April 27, 2006

Mr. Phillip C. Gregory
Manager, Packaging Engineering
Washington TRU Solutions, LLC
P.O. Box 2078
Carlsbad, NM 88221-2078

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF AN APPLICATION FOR REVISION 4 OF THE RH-TRU 72-B SHIPPING PACKAGE (DOCKET 71-9212)

Dear Mr. Gregory:

By letter dated October 14, 2005, Washington TRU Solutions LLC, on behalf of the U.S. Department of Energy, submitted a request for a revision, Revision 4, to Certificate of Compliance No. 9212 for the Model No. RH-TRU 72-B shipping package. In connection with the staff's review, we have identified additional information requirements for completion of the review. The required information is identified in the enclosure to this letter.

We request that you provide this information by June 7, 2006. Please inform us immediately if you are unable to provide the information requested. To assist us in re-scheduling your review, you should include a new proposed submittal date and the reasons for the delay.

Please reference Docket No. 71-9212 and TAC No. L23913 in future correspondence related to this request. The staff is available to meet with you to discuss your proposed responses. If you have any questions regarding this matter, I may be contacted at 301-415-8500.

Sincerely,

/RA/

Jill S. Caverly, Project Manager
Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9212
TAC No. L23913

Enclosure: Request for Additional Information

Mr. Phillip C. Gregory
Manager, Packaging Engineering
Washington TRU Solutions, LLC
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OFC	SFPO		SFPO	E	SFPO	E	SFPO	E
NAME	JCaverly		MDeBose		TChuang		ABarto	
DATE	4/20/06		4/24/06		4/24/06		4/25/06	

OFC	SFPO	E	SFPO	E	SFPO	E		
NAME	ADias for CLB		LCampbell		GBjorkman for CGI		RNelson	
DATE	4/26/06		4/26/06		4/27/06		4/27/06	

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Request for Additional Information
Washington TRU Solutions LLC
Docket 71-9212
Revision 4 to Model No. RH-TRU 72-B Package

By application dated October 14, 2005, Washington TRU Solutions LLC (on behalf of the U.S. Department of Energy) submitted a revision to Certificate of Compliance No. 9212 for the Model No. RH-TRU 72-B package. This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission (NRC) staff in connection with its review of the proposed application.

The information requested in this RAI is needed by the staff for it to complete its review of the application and to determine whether the proposed plan has demonstrated compliance with regulatory requirements.

Additional information requested include the following:

RH-TRU 72-B SAFETY ANALYSIS REPORT

CHAPTER 1.0 - GENERAL INFORMATION

1-1 Revise the SAR text so that the Inner Vessel (IV) is properly identified as an optional containment boundary. In many instances (for example: 4th paragraph on page 1.1-2, 2nd paragraph on page 1.2-1) the IV is identified as providing an inner containment boundary.

This statement is incorrect in the face of the current amendment application, where the leakage rate testing of the Inner Vessel is proposed as optional.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

CHAPTER 2.0 - STRUCTURAL AND MATERIALS

2-1 Justify the inconsistency on the boundary conditions assumed between the upper and lower plates subjected to puncture bar acceleration of 29.5 g. This information is located in Section 2.7.3.3 -End Puncture, page 2.7-28.

For the top closure lid, the maximum stress was calculated to be 61,666 psi giving rise to a safety margin of +0.1, assuming the lid is simply supported at its edge. However, for the bottom closure plate, different boundary conditions of fixed edge are assumed, resulting in a maximum stress of 63,446 psi or safety margin of +0.07.

On the other hand, if the simply supported boundary conditions are also assumed for the bottom closure plate, consistent with the boundary conditions set for the top, the staff calculated the maximum bending stress at the center of the plate to be 88,799 psi, exceeding the allowable stress intensity for Type F304 stainless steel at 160F (67,700 psi) by a factor of 31%.

This information is necessary to determine compliance with 10 CFR 71.41(a) and 10 CFR 71.73(c)(3)

2-2 Provide information to justify the torque coefficient K = 0.2 for chrome plated bolts. This information is located in Section 2.10.6.2 - Analysis Methodology, page 2.10.6-3.

The choice of K value used for calculating the bolt stresses is very sensitive to the outcome as can be witnessed in the Tables 2.10.6-1 to 2.10.6-8. For example, using K = 0.13, the stress intensity of the bolt is calculated as 56,702 psi for the case of 90 degree drop, whereas if K = 0.2 the stress intensity drops to 40,667 psi. It has been established that K = 0.11 -0.15 for Cd plated bolts. However, there is no reference information or data provided to support using the K value of 0.2 for the Chrome plated bolts.

This information is necessary to determine compliance of 10CFR 71.31 (a)(1)

CHAPTER 3.0 - THERMAL

3-1 Revise the allowable temperature limits for the butyl O-ring presented in the 2nd paragraph of Section 3.3, since they do not agree with the provided reference. Similarly, revise the values shown on Table 3.1-1. Verify that, throughout the application, material temperature allowable limits are consistent.

The Safety Analysis Report for the TRUPACT-II Shipping Package, Revision 21, which is referenced in the current application, indicates the butyl rubber sealing material having a working range of -65°F to 225°F, and a short duration (8 hours or less) upper limit of 400°F. Also, on page 3.5-4 of the RH-TRU 72-B application, an upper operating limit of 250°F for the butyl O-ring seals is mentioned.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

3-2 Clarify footnote 2 on page 3.2-2, where a justification for using a value of 0.3 for the emissivity of the outer surfaces makes reference to a 0.5 value. Provide references for all emissivity values proposed on Table 3.2-3.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

3-3 Clarify how external barometric pressure changes can influence the internal pressure developed inside the IV, as stated on page 3.4-3. Provide a physical explanation for subtracting 11.2 psi from the design pressure of 150 psig, as shown on page 3.4-5.

In Section 3.4.4.3, the approach (using a pressure limit of 138.8 psig instead of 150 psig) for justifying the 23.5 watts decay heat for waste material “NewPaper” is definitely conservative (a higher pressure limit would allow a higher decay heat value) but seems

to lack any physical meaning. On page 2.6-7, the reduced external pressure condition (per 10 CFR 71.71(c)(3)) of 3.5 psia is considered negligible from a structural perspective; however, this low pressure value is somehow associated with an internal pressure of 11.2 psig.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

3-4 Justify the use of 493 liters as the total void volume in the NCT maximum pressure calculations for both NewMet and NewPaper waste materials when, on page 3.4-7, the canister and IV void volumes (190.5 + 493 = 683.5 liters) are identified as the only volumes available in calculating pressures under NCT. Provide mathematical justification for both 190.5 and 493 liters values. Discuss the reason for calculating pressure inside the package IV (and not inside the OC) when, in fact, this application suggests optional pre-shipment leakage testing of the IV closure.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

3-5 Clarify the statement in the first paragraph on page 3.4-8: “for decay heats greater than 23.5 watts, compliance with the applicable hydrogen gas generation limit ensures compliance with the pressure limit.” Modify the application appropriately.

This subject is further addressed in Section 5.3 of the RH-TRAMPAC document. However, a generalization is being made based on a specific result from content code ID 325 B (calculations shown in Section 2.5.5 of the RH-TRU Appendices document). Had another content code been chosen and with fewer restrictions (confinement layers) for the flowing of gases, the ratio between the FGGRs would be smaller. The generalization that is being proposed is not acceptable because it ignores the intrinsic details of any given content code. For example, in the extreme case of a content code waste with no internal barriers for the movement of radiolytic gas, a rather large FGGR would be determined based on the 5% hydrogen molar faction limit, since the available internal volume is large. In this case, the FGGR (and the corresponding decay heat limit) based on a pressure limit approach should take precedence.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

3-6 Provide a physical explanation for the thermal shield not reaching temperature values much closer to the 800°C (1472°F) fully engulfing fire environment. Provide the time-dependent temperature behavior for other nodes (besides node 571) situated on the thermal shield. If an error is found with the thermal modeling, revise the application accordingly.

Figures 3.5-3 and 3.5-8 show the temperature for node 571 barely above 1200°F, even at the end of the 30 minutes fire. This is hardly credible, especially because of the

thermal shield design: 10 gauge stainless steel sheet spaced outward from the outer shell by a 12 gauge wire wrap on a 3-inch pitch space. This steel sheet is somewhat isolated from the rest of the package body and, due to its small thermal inertia, should have quickly responded to the fire, with its temperature reaching values very close to the fire itself.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

CHAPTER 4.0 - CONTAINMENT

4-1 Clarify whether the choice of using pre-shipment or maintenance/periodic leakage rate testing means that all containment seal boundaries (in the Inner Vessel and the Outer Cask) are to be tested under the same procedure. Modify the application (Chapters 4 and 7) appropriately.

The application is not clear about the possibility of using pre-shipment leakage rate test criteria for some of the seal ports and maintenance leakage rate test criteria for others.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

4-2 Revise the SAR to clarify the discrepancy between the test conditions for Rainier Rubber Butyl Compound RR0405-70 and the stated operating temperatures in the text of Section 4.3, “Containment Requirements for the Hypothetical Accident Conditions.”

Section 4.3 of the SAR states that butyl rubber O-ring testing on a previously approved package “demonstrated that compressions as low as 10% will still result in a ‘leaktight’ seal at both hot (at and above 350 EF) and cold (-40 EF) conditions.” Footnote 3 on the same page states that the test O-rings were “stabilized at -20 EF and shown, via helium leak testing, to be leaktight.” The SAR should show that the O-ring material is capable of providing containment capabilities at the minimum regulatory temperatures (see RAI 3-1).

This information is necessary to show that the package meets the containment requirements for normal conditions of transport specified in 10 CFR 71.51(a)(1).

CHAPTER 7.0 - OPERATING PROCEDURES

7-1 Specify and justify which ports shall be used for pre-shipment leakage rate testing for both the Outer Cask and the Inner vessel. Modify the SAR so that a vent port is clearly identified as being the same as the gas sampling port.

Section 7.4.1.2, step 1, is confusing about the appropriateness of using different ports for the pre-shipment leakage tests, including the fact that the expression “vent port” is rarely used throughout the SAR. The previous version (Revision 3) of the RH-TRU 72-B application seemed to indicate that there were 3 tests to be performed in the Inner Vessel (IV) and 2 tests in the Outer Cask (OC).

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

7-2 Provide physical and mathematical details about the procedures for Determining the Test Volume and Test Time (Section 7.4.1.2) and Performing the Gas Pressure Rise Leakage Rate Test (Section 7.4.1.3). Explain the temporal and thermal-hydraulics requirements that would characterize a stable system as specified in Steps 6 and 7 of Section 7.4.1.2. Justify the evacuation criteria of 0.76 torr or the sensitivity on the digital readout, whichever is less, specified in Step 5 of Section 7.4.1.2.

The proposed procedure is very different from the one previously approved (Revision 3 of the RH-TRU 72-B application, dated August 2001) and does not resemble anything presented or discussed in the ANSI N14.5-1997 Standard. No detail is given about what characterizes a stable system, how long (time) should pass before the stability is verified, or whether temperature changes are to be observed and accounted for.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

CHAPTER 8.0 - ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

8-1 Clarify whether the Inner Vessel and Outer Casks are hydrostatically tested to 150% of their MNOP values. If this is the case, revise the application so that the hydrostatic tests are performed after the fabrication leakage rate tests (#1 x 10^{-7} ref-cm^3/s air).

Section A.3.5 of the ANSI N14.5-1997 states that "for leaks smaller than 10^{-6} ref-cm^3/s, wetting of the test item before leakage rate test should be avoided." Some of the leak paths may become clogged by liquid if the hydrostatic test is conducted prior to the leakage rate test.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

8-2 Revise the application so that the calibration of the leak detector (as described in steps 8.1.3.0.2 and 8.2.2.0.2) takes into account the whole leak detecting system to be used during the tests.

The length of pipes as well as pipe fittings may affect the outcome of a measuring effort.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

8-3 Clarify how the 60-seconds flame retardancy test and the 90-seconds intumescence test support the use of the polyurethane foam material as a thermal barrier during the 30-minute regulatory fire.

These acceptance tests seem far removed from the expected behavior of the foam during a 30-minute regulatory fire. Note that during the intumescence test, any remaining flame is to be gently extinguished after the sample is removed from the furnace. This is in disagreement with 10 CFR 71.73(b)(4), which explicitly says that "any combustion of materials of construction must be allowed to proceed until it terminates naturally."

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

RH-TRU PAYLOAD APPENDICES

APPENDIX 2.5

2.5-1 Clarify the differences between Table 2.5-1 in the RH-TRU Payload Appendices and Table 2.4-1 in the RH-TRAMPAC document. Modify the application appropriately.

The two tables do not address the same confinement layers.

10 CFR 71.7 states that the application must be complete and accurate in all material respects.

2.5-2 Justify the use of 333K (= 140°F) as un upper bound temperature value for calculating decay heat limits, as proposed in Section 2.5.4. Modify RH-TRAMPAC, if appropriate.

From the Tables 3.4-3 and 3.4-3 in the SAR, one can see that average payload temperatures can reach much higher values. One would recommend that, at the end of the iterative process to determine the decay heat limit for a given content code, the assumed content temperature be verified against the resulting decay heat value. There may be situations where the conservatism behind the assumed high temperature value is being violated.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

2.5-3 Revise/clarify the calculations shown in Section 2.5.5 and 2.5.6 to justify the choice of the PVC pouches as the Innermost Confinement Boundary.

As clearly stated in Section 2.7.1 of the RH-TRAMPAC document, sealed containers that are greater than 4 liters are prohibited except for metal containers packaging solid inorganic waste. One would then assume that the metal cans (5-gallon, 7.5 gallon, or 10-gallon) mentioned for content code ID 325B must have some sort of venting and, if so, must be considered as confinement boundaries that are interior to the PVC pouches. The 9700 cm^2 area calculated for the PVC pouch does not include the contribution of either the top or bottom of the assumed cylinder. The FGGR limit per canister value of

9.352 shown in Table 2.5-8 can not be reproduced. The values presented in Table 2.5.10 were derived through the use of the Arrhenius equation (Equation 34) when, in fact, dose-dependent G's for alpha and beta radiations are not temperature-dependent, as stated in Attachment A to Appendix 2.2.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

2.5-4 Quantify the degree of conservatism associated with the proposed RADCALC procedure for establishing decay heat limit for a given content code. Clarify the degree of precision with which the isotopic composition is known/estimated. Discuss how variations among drums of the same content code are accounted for when establishing bounding values for isotopic composition. Discuss the appropriateness and conservatism behind the gamma deposition model, specified through a container geometry option and a waste density input value. Discuss and quantify how the input variables uncertainties and the input options affect the overall RADCALC results and how this is taken into consideration in the proposed methodology for determining decay heat limits. Discuss and quantify benchmark efforts that have been conducted to verify the applicability of the RADCALC code for waste scenarios similar to what is being proposed.

The combined uncertainties (input and options) in the use of RADCALC may adversely play against the conservative assumptions previously described in the methodology for establishing decay heat load limits. The precision of RADCALC calculations must also be accounted for.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

2.5-5 Discuss the possibility of different content code drums being stored together, prior to shipping, or being loaded into the RH-TRU 72-B cask. Clarify whether RADCALC can correctly handle a heterogeneous loading. Discuss the reason for not accounting for gas generation due to the interaction between gamma radiation and the materials used for pouches and liners. Provide a conservative approach and modify RH-TRAMPAC, if appropriate.

The calculations that were presented rely on the drums being of the same code content, prior to and during transportation. The determination of steady-state flammable gas concentrations is based on the homogeneous loading assumption. The mixing of different code content drums is not as straight forward since, due to the gamma-radiation, there is the possibility of inducing gas generation in neighboring drums. For example, a high-radiation but non-hydrogen-bearing waste drum could induce hydrogen gas in a low-radiation but high-hydrogen-bearing waste drum right next to it. Without the knowledge of this "spatial" effect, one could erroneously conclude that the second drum was OK for shipping.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

2.5-6 Discuss the reason for not accounting for gas generation due to the interaction between gamma radiation and the materials used for pouches and liners for a given content code waste. Clarify whether there were material restrictions (i.e., low G values for liner materials) when the waste was being generated. Provide a conservative approach and modify RH-TRAMPAC, if appropriate.

Gamma radiation will not be fully deposited within the waste itself. The radiation that escapes will interact with the surrounding material, including hydrogen-bearing components such as PVC pouches, or fiber liners. The calculations that were presented rely on the gas being generated within the waste matter only.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

APPENDIX 3.1

3.1-1 Provide a reference for Equation 4 in Section 3.1.4 and discuss its proper statistical applicability. Clarify the terms in this equation. Specify a minimum value for N (true population size) below which the proposed sampling technique is not applicable. Explain how n_0 is specified/determined, based on a non-infinite population. Clarify how any bias in the container selection will be avoided.

Sampling techniques are in general not applicable to small populations, unless a larger margin of error is applied. Known or unknown variances in the process of generating waste containers, even if belonging to the same content code, may also invalidate the proposed statistical approach. Depending on the waste stream process and the period of time the containers were generated (months, years), it is possible for progressive modifications to have taken place.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

APPENDIX 4.6

4.6-1 Revise the text in Section 4.6.4, so that the proper Table in the SAR is identifed. Clarify whether the 164 watts limit is being derived from the paper waste Table 3.4-3 or the metallic waste Table 3.4.4. Justify the use of average payload temperatures to support the proposed decay heat limit.

The referenced Table 3.4.4-1 does not exist. Two hypothetical and bounding content codes are addressed in Section 3.4: NewMet (inorganic waste) and NewPaper (organic waste). As a result of Inner Vessel pressure limitations, the decay heat load limit for the organic waste is established as 23.5 watts. This value is far more limiting than the proposed 164 watts.

10 CFR 71.33 states that the application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package.

RH-TRAMPAC (TP)

TP3-1 Revise Chapter 3.0 of the RH-TRAMPAC, "Nuclear Properties Requirements," to justify adding only one standard deviation to the measured values when determining ^{239}Pu FGE and ^{235}U FEM, and subtracting only one standard deviation from the measured value when determining ^{240}Pu content. Alternatively, revise Chapter 3.0 of the RH-TRAMPAC to require two times the measurement error to be considered.

Chapter 3.0 of the previously approved CH-TRAMPAC requires the addition of two times the measurement error when determining ^{239}Pu FGE, and the subtraction of two times the measurement error when determining ^{240}Pu content. The RH-TRAMPAC should either be consistent with the CH-TRAMPAC requirements, or discuss why a less conservative determination of nuclear properties is appropriate for the RH-TRU 72B.

This information is needed to ensure that the applicant has identified the specific contents of the package according to §71.33(b).

TP5-1 Clarify the 7.02×10^{-7} g-mol/sec FGGR value mentioned in the second paragraph of Section 5.3.

This value cannot be found in Appendix 2.5 of the RH-TRU Payload Appendices, as stated.

10 CFR 71.7 states that the application must be complete and accurate in all material respects.