of the SAR. It is necessary to be as clear as possible with regards to the operating procedures to avoid human error, especially when dealing with such a high dose rate TC as is the OS197L.

- 5-53 Correct the apparent typo in B 10.5.2.4a: 10 CFR 72.21.2(b)(2)(i)(C) should be 10 CFR 72.212(b)(2)(i)(C).
- 5-54 Correct the apparent typo on drawing number NUH-03-8012.

Note 9 on drawing NUH-03-8012 refers to the "DEACON AREA SHIELDING." The staff believes this should be the "DECON AREA SHIELDING."

- 5-55 Correct several typos in SAR section W.5. Please note that while the staff has identified several typos, the applicant should ensure that any typos the staff has not specifically identified should also be corrected.
 - In the second paragraph of section W.5, the staff believes that the 61BT and 52B DSCs referred to should be the 61BTH and the 32PTH DSCs.
 - In section W.5.1, correct the statement: "A brief description of the various shielding configurations evaluated **herein in provided in** Figure W.5-1..." (Emphasis added).
 - In section W.5.2.1, correct the statement: "The results of the ANISN evaluation demonstrate that the dose rates **on an around** the OS19L..." (Emphasis added).
 - Correct the various instances of: "OS19L" (pp. W.5-2, W.5-6, W.5-8, W.5-9) and "OS19IL" (p. W.5-6).
 - In Section W.5.4.8.1, p. W.5-9, the staff believes that the reference to "Section W.5.4.7.2" should be a reference to Section W.5.4.8.2, and that the reference to "Section W.5.4.7.3" should be a reference to Section W.5.4.8.3.
 - In Section W.5.4.10.1, p. W.5-12, the third sentence states: "The DSC cavity contains water..." The staff believes that this should state that the DSC cavity does **not** contain water.
 - In Section W.5.4.10.4, revise the following sentence so that it is grammatically correct: "During this operation, the TC neutron shield is empty and a temporary 2" aluminum cask lid **consisting is utilized** for weight management." (Emphasis added.)

5-56 Correct the typo in step 14 of Section W.8.1.5 (page W.8-25), where the user is directed to check for "streaming" rather than "steaming." Additionally, correct any other instances of this typo.

5-57 Correct the apparent typo in step 19 of section W.8.1.3.

Step 19 of Section W.8.1.3 refers to the TC dose rates in TS 5.3.4e. There is no TS 5.3.4e. The staff believes that step 19 should refer to TS 5.2.4e, which contains TC dose rates.

5-58 Correct the typo on the second line at the top of p. W.10-2: "bar" should be "bare."

CHAPTER 7 Materials Evaluation

7-1 Add footnotes requiring testing of the boron content, similar to current footnotes (2) and (3), to the other models in the table in Section 4.1 of Amendment 11.

The boron in the plates is used for criticality control. Inadequate boron in the plates could allow unexpected criticality to occur

This information is needed to verify compliance with 10 CFR part 72.124 (b) Criteria for nuclear criticality safety.

7-2 Modify SAR Section 5.1.1.9 to describe the operations and condition limitations that are necessary to prevent oxidation of the fuel during dry cell loading. Any limitations to prevent oxidation during unloading should be included by reference in the Technical Specifications.

Section 5.1.1.9 of the SAR suggests the possibility of unloading operations outside of a spent fuel pool (i.e., in a dry cell). The proposed operations descriptions are the same as for wet unloading in a spent fuel pool except for the removal of operations involving filling and draining the MPC with water. However, the operations overlook the prevention of fuel oxidation, a critical issue when spent fuel is exposed to an oxidizing gaseous atmosphere. The concerns expressed for fuel oxidation during loading in Interim Staff Guidance (ISG) No. 22, "Potential Rod Splitting Due To Exposure To An Oxidizing Atmosphere During Short-Term Loading Operations In LWR Or Other Uranium Oxide Based Fuel," also hold for unloading. ISG-22 discusses fuel oxidation, the conditions for which it can occur and means for its prevention. As stated in ISG-22, fuel oxidation can result in gross cladding breaches and create shielding, criticality and fuel dispersal concerns. The ISG further indicates that the oxidation concern extends to intact fuel as well, since intact fuel may have pinhole leaks and hairline cracks, which provide a path for the loading atmosphere to reach the fuel.

The applicant should provide a description of the essential operations and condition limitations through which fuel oxidation is prevented in Section 5.1.1.9 of the SAR. One way to prevent fuel oxidation is to limit dry cell unloading to only that fuel which is known to have no breaches (including pinhole leaks and hairline cracks). This limitation will necessitate the use of an appropriate method to ensure to a high level of confidence that a fuel assembly does not have any cladding breaches. As stated previously, the staff believes 4-sided visual inspections of an assembly, alone, are insufficient to provide the

necessary confirmation. Methods such as sipping, ultrasonic testing, and a review of reactor records can provide the necessary level of confidence.

For dry unloading of fuel containing cladding breaches, ISG-22 provides possible options to control and/or prevent fuel oxidation. One of these is to maintain the fuel rods in an inert environment. In developing the necessary operations and limitations, the applicant will need to consider impacts on other areas such as contamination control.

Note that if any discussion on unloading is added to appendix W it would also have to address the issue in this RAI.

This information is needed to confirm compliance with 10 CFR 72.236(h) and 72.236(l).