UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 8, 2015

Mr. T. E. Sellmer
Manager – Transportation Packaging
Nuclear Waste Partnership, LLC
P.O. Box 2078
Carlsbad, NM 88221

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF THE MODEL NO. RH-TRU 72-B

Dear Mr. Sellmer:

By letter dated November 10, 2014, as supplemented February 18, 2015, Nuclear Waste Partnership, LLC, submitted an application for an amendment to Certificate of Compliance (CoC) No. 9212 for the Model No. RH-TRU 72-B transportation package.

In connection with the staff's review, we need the information identified in the enclosure to this letter. We request you provide this information by June 12, 2015. Inform us at your earliest convenience, but no later than June 5, 2015, if a substantial date change is needed. To assist us in re-scheduling your review, you should include a new proposed submittal date.

If you have any questions regarding this matter, please contact me at 301-415-5253.

Sincerely,

/RA/

Huda Akhavannik
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9212
TAC No. L24965

Enclosure: Request for Additional Information

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Request for Additional Information
Nuclear Waste Partnership LLC
Docket No. 71-9212
Model No. RH-TRU 72-B Package

2.0 Structural

2-1 Explain why the center-pivot trunnion attachment weld was reduced from 1.5 inches to 0.75 inches in Section 2.5.2.4 of the safety analysis report (SAR).

In Section 2.5.2.4 of Revision 7 of the SAR, the weld that attaches the trunnion to the base plate was shown to be changed from 1.5 inches (Revision 6) to 0.75 inches (Revision 7). The SAR reports a positive margin of safety of 0.51; however, there is no explanation as to why this weld was reduced in size. Additionally, an inspection of Drawing No. X-106-500-SNP, sheet 7, Rev. 5 (the drawing that accompanies Revision 6 of the SAR) reveals that this weld has always been a 0.75 inch weld.

This information is needed to demonstrate compliance with 10 CFR 71.33(a).

2-2 Justify the effective throat sizes of the bevel welds for the trunnions in Sections 2.5 of the SAR.

In all cases in Section 2.5, the throat size of the bevel welds is assumed to be equal to the distance from the root to the face of the weld. ASME BPVC Section III, Division 1, Subsection NF-3324.5(f)(3), states that the effective throat shall be the minimum distance from the root to the face of the weld, as long as the included angle at the root is equal to or greater than 60 degrees. For angles less than 60 degrees, limitations are put on the effective throat size to include a reduction in the distance from the root to the face by 0.125 inches and a reduction by a factor of 0.75 depending on the angle. AWS D1.1 also requires a similar reduction in the effective throat size of a bevel weld.

Neither the SAR nor the drawings indicate the bevel angles for these welds. If the angles are less than 60 degrees, this will reduce the margins of safety of the trunnion welds by at least 50%, and in one case by 80%. If the bevel angles are less than 45 degrees, the lifting trunnion attachment weld will no longer have positive margin in accordance with the ASME BPVC Section III, Division 1, Subsection NF, stress acceptance criteria.

This information is needed to demonstrate compliance with 10 CFR 71.33(a).

2-3 Clarify the use of the term “full penetration” as it is used to describe the bevel welds for the trunnions in Section 2.5 of the SAR and its association with the weld symbols on sheet 7 of Drawing No. X-106-500-SNP, Rev. 6.

In Section 2.5 of the SAR, the term “full penetration” is used to describe the bevel welds associated with the trunnions. The staff is accustomed to this term being used interchangeably with the term “complete joint penetration,” which AWS D1.1 defines as: a joint root condition in a groove weld in which the metal extends through the joint thickness. In other words the entire interface between the two pieces being jointed is fused through the welding process. The weld symbols on sheet 7 of Drawing No. X-106-500-SNP, Rev. 6 do not indicate that these welds are complete joint penetration welds. If “full penetration” means the complete depth of preparation (i.e., from the root to the face of the weld), this contradicts the use of “full penetration” in Section 1.2.1.1.1. of the SAR. In Section 1.2.1.1.1, “full penetration” is used to describe the 3/8 inch seam weld of the inner vessel, which is a complete joint penetration weld and indicated as such on sheet 3 of Drawing No. X-106-500-SNP.

This information is needed to demonstrate compliance with 10 CFR 71.33(a).

3.0 Thermal

3-1 Clarify how post-fire maximum temperatures for all package components will be achieved based on a steady state solution approach.

Page 3.1-3 of the SAR states that the package is evaluated based on steady-state, post-fire conditions at an ambient temperature of 100ºF with insolation in still air, as described in 10 CFR 71.73(c)(4), until maximum temperatures for all package components have been achieved.

Post-fire conditions based on a steady state solution will only result in equilibrium temperatures for the package, exposed to conditions similar to normal conditions of transport (NCT) and will not reflect the transient nature of the post-fire conditions of the package.

The information is needed to demonstrate compliance with 10 CFR 71.73

3-2 Provide adequate justification for the exclusion of internal convection between bodies.

Page 3.4-1 of the SAR states that consistent with NRC-accepted thermal analysis methodology, internal convection between bodies is conservatively ignored.

Staff is unaware of any guidance that provides instruction that ignoring internal convection is conservative. Neglecting internal convection will not always be conservative. For example, depending on the heat source, neglecting internal convection will actually result in predicted non-conservative temperatures during fire. The applicant needs to provide adequate justification for the analysis that will always result in either conservative or realistic temperatures, for all analyzed conditions.

The information is needed to demonstrate compliance with 10 CFR 71.71 and 71.73

3-3 Provide all material thermal properties that will adequately cover both NCT and hypothetical accident conditions (HAC) thermal conditions.

Page 3.4-2 of the SAR states that as presented in Section 3.2, “Summary of Thermal Properties of Materials,” temperature-dependent values for thermal conductivity and specific heat are used whenever data is available

The applicant needs to provide adequate thermal properties for all the materials used in the thermal design of the package.

The information is needed to demonstrate compliance with 10 CFR 71.71 and 71.73

3-4 Describe the outer cask fabrication process where lead will be in direct contact with the inner and outer surfaces which contain the material.

Page 3.4-2 of the SAR states that the outer cask thermal model assumes lead shell is in direct contact at its inner and outer surfaces, both radially and axially.

Fabrication process may result in imperfect contact between lead and the surrounding surfaces (see also Section 3.5.5 of the SAR). Assuming perfect contact may result in non-conservative predicted temperatures.

The information is needed to demonstrate compliance with 10 CFR 71.71 and 71.73

3-5 Explain how ignoring radiation and air conduction heat transfer within the two small annular voids in the inner vessel will be conservative during HAC.

Page 3.4-3 of the SAR states that radiation and air conduction heat transfer within the two small annular voids under each of the two inner vessel spacers is conservatively ignored.

This assumption may result in conservative temperatures during NCT but will underestimate temperatures during HAC where the heat source is external to the package.

The information is needed to demonstrate compliance with 10 CFR 71.73

3-6 Clarify why for the calculation of the maximum internal pressure the NCT thermal results are not used.

Page 3.4-8 of the SAR states that decay heat dependent temperatures for the packaging and payload components used in the internal pressure calculations are based on a parabolic (i.e., second-order polynomial) equation. The SAR also states that the parabolic equation coefficients for applicable packaging and payload components are presented in SAR Table 3.4-4.

However, the SAR does not provide a description of how these coefficients are obtained and validated. The equation and coefficients may introduce more uncertainties in addition to the uncertainty of the thermal models.

The information is needed to demonstrate compliance with 10 CFR 71.71 and 71.73

3-7 Justify the heat transfer coefficients values used during HAC (fire).

Page 3.5-2 states that heat transfer coefficients during HAC are calculated in the range between 1.40 and 2.05 Btu/hr-ft^2-ºF and that for conservatism, an upper-bound convection coefficient of 2.1 Btu/hr-ft^2-ºF is applied. Also, page 3.6.1-3 states that a representative upper-bound gas velocity, V = 9 m/s (29.5 ft/s), is used for all calculations.

Typically the NRC has accepted heat transfer coefficient based on maximum gas velocity temperatures that were measured at Sandia National Laboratory (M. E. Schneider, L. A. Kent, Measurement of Gas Velocities and Temperatures in a Large Open Pool Fire, Heat and Mass Transfer in Fire, HTD, Volume 73). The use of the maximum velocities to calculate the heat transfer coefficient will result in conservative heat transfer coefficients. The applicant does not provide adequate bases to use a lower gas velocity value because the velocities at the assumed location were not measured.

The information is needed to demonstrate compliance with 10 CFR 71.73

3-8 Provide the following containment boundary seal temperatures and allowable limits in Tables 3.1-1, "Maximum NCT Temperatures with Insolation (ºF)" and 3.1-2, "Maximum HAC Fire Transient Temperatures (ºF)" of the application.

The following containment boundary seal temperatures and allowable limits were not provided in the application: 1. Inner vessel (IV) backfill port seal, 2. IV gas sampling port seal, and 3. Outer cask (OC) gas sampling port seal.

This information is necessary to determine compliance with 10 CFR 71.51(a)(1) and (2).

5.0 Shielding

5-1 Demonstrate that for the NS15 and NS30 the NCT dose rate limit at two meters from the vehicle edge is the most restrictive dose rate limit.

The applicant uses the 2 m NCT dose rate limit in establishing package content limits and states that this is bounding for all other dose rate limits. In RSI 5-1, provided in the letter dated December 19, 2014, the staff requested that the applicant provide additional information justifying that this is the most restrictive limit for all energies for both distributed and concentrated sources. The applicant provided an analysis of all energies at all dose rate limit locations for both gammas and neutrons for the RH-TRU waste canister for both concentrated and distributed source geometries and demonstrated that in all cases, with the exception of the lowest energy, the 2 m NCT surface was the most limiting. However, the applicant did not provide these evaluations for the neutron shielded canisters (NS15 and NS30) stating that the RH-TRU waste canister results were "bounding" because "NSCs provide a greater amount of material attenuation in comparison to the RH-TRU waste canister under NCT." The staff requires additional explanation in lieu of performing the evaluations. The staff expects that there could be a greater possibility of the cask surface dose rates being closer to the regulatory limit (as opposed to the 2 m dose rates being closer to their limit) at the lowest neutron and

gamma energies based on the RH-TRU canister results, and that this effect may even be magnified by the greater attenuation. Thus, the applicant should demonstrate that the 2 m dose rate limit is the most restrictive for these NSCs. One way to do that is to provide additional calculations at the lowest neutron and gamma energy for the concentrated and distributed source geometry for the NS30 canister demonstrating that this is not the case.

This information is needed to demonstrate compliance with 10 CFR 71.47 and 71.51.

5-2 Provide radiation survey data from shipments since CoC Revision 6, and determine the allowable contents limits for a representative sample of these shipments using the proposed analytical method.

The current RH-TRU 72-B amendment application includes an analytical basis for determining nuclide activity limits rather than relying solely on pre-shipment measurement. The staff's SER supporting CoC Revision 6 states in Section 5.1.3 (ML111710724) that pre-shipment measurement is not an acceptable method for determining compliance with NCT dose rate limits but that it was accepted for that amendment only partly because the applicant instituted comprehensive measurement procedures and provided operational performance data for previous shipments. With the development of the activity limits in the current proposed CoC revision, the applicant is relying less upon pre-shipment measurement than before; however, the applicant is still relying upon measurement to quantify certain modeling uncertainties including:

a) Deviation from the assumed NCT analytical configuration (including centrally located sources with activity that is equally divided into three internal canisters).
b) Measured surface dose rates for distributed waste being allowed to vary up to a factor of 10 from the average surface dose rate.
c) Potential source movement and concentration during NCT. The staff has additional questions on the response to Observation 5-5; however, data from actual RH-TRU shipments would provide reasonable assurance that this administrative margin is adequate to account for movement during NCT.

The additional shipment data should be similar in nature to that submitted to the NRC on February 16, 2011 ("Response to request for Supplemental Information Regarding Application for Revision 5 of the RH-TRU 72-B Shipping Package," ML110530111) but each data point should show which canister was loaded (i.e., RH-TRU waste canister, NS15 or NS30), and show pre and post shipment measured activity showing the changes in activity as a result of transportation. Further, the determinations of activity limits for a representative sample of the previously shipped material using the new method will demonstrate that the method is conservative and applicable for RH-TRU waste. The evaluated shipments should represent the spectrum of shipments that have been made in terms of the canister types used and the source types, geometries, and energy spectra. By performing this evaluation, the application will rely more on "prototypical" measurements vs. pre-shipment measurements to demonstrate the new shielding analysis and method for determining a package's contents' acceptability.

This information is needed to determine compliance with 10 CFR 71.47.

5-3 Provide additional justification that the proposed analytical method is appropriate for and adequately addresses: (a) canisters containing drums with different activities and (b) canisters loaded with fewer than three drums.

In Observation 5-8, staff noted that it needed additional information on the distribution of the contents within the three canisters. Section 2.8.1 of the RH-TRAMPAC document states that waste can be directly loaded into the RH-TRU waste canister or in three or fewer drums. With respect to the neutron shielded canisters, Section 2.8.2 states that waste must be loaded into the drums, but can be in three or fewer. In response to the staff's observation, the applicant clarified that the analysis divides the sources evenly into three regions within the canister. Based on the analysis performed, the staff finds that it would be more appropriate to establish drum limits rather than package limits, as a single drum loaded with the maximum activity intended for three separate drums could exceed regulatory dose rate limits.

The response to staff Observation 5-8 also referred the staff to Attachment A, "Shielding Summary," in its justification of this modeling assumption. Attachment A discusses that establishing limits with a 0.70 meter margin to the 2 meters is conservative and that pre-shipment measurement can still play a role in ensuring NCT dose rate limits are met. Although the staff agrees with these statements in general, there is not any specific information on how this specifically bounds a scenario where the maximum activity for a package could be loaded into a single drum. Although the staff agrees that a package loaded in a non-conservative way would not pass pre-shipment dose rate measurements, the staff also must certify package designs based on a package evaluation that demonstrates that the package meets normal condition dose rates (10 CFR 71.35). While the staff recognizes that measurements can still play a role in meeting NCT dose rate limits, that role should be limited to verifying uncertainties and not compensating for known non-conservative analytical assumptions. Further, "prototypical" measurements (see the preceding question), better fill this role than do pre-shipment measurements. Thus, it is still not clear that the method adequately addresses scenarios (a) and (b) of this question.

Using the current arguments in response to Observation 5-8 the staff would like the applicant to discuss specifically how the 0.70 meter reduced distance to the 2 meter surface specifically compensates for the possibility of loading drums with unequal activity. Alternatively the applicant should provide additional information addressing the non-conservative scenarios, such as:

a. discuss in more detail the process used during loading that ensures that the package activity will not be concentrated within a single drum and in the case of direct loading or loading of fewer than three drums, discuss how activity limits will be reduced to not exceed package dose rate limits. State the procedures that are followed and add them to the operating procedures as necessary.
b. Discuss any practical considerations from the RH-TRU payload appendices that would limit activity in a single drum.
c. Establish and justify limits for individual drums.

In all cases the applicant should discuss the size of the drums used in the analysis and the differences in external dose rate when smaller drums are shipped (i.e., 15 gallon versus 30 gallon versus 55 gallon).

This information is needed to verify compliance with 10 CFR 71.47.

5-4 Provide a representative MCNP output file for the Shielding Evaluation under NCT and HAC.

The staff reviews output files to ensure such things as proper convergence was achieved and that the calculated radiation levels agree with those reported in the application.

This information is needed to verify compliance with 10 CFR 71.47(b) and 10 CFR 71.51(a)(2).

6.0 Criticality

6-1 Clarify the explanation of the results of the SCALE 5.1 benchmark calculations in Section 6.5.3.2 of the SAR.

The paragraph spanning pages 6.5-6 and 6.5-7 in the SAR ambiguously separates the discussion of the LEU and LEU with special reflector materials. This LEU benchmark discussion does not seem to match that described in Section 6.1.5.2 of the SAR.

This information is necessary to determine compliance with 10 CFR 71.59.

7.0 Operating Procedures

7-1 Provide a brief explanation to verify the change in Section 7.4.1.2 step 5 of the application is physically appropriate.

The step has been changed to evacuate the test volume to less than 10% of the ambient pressure; therefore the test volume is not evacuated as much as it was previously. The staff notes that other leakage rate testing in the application has an evacuation of the system to less than 10% of the ambient pressure. Although, ANSI N14.5-2014 Section A.5.2.4, “Test method and Considerations,” describes evacuating the test item to a suitable pressure, typically 10^{-3} atm, which is 0.1% of ambient pressure.

This information is necessary to determine compliance with 10 CFR 71.51(a)(1).

7-2 Address the following regarding the equation in Section 7.4.1.2 step 9 of the application:

1. Provide the equation number(s) in ANSI N14.5-2014 that the equation is based on, or provide the derivation and reference for this equation.
2. Clarify if the units for atmospheric pressure, test pressure, and sensitivity of the pressure transducer are appropriate considering there is a mix of millitorr and torr.
3. Address if it is expected that the system will remain isothermal for the calculated test time for the duration of the pressure rise leakage rate test.

The staff was not able to find a reference for the equation provided in Section 7.4.1.2 step 9 of the application. There also appears to be inconsistency regarding units. Small temperature variations can lead to large pressure variations in a pressure rise test; it is not clear if the system will remain isothermal for the calculated test time.

This information is necessary to determine compliance with 10 CFR 71.51(a)(1).

7-3 Specify in Chapters 7 and 8 of the application that written leakage rate testing procedures are developed and approved by personnel certified by the American Society of Nondestructive Testing (ASNT) as a Level III examiner for leakage testing.

Chapters 7 and 8 of the application do not specify that the written leakage rate testing procedures are developed and approved by personnel certified by the American Society of Nondestructive Testing (ASNT) as a Level III examiner for leakage testing as indicated by industry standards. The ANSI/ASNT CP-189-2006, "Standard for Qualification and Certification of Nondestructive Testing Personnel," provides the minimum training, education, and experience requirements for nondestructive testing personnel. This ANSI standard states that a nondestructive testing personnel Level III examiner has the qualifications to develop and approve written instruction for conducting the leak testing.

This information is necessary to determine compliance with 10 CFR 71.37, 71.87, and 71.119.