October 12, 2010

Dr. James M. Shuler
Manager, Packaging Certification Program
Safety Management and Operations
Office of Environmental Management
Department of Energy
Washington, DC 20585

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF CERTIFICATE OF COMPLIANCE NO. 9315, REVISION 10

Dear Dr. Shuler:

By letter dated May 3, 2010, as supplemented July 21, 2008, and September 29, 2010, the Department of Energy (DOE) submitted a revised application in accordance with 10 CFR Part 71 for an amendment to Certificate of Compliance (CoC) No. 9315 for the Model No. ES-3100 package to add an HEU oxide loading of 15.13 kg total oxide and 12.12 kg U-235, with a CSI of 0.4.

In connection with our review, we need the information identified in the enclosure to this letter. Additional information requested by this letter should be submitted in the form of revised Safety Analysis Report pages. To assist us in scheduling staff review of your response, we request that you provide this information by December 3, 2010, in order for us to issue a revised CoC by February 2011. If you are unable to provide a response by that date, our review may be delayed. Staff also stresses that responses should be very clearly and concisely written to provide the information necessary to make a safety determination.

Please reference Docket No. 71-9315 and TAC No. L24444 in future correspondence related to this request. The staff is available to meet to discuss your proposed responses. If you have any questions regarding this matter, I may be contacted at (301) 492-3339.

Sincerely,

/RA/
Kimberly J. Hardin, Senior Project Manager
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9315
TAC No. L24444
Enclosure: Request for Additional Information

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Enclosure: Request for Additional Information
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Request for Additional Information
U.S. Department of Energy (DOE)
Docket No. 71-9315
Certificate of Compliance No. 9315
Model No. ES-3100 Package

By application dated May 3, 2010, as supplemented July 21, 2008, and September 29, 2010, the U.S. Department of Energy (DOE or the applicant) requested an amendment to Certificate of Compliance (CoC) No. 9315 for the Model No. ES-3100 package. The applicant requested a revision to the CoC to add an HEU oxide loading of 15.13 kg total oxide and 12.12 kg U-235, with a CSI of 0.4. This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission staff in connection with its review of the application. The requested information is listed by chapter number and title in the applicant's Safety Analysis Report (SAR). NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Materials," was used by the staff in its review of the application.

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

Chapter 3 Thermal Review

3-1 Confirm that the content change in the amendment did not affect normal conditions of transport (NCT) and hypothetical accident condition (HAC) calculations.

The content with a 0.4 CSI has been added to Table 1.3 (page 1-16 of the Safety Analysis Report), which indicates that the basis for the limit is hydrogen generation. Confirm that the decay heat and the thermal and hydrogen generation/pressure calculations under NCT and HAC remained the same as a result of this content change.

This information is needed to determine compliance with 10 CFR 71.43, 71.71, and 71.73.

3-2 Confirm that the NCT and HAC analyses are not affected by the presence of silicone rubber pads and the use of carbon steel or stainless-steel can spacers.

a) Table 3.15 (page 3-23) indicates that the thermal analyses assumed silicone rubber pads were part of the model. Page 7-2 states that silicone rubber pads may not be used in the packaging. Confirm that the results with the silicone rubber pads bound the results if the silicone rubber pads are not used.

b) Likewise, the updated SAR (page1-22) indicates that either carbon steel or stainless-steel can spacers will be used in the package. Confirm that the results from the NCT and HAC analyses are bounded by using either carbon steel or stainless-steel can spacers.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-3 Clarify the temperature that the package was exposed to during the physical furnace test.

The temperature that the package was exposed to during the physical furnace test should be clarified. Page 3-33 of the SAR states that the furnace had a set point of 871°C (1600°F). However, page 3-34 of the SAR states that most of the thermocouples in the furnace were at 800°C (1475°F) during the test. Table 3.17 then lists component temperatures of 1600°F, implying that some of the temperatures listed include a 125°F margin (considering that regulations state a fire temperature of at least 1475°F). This should be clarified.

This information is needed to determine compliance with 10 CFR 71.73.

3-4 Discuss the effects on package functionality considering that many of the packaging components are at temperatures near/at their allowable during the hypothetical accident condition.

Per Table 3-17, many of the package components are at temperatures near/at their allowable during the hypothetical accident condition (silicone bronze nut, top plug, Kaolite 1600, Cat 277-4, etc.). There should be a discussion that explains the reasons this is acceptable. Specifically, the degradation that is expected if the temperature exceeds the allowable limits of these components should be discussed. This information is needed to determine if these parts still maintain their containment, shielding, and criticality functions.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-5 Discuss the length of time that the Cat 277-4 is at 320°F (Table 3.17) during the HAC; confirm that it is less than four hours.

Table 3.15 (page 3-23) states that Cat 277-4 has an allowable temperature range between -40°F and 302°F. The maximum temperature of Cat 277-4 experienced under HAC is listed as 320°F (Table 3.17), which is the (short term, per Table 3.15) allowable limit (Table 3.17). The degradation that occurs and the effect on package performance, including containment, criticality, and shielding, should be discussed. This is necessary because according to page 5 of the RSI response, the 320°F allowable limit is valid for four hours and (uncorrected) Cat 277-4 temperatures reach high temperatures (approximately 225 - 265°F) for greater than four hours (pages 3-117, 118). There should be a discussion on the time period that the CAT 277-4 exists at 320°F during the HAC and explicitly stated in the Table.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-6 Clarify the allowable temperature of the Viton O-ring and the temperature of the Viton O-ring during HAC.

a) Page 5 of the RSI response (footer date of 7-22-10), Table 3.17 and Table 3.16 lists the maximum Viton O-ring temperature as 400°F. However, Table 3.15 lists the allowable temperature as 302°F. Confirm the allowable temperature of the Viton O-ring. It is important to consider that the O-ring will have a different allowable temperature limit than the VCO metal fitting.

b) Page 4 of RSI response (Table 3.17, footer date of 7-22-10) lists the maximum Viton O-ring temperature under HAC as 306°F, which is greater than the 302°F maximum allowable temperature listed in Table 3.15. The text on page 5 states that the maximum ethylene propylene O-ring temperature is 286°F. The maximum corrected temperature of the Viton O-ring should be clarified.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-7 Provide the uncertainty (°F) of the temperature indicator patches.

The uncertainty (°F) of the temperature indicator patches used to determine component temperatures at the hypothetical accident condition should be provided. In addition, confirm whether the temperature indication is conservative (i.e., are the temperatures indicated/measured always higher than actual?).

This information is needed to determine compliance with 10 CFR 71.73.

3-8 Clarify whether the vapor pressure of melted uranyl nitrate crystals was considered in the package pressure calculations.

The maximum temperature of the containment vessel under HAC is given as 141.22°C (page 3-31). A potential content of the package is uranyl nitrate (page 1-13), which has approximate melting and boiling points of 60°C and 118°C, respectively. Is the vapor pressure of melted crystals significant, and if so, was it taken into account in the package pressure calculations during HAC?

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-9 Clarify the source of the “flaming or smoking” event during the furnace testing.

Page 3-34 discusses that the package was “flaming or smoking” after the furnace test. It is stated on page 1-6 that Kaolite1600 does not undergo chemical decomposition at temperatures below 1260°C (2300°F). Therefore, discuss what was burning as a result of the furnace testing and was it a component important to safety?

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-10 Confirm the maximum pressure of the containment vessel under HAC.

Table 3.17 states that the maximum containment vessel pressure during HAC is 40.701 psia. Page 3-17 (footer date of 2-26-2009) lists 42.288 psia. Page 3-161 lists 40.701 psia (footer date of 2-26-2009). Clarify the maximum containment vessel pressure for the HAC.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-11 Discuss the comparisons between the furnace test and finite element temperature results.

Page 3-36 mentions that MSC.Patran / ABAQUS finite element models were used to determine adjustments to the component temperatures measured during the HAC test. A brief discussion that compares the HAC experimental temperatures and the PATRAN and ABAQUS modeling results should be provided to confirm the appropriateness of the finite element model.

This information is needed to determine compliance with 10 CFR 71.41 and 71.73.

3-12 Confirm that thermal adjustment five is conservative, considering the potential differences in the crush/impact effects of using BoroBond4 and Cat 277-4 shielding material.

The 10 CFR 71.73 tests (including thermal) were performed with packaging made with BoroBond4 shielding material. Page 3-37 states that thermal adjustments were made to account for the use of Cat 277-4 shielding material (thermal adjustment seven) and the changes in the packaging geometry during crush/impact tests, etc. (thermal adjustment five). Would using Cat 277-4 as the shielding material during the impact tests, etc., have caused significantly different packaging geometry changes and, therefore, a significantly greater temperature adjustment (thermal adjustment five)?

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-13 Confirm the use of the G value in the radiolysis calculations.

The HAC analysis on page 3-160 indicates a 0.25 G value in the third equation, which is based on testing at 200°F (NCT analysis, per page 3-152) whereas the 0.8 and 7.0 G values in the first and second equation are based on 286°F testing. In order to be conservative, the 0.25 G value in the third equation should also be based on the higher temperature to reflect the HAC conditions.

This information is needed to determine compliance with 10 CFR 71.73.

3-14 Clarify the radiolysis of water effect on pressure calculations.

Page 3-154 took into account the radiolysis of water when determining the NCT pressure. However, it does not appear on page 3-161 that radiolysis of water was taken into account for the HAC pressure. This should be clarified.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-15 Provide a reference (or basis) for the 0.2 mol % hydrogen concentration due to permeation and diffusion.

Page 3-165 states that the steady-state concentration of hydrogen can be 0.2 mol%. A reference or basis for this value should be provided.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

3-16 Provide a reference (or basis) for assuming a temperature difference of 9°F between the gaps within the package.

Page 3-96 states that calculations assumed a temperature difference of 9°F between gaps. The basis or reference for this assumption should be provided.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

Chapter 7 Operating Procedures Review

7-1 Clarify the time period between closing a container and closing the containment vessel.

Page 3-165 states it is not necessary to vent containers before loading them into the ES-3100. This may be reasonable only if the time between closing a container and loading it into the ES-3100 is a short period. For example, closing a container and leaving it closed for a long time period before putting it in the containment vessel would mean that the amount of generated gas within the vessel is greater than that analyzed in the SAR. a) What is the time between closing the container, placing it in the containment vessel, and then closing the containment vessel? b) Where in Chapter 7 does it indicate that there is a time limit associated with closing the container and it being placed within the ES-3100?

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

7-2 Clarify the operation of the nylon plugs in Chapter 7 of the SAR.

Page 1-5 and Page 3-30 indicates there are nylon plugs that prevent the pressurization of the package "… in the event of a thermal accident." Considering their importance, the plugs should be mentioned explicitly and the task of checking them should be included in Chapter 7.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.

Chapter 8 Acceptance Tests and Maintenance Program Review

8-1 Discuss how one will ensure that the condition of Kaolite is acceptable over the life of the package.

Cracks exist within the Kaolite insulation following casting and vibration testing (page 3-28). This indicates that cracking of Kaolite can occur over the life of the package (vibrations due to shipment, etc.). Recognizing that Kaolite provides the thermal barrier under hypothetical accident conditions, fractured Kaolite could allow continuous void spaces that provide pathways for the fire to the interior of the package where lower allowable temperature limited components reside. There should be a maintenance procedure to confirm the condition of Kaolite is acceptable.

This information is needed to determine compliance with 10 CFR 71.43 and 71.73.