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Office of the Secretary
Rulemaking and Adjudications Staff
U.S. Nuclear Regulatory Commission
Washington DC 20555-001

Subject: TN Response to CoC 1004 Amendment No.5 Rule Making Comments

References: 1. Comments on Direct-to-Final Rule on Amendment No. 5 to CoC No. 1004 from Global Energy Consultants, LLC, Dated September 11, 2003 (RIN 3150-AH26).

2. Direct Final Rule to Add Amendment No. 5 to CoC 1004, Federal Register, Volume 68, No. 160, August 19, 2003 (RIN 3150-AH26).

Dear Sir:

Transnuclear Inc. (TN) has carefully reviewed the comments received by the NRC (Reference 1) and prepared a detailed response that establishes our technical position with regard to these comments.

TN understands that it is not required to provide a response to the referenced comments. Nevertheless, we have provided a detailed response that demonstrates unequivocally why the direct final rule to add NUHOMS®-32PT DSC to CoC 1004 (Reference 2) is technically sound and procedurally appropriate.

Attachment A provides a detailed response to each comment. The response shows that in each case, the comments fall in one or more of the following three categories:

- Comments are based on inaccurate assumptions about the design features of the NUHOMS® system and its licensing bases (Comments: 2, 3, 4, 5, 7, 8, 12, and 15),

- Information already provided in the latest Amendment (SAR) Application, associated Technical Specifications, or the NRC SER was either misunderstood or misinterpreted (Comments: 1, 3, 7, 10, 11, 12, 15), and

- Comments related to the design, fabrication, and operation of the NUHOMS® system have no technical merit (Comments: 2, 5, 6, 7, 8, 9, 11, 13, 14).

TN strongly believes that none of the comments have any significant and adverse impact on the design as submitted in CoC 1004 Amendment 5, nor would the comments warrant any additional technical review of the amendment application. As clearly demonstrated in Attachment A, the comments do not require any change to the CoC No 1004 Amendment 5 or associated Technical Specifications or SER.

We urge the NRC to document its response to the comments received and move expeditiously with the due process of issuing a final CoC for this amendment.

Template = SECY-067

SECY-02

If you need any additional clarification, please do not hesitate to contact me at 510-744-6053.

Sincerely,

U. B. Chopra
Licensing Manager

Docket 72-1004

Attachment A: TN Response to CoC 1004 Amendment No. 5 Rule Making Comments.

cc:

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TN Response to CoC 1004 Amendment No. 5 Rule Making Comments

Comment No. 1: Ambiguous Technical Specification with Respect to Acceptable Seismic Motion

Response to Comment 1:

The NUHOMS® Technical Specifications (TS) Section 1.1.1, Page A-1, clearly state that the "site-specific parameters and analyses identified in the SER, that will need verification by the system user...".

Each licensee needs to verify that the 0.25g horizontal and 0.17g vertical design basis peak accelerations bound those for a specific site. Section 3.1.2.1.7 of the SER [1] further clarifies this requirement by stating that the HSM seismic design is based on the NRC Reg. Guide 1.60 response spectra with a horizontal ground acceleration of 0.25g and a vertical acceleration of 0.17g applied at the top of the concrete pad/basemat of the HSM. Section M.3.7.3 of the SAR [2], and Section 3.2.3 and Figure 8.2-2 of the FSAR [3], clearly indicate that the NUHOMS® system design is based on the R.G. 1.60 Response Spectra anchored to peak accelerations (zero-period accelerations) of 0.25g horizontal and 0.17g vertical.

Evaluation for site-specific soil conditions, including the effects of soil-structure interaction, are addressed by the system user, consistent with the provisions of 10CFR 72.212.

Therefore, no ambiguity exists in the Technical Specification requirement with respect to seismic motion.

Comment No. 2: Lack of Demonstration to Compliance with 72.130

Response to Comment 2:

The required alignment of the DSC with respect to the HSM specified in NUHOMS® Technical Specifications 1.2.9 is not a tedious but a simple and routine loading operation, as demonstrated by the successful loading of over 213 NUHOMS® canisters currently in operation without any significant incident during loading.

Effect of Long-Term Settlement:

As stated in FSAR Section 1.3.1.2, the design of the ISFSI pad consists of a reinforced concrete pad placed over a compacted engineered fill subgrade. Thus the assertion that there is an "absence of a mandated hard subgrade,..." is incorrect.

The NUHOMS® Transfer System incorporates design features that allow the centerlines of the DSC/HSM and TC to be accurately aligned under cases involving large uneven settlements.

Therefore, retrievability of the DSC is assured, and the requirements of 10CFR72.130 are met.

Effect of Weather:

The potential for surface corrosion under the ambient environmental conditions and its effect on the retrievability of the DSC has been considered by selection of corrosion resistant materials. The DSC shell structure is fabricated from ASME SA-240, Type 304 stainless steel. The material used as the sliding surface of the DS is a high-hardness stainless steel plate (Nitronic® 60). This plate is mounted on the HSM rails as shown on drawing NUH-03-6016-SAR contained in FSAR Appendix E. The surface of the Nitronic® 60 plate is smooth and lubricated to minimize friction. Furthermore, both the DSC and the DSC support structure are housed inside the HSM reinforced concrete structure, and protected from direct exposure to weather by the HSM.

Therefore, the NUHOMS® design appropriately considers the effect of ambient environmental conditions and the retrievability of the DSC is assured, and the requirements of 10CFR72.130 are met.

Pull Load of 60 kips less than insertion load of 80 kips:

The assertion that " the permitted pull force is only 60 kips" is incorrect. As shown in FSAR Table 3.2-1 (Design Loadings), and Table 8.2-25 (Load Combinations), the DSC is evaluated for a normal condition pull load of 60 kips and an accident condition pull load of 80 kips. The 60 kips normal condition load is set to ensure adequate margin vis-a-vis the calculated pull load of less than 30,000 lbs (29, 580 lbs per FSAR Section 8.1.1.1.D for 32PT DSC bounding weight of 102,000 lbs), based on a friction coefficient of 0.25 per FSAR Section 8.1.1.1.D (not 0.2 as indicated in the comments). Alternatively stated, to develop the 60 kips pull load the required friction coefficient is 0.51,which is significantly higher than the 0.25 value. The accident condition pull load is 80 kips. Similarly, the friction coefficient associated with the 80 kips pull load is 0.68 (for the 32PT DSC). These friction coefficients are sufficiently high to consider any effects due to potentially weathered surfaces.

Therefore, retrievability of the DSC is assured, and the requirements of 10CFR72.130 are met.

Bottom Cover Plate not Analyzed

The assertion that there is no analysis in the FSAR for the DSC bottom cover plates is not correct. The DSC inner and outer bottom cover plates are explicitly included in the ANSYS analysis models of the DSC shell assembly shown in Figures 8.1.14b and 8.1-15 of the FSAR. The models are analyzed for the loading and unloading load combinations provided in FSAR Table 8.2-25 and 32PT SAR Amendment Table M.2-15 (Load Cases LD-1 to LD-7 and UL-1 to UL-8, respectively). The outer bottom cover plate is qualified for the normal, off-normal, and accident load conditions of the push/pull loads combined with internal pressure using ASME Code allowables.

Comment No. 3: Lack of Compliance with 10CFR72.122(b)(2)(1)

Response to Comment 3:

Concurrent Seismic or Tornado Missile Event During Process of DSC Insertion during Transfer Operations

As stated above, the alignment operation of the TC/DSC to the HSM is not a tedious but a simple and routine loading operation. Furthermore, once the TC/DSC is aligned to the HSM, the insertion of the DSC in the HSM is a short duration process (typically within 15 minutes). During this time the TC is in the horizontal position securely attached to the transfer trailer skid and to the front of the HSM to ensure there is no differential motion that would affect the loading operation.

Tornados are predictable weather phenomena and no transfer operations would be attempted during times when there is a possibility of a tornado occurring.

Postulated accident conditions during transfer operations from the Fuel Handling Building to the ISFSI are evaluated as described in FSAR Section 8.2.3.2.D for the seismic accident event and Appendix C for tornado missiles.

Therefore, the DSC/TC and HSM are evaluated for environmental conditions and natural phenomena in accordance with the requirements of 10CFR72.122(b)(2)(1).

Bracing of DSC Support Structure

The assertion that the DSC support structure steel is not braced is incorrect. As shown in the FSAR Appendix E drawings of the HSM, the DSC support structure is directly attached to the sidewall and front wall of the HSM, which carry all axial and lateral loads. The seismic evaluation of the DSC support structure includes the weight of the heavier 32PT DSC and is summarized in FSAR Section 8.2.3.2.C. The support structure is designed and qualified to the requirements of the AISC manual of steel construction.

Therefore, no additional cross bracing of the support structure is required.

Vulnerability of the HSM Roof and Door to Environmental and Natural Phenomena Loads

The 3-foot thick roof slab is attached to the base unit by bolted connections at the inside front and rear walls. Although the roof bolted connections will resist roof sliding, they are not designed, nor relied upon, to resist roof accident loads such as missile impact. The 4 inch key provided on the underside of the roof is designed to resists these loads. The weight of the roof is sufficient to resist the wind suction load due to tornado pressure. Similarly, the maximum lateral seismic force acting on the roof is less than the resisting force available from friction of the roof unit on the base unit.

As shown in drawing NUH-03-6004-SAR in Appendix E of the FSAR [3], the door is attached to the base unit of the HSM by either four (4) clamps or 4 bolts (not 3 straps as indicated in the comments), and bolted to the front wall of the HSM. These clamps/bolts are designed and qualified for the tornado wind, and seismic loads. The door is qualified for the tornado wind, seismic, and tornado generated missile impact loads. The HSM roof and door evaluations are described in FSAR Section 8.2.2 and 8.2.3 respectively.

Thus, the NUHOMS® HSM is designed to withstand the effects of natural phenomena in accordance with 10CFR72.122(b)(2)(1).

Comment No. 4: Lack of Compliance with Postulated Accident Events per 72.122(b)

Response to Comment 4:

The postulated drop loads for the TC are mechanistically not possible. There are no failure mechanisms within the system design that would allow a TC drop accident. However, to show compliance with 10CFR72.122 (b) TC drop accidents are postulated.

The postulated drop accident accelerations described in the FSAR are based on maximum accelerations for dropping the TC from heights of up to 80 inches onto a surface representative of the worst case typically found at an ISFSI, or along the transfer route. There is no requirement for a drop onto a rigid surface in 10CFR72, therefore; the methodology adopted considers the stiffness of the impacted surface. There is no claim in the FSAR, or the 32PT SAR amendment, that the drop of 80 inches is onto an "essentially unyielding surface."

As documented on page 3-19, Section 3.2.2.3.E of the NUHOMS® SER [4], the NRC validated the basis for the design basis g load used for the drop evaluations by performing an alternate calculation which is independent of the EPRI methodology cited in the comments. In addition, each licensee is responsible for evaluating the chosen transfer route to ensure that the FSAR conditions are met.

In the stress analysis of the DSC for the side drop, the DSC is analyzed assuming the TC is rigid. Conservatism is included in the design as all drop loads are analyzed as equivalent static loads. Thus, the DSC analysis and evaluation are in compliance with 72.122 (b) requirements.

Comment No. 5: TC/DSC Lift Height Per Technical Specification Para. 1.2.13

Response to Comment 5:

Low Temperature Incompetent Carbon Steel Shield Plugs

The Technical Specifications permit lifting of a DSC inside the Fuel Handling Building when the temperature is greater than -20°F and limit the maximum height to 80 inches. For the carbon steel shield plugs, at an ambient temperature of -20°F, the

DSC shield plugs can be at a temperature of -20°F if the DSC decay heat load is zero, which is not credible. In addition, TC movements inside the fuel building are controlled by 10CFR50 criteria which typically do not allow any operations at these low temperatures.

Per Technical Specification 1.2.13, movement of a TC/DSC outside the Fuel Handling Building is restricted to a low of 0°F. As discussed above, it is mechanistically not possible to drop the TC/DSC once outside the Fuel Handling Building, since the TC is securely attached to the transfer trailer skid. At 0° F, and under a very conservative assumption that there is no decay heat in the stored spent fuel, the ASTM A36 carbon steel has sufficient fracture toughness capability to resist extensive fracture or the suggested "pulverization".

Absence of Welds in the 32PT DSC Basket

The assertion that the fuel compartment tubes are not welded is incorrect. SAR drawing NUH-32PT-1004-SAR included in Section M.1.5 of the SAR [2] provides the welding details.

Comment No. 6: Absence of Non-Mechanistic Tipover

Response to Comment 6:

The tipover of a NUHOMS® HSM is not a credible event because of its unique configuration at the ISFSI with either side shield walls on both ends of a single HSM or close spacing of HSMs within an array. These are unique design features of a NUHOMS® HSM which make it inherently more stable as compared to the overpacks of other dry storage casks.

The HSMs are evaluated for a tipover under accident seismic and tornado loads and are shown to be stable with the required factors of safety. These evaluations, summarized in Section 8.2 of the FSAR [3] are conservative and bounding for a single free standing HSM, ignoring the stabilizing influence of side shield walls or close spacing of HSMs within an array. A scenario that would result in a tipover of this configuration is therefore, not credible.

Comment No. 7: Questionable Compliance with 10CFR.124 (Criticality Safety)

Response to Comment 7:

Neutron Absorber Panels

The assertion that the neutron absorber panels are not "fixed" as required by 72.124(b) is incorrect. The connection details for the neutron absorber panel are shown on the drawings included in Section M1.5 of the SAR [2].

Boron loading in Absorber Panels

The required B-10 loading in the neutron absorber panels is demonstrated to be adequate to meet all the criticality safety regulatory requirements as demonstrated by the criticality analysis presented in Section M.6 of the SAR [2]. The criticality analysis presented in Section M.6 also demonstrates that the additional boron provided by the PRAs is adequate to maintain k_{eff} below 0.95 for all postulated events.

PRA Design

The PRA's are fabricated under a safety related Quality Assurance plan and inspected to assure integrity of the finished components. The PRAs are thin wall tubes filled with B_4C pellets. The PRA top closure welds will be done to either AWS or ASME criteria including 100% visual examination to ensure they are sound.

Once the PRA's are inserted into the fuel assembly, they are free to expand thermally. Therefore, thermal stresses are small and there is no mechanism to cause fracture of the welds and release of the encased boron. The PRA's will not be internally pressurized. The PRA's will be exposed to a liquid environment for a period of hours only during loading operations, so no long term degradation of the PRA tubing will occur. During storage the PRA's are contained within a dry helium environment. Hence, there are no credible mechanisms that will cause the leaching out of Boron carbide from the PRAs.

Comment No. 8: Non-Compliance with 72.236(h)

Response to Comment 8:

Fuel Compartment Opening Size

The 32PT DSC is not in violation of the requirements of 72.236(h). The 32PT DSC is fully compatible with wet and dry spent fuel loading and unloading facilities. The dimensions of fuel compartment openings are adequate to accommodate the fuel assemblies including the Westinghouse and B&W fuel types.

Loose Aluminum Transition Rails

There are no loose aluminum transition rails in the 32PT DSC. The aluminum transition rails are attached to the basket fuel compartment walls by studs as shown on drawings included in Section M.1.5 of the SAR amendment application. Note that the Figure M.3.7.3 of the SAR [2] depicts the ANSYS stress analysis model of the 32PT DSC basket stress analysis model and typically, does not show any details for attachment of the transition rails.

The details utilized in the fabrication of the 32PT basket and shell are similar to those developed for other licensed, and fabricated DSCs supplied by Transnuclear, Inc. Ovality of the shells has not proved to be a problem in past fabrication as they are re-rolled after welding, if required, and the aluminum rails and basket fit without the suggested problems. The fit of all components has been evaluated for the allowed tolerances. More importantly, the DSCs are fabricated under TN's QA program and final performance testing of each DSC assures verification of correct design dimensions and tolerances, prior to TN certification.

Comment No. 9: Non-Compliance with 72.122(l)

Response to Comment 9:

Handling of a Loaded DSC

There is no need to provide means to handle a loaded DSC by itself. The empty DSC is placed inside the TC prior to fuel loading utilizing lifting lugs under the shield plug. Once the draining, drying and sealing operations are complete and the TC lid is bolted in place, the analysis presented in Section 8.2 of the FSAR [3] show that there are no postulated accident events whereby the DSC is inadvertently separated from the TC.

The retrievability of the fuel is assured because the DSC can be removed from the HSM or the TC as described in Section M.8.2 of the SAR [2].

Handling of a loaded DSC by itself is never required during fuel loading or DSC transfer to the HSM operations in the NUHOMS® system. In the NUHOMS® system design, a loaded DSC is always handled by the TC. This feature also does not impose excessive loads on the welds between the DSC shell and cover plates because the DSC cover plates don't need to support the weight of a loaded DSC.

Comment No. 10: Non-Compliance with an Invoked ISG (ISG-11, Rev. 2) and 72.122(h)(1)

Response to Comment 10:

The assertion that the NUHOMS®-32PT system does not meet the guidance of ISG-11 Rev. 2 and 72.122(h)(1) is not correct. In response to RAI No.2, TN submitted Revision 4 of the 32PT DSC amendment application dated January 2003, including section M.4.1 and Table M.4.2 (Docket 72-1004, TAC No. L23343), which are consistent with the guidance provided in ISG-11, Rev. 2. The NUHOMS®-32PT system meets all the guidance of ISG-11, Revision 2.

Comment No. 11: Material Selection: Conformance to 10CFR72.122(a)(b) and (c)

Response to Comment 11:

Shield Plug Material:

There are small radial clearances provided between the carbon steel bottom shield plug and the stainless steel DSC shell. Therefore, free expansion of the bottom shield plug can occur before it comes into full contact with the DSC shell. Further, the coefficient of thermal expansion for carbon steel is approximately two thirds of the that for stainless steel shell (~6.6 x 10^{-6} compared to~ 9.5 x 10^{-6}in/in/°F). As the temperature of the components rises, the stainless steel DSC shell and inner and outer bottom cover plates will expand more than the carbon steel plug and the cavity available for the shield plug will increase in size. The air that is trapped in the cavity will have no effect on the shield plug or DSC performance.

Since the decrease of the decay heat load from the fuel as a function of time is a relatively slow and orderly process, and there is no significant thermal cycling of the

DSC, the only temperature variation in the DSC will be the result of changes in ambient conditions. These temperature variations are small and the stresses resulting from this cyclic loading are very small and well within Code allowables.

Therefore, the material used for the shield plug is appropriately qualified for its intended application.

Neutron Absorber:

Technical Specification Table 1-1h imposes requirements for the neutron absorber material. Additional requirements for acceptance testing of the neutron absorber materials are included in Section M.9 of the SAR [2]. Therefore, no additional requirements are necessary.

TN has performed extensive evaluations of chemical, galvanic or other reactions of the DSC materials with the environment to potentially generate hydrogen and the methods required to control it.

However, to ensure that the safety hazards associated with the ignition of hydrogen are mitigated, as described in Section M.8.1.3 of the SAR [2], the 32PT DSC cavity is monitored prior to, and during welding, of the inner top cover plate. If at any time, the hydrogen concentration exceeds 2.4%, the welding is stopped and the cavity purged. Welding is not resumed until safe levels of hydrogen concentration are established. Once the welding is complete, the cavity is vacuum dried and no further source of hydrogen generation is available. The adequacy of this approach is also documented in the 32PT SER Section 3.1.4.7, page 3-9 [1].

Comment No. 12: Potential for Fire in the Vicinity of the HSM Ignored

Response to Comment 12:

The assertion that a potential for fire in the vicinity of the HSM has been ignored is incorrect. As stated in Section M.4.6.3 of the SAR [2], the fire event associated with the loading operations and storage within the HSM is bounded by the analyzed TC fire event. The assumptions used in the bounding TC fire analysis presented in Section M.4.6.3 are extremely conservative. The NUHOMS® system maintains its integrity and meets all the regulatory requirements even under this very conservative analysis. Any potential for fire near the ISFSI, or along the route, must be evaluated by the system user as part of 72.212 evaluation.

Comment No. 13: Violation of ASME Code Requirement

Response to Comment 13:

The inner bottom cover plate-to-shell joint is examined in accordance with ASME BPVC Section III, Subsection NB using the UT method. The examination of the full penetration corner joint is specifically addressed in paragraph NB-5231(c). The geometry of this weld is in accordance with Figure NB-4243-1, sketch (f). The weld geometry of Figure NB-4243-1, sketch (f) has been successfully examined on inner bottom cover plate-to-shell joints of the DSC. Thus, the capability of the examination method to detect discontinuities in accordance with ASME BPVC Section V, "Nondestructive Examination" has been demonstrated.

Comment No. 14: Unsafe Practice for Canister Reflooding

Response to Comment 14:

The procedures outlined in the 32PT SAR [2] for reflooding operations are appropriate and not in violation of ISG-11, Rev. 2. According to ISG-11, Revision 2, "Repeated thermal cycling of the cladding during fuel loading operations is minimized. The thermal cycling of the cladding with temperature differences greater than 65°C should not be permitted." It applies to repeated thermal cycling during fuel loading operation only. Reflood of the fuel is a one-time phenomenon and does not result in repeated thermal cycling. Therefore, the assertion that the DSC reflooding operation results in exceeding the 117°F temperature limit of the fuel cladding per ISG-11, Revision 2 is not correct.

Flooding the transport cask cavity method is routinely used to unload hundreds of fuel assemblies all over the world and no unacceptable behavior is observed. The procedure used in the NUHOMS® system during reflooding operation is even safer than the simple flooding. The flow rate of the reflood water is controlled during reflood operation. A very low flow rate is used during reflooding process.

As described in Section M.4.7.3 of the SAR [2], when the pool water is added to the DSC cavity through siphon tube, it will come in contact with the hot basket components, some of it will flash to steam causing internal cavity pressure to rise. This steam pressure is released through the vent port. The steam will also help cool the initially hot fuel rods causing the fuel temperatures to drop. Therefore, by the time the reflood water approaches the fuel rods, the fuel rods have undergone significant cooling. The temperature of the reflood water has also increased sufficiently by the time it approaches the fuel rods thus minimizing the thermal shock. Therefore, no damage to the fuel rods is expected during this reflood operation.

Comment No. 15: Failure to Analyze a Credible Flood Event

Response to Comment 15:

The low elevation flood that submerges the bottom vents is bounded by the analysis performed for the postulated complete blockage of inlet and outlet vents for the following reasons:

Before the introduction of any floodwater, the HSM concrete wall temperatures will be at their calculated steady-state normal or off-normal conditions. These concrete temperatures and thermal gradients are significantly lower than the ones predicted for the complete blockage of all inlet and outlet vent conditions at –40°F and 117°F ambient conditions. Blockage of inlet vents due to floodwater will cause the temperature in the HSM cavity and hence the HSM inside surfaces to increase. At the same time, flood water will help cool the submerged portion of the HSM and will act as evaporative cooler for the DSC. Therefore, the rate of temperature increase will be significantly slower than what would be expected for complete blockage of both inlet and outlet vents.

In the evaluations presented in Section 8.1 of the FSAR [2], the HSM is conservatively evaluated for the controlling thermal gradients that result from a complete blockage of both inlet and outlet vents. The maximum temperature gradients in the HSM wall for the 125°F and –40°F ambient condition are 102°F and 99°F respectively for the blocked vent case. These temperature gradients bound the gradients that would be expected from the partially submerged HSM due to flooding.

References

1. Preliminary Safety Evaluation Report, Docket No. 72-1004, Standardized NUHOMS® Modular Storage System for Irradiated Nuclear Fuel, Certificate of Compliance No. 1004, Amendment No. 5.

2. Amendment No. 5 to NUHOMS®COC 1004, Addition of 32PT DSC to Standardized NUHOMS® System.

3. Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Fuel, NUH-003, Revision 6.

4. Safety Evaluation Report of the VECTRA Technologies, Inc. SAR for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel, December 1994.