March 1, 2007

Mr. Richard W. Boyle
Radioactive Materials Branch
U.S. Department of Transportation
400 Seventh Street, S.W.
Washington, D.C. 20590

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION

Dear Mr. Boyle:

This is in response to your letter dated August 23, 2006, requesting our assistance in revalidation of the United Kingdom Certificate of Approval No. GB/3962A/B(U)-96 for the Model No. R7016 package.

In connection with our review, we need the information identified in the enclosure to this letter. To assist us in scheduling staff review of your response, we request that you provide this information by 30 days of the date of this letter. If you are unable to provide a response by that date, our review may be delayed.

If you have any questions regarding this matter, I may be contacted at (301)415-8500.

Sincerely,

/RA/

Jessica M. Glenny, Project Scientist
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-3079
TAC No. L24009

Enclosure: Request for Additional Information

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Request for Additional Information

Docket No. 71-3079

Model No. R7016 Package

United Kingdom Certificate of Approval No. GB/3962A/B(U)-96

DRAWING

Provide a complete version of the licensing drawings.

The drawings provided in the application are incomplete. This could be a result of resizing and reproducing the drawings. The staff needs a complete version of the drawings for its evaluation.

This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 807.

THERMAL

1. Provide document R32-05/1.4: "Thermal Analysis of the R7016 Radioactive Materials Transport Container."

   This analysis document is referenced in Section 4.3.1, "Validation," of "Thermal Performance of the R7016 Transport Container" and was not provided in the documentation submitted to the staff. Staff will need to review this document to make a finding on the adequacy of the thermal analysis.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraphs 651 and 728.

2. Justify the statement that the analysis results of the R7016 "showed sufficiently good agreement" with the thermal test results for the package.

   Section 4.3.1, "Validation," of "Thermal Performance of the R7016 Transport Container" states that analysis results were in "good agreement" with test results; however, a direct comparison of experimental (test) results with analysis results is not provided, neither is a complete description of the thermal tests conducted on the package and the results of those tests provided.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraphs 651 and 728.

3. Provide a clarification of the sources for the temperature values presented for Normal and Accident Conditions in the table in Section 4.3.2 of “Thermal Performance of the R7016 Transport Container” and Table 1 in Section 4.1, “Reference Case,” of Report R31-05/2.0, “Thermal Sensitivity Analysis of the R7016 Transport Container” (page 6).

   It is not clear from the description in the text of the two tables mentioned above whether they record the same case for Normal Conditions. The temperatures are different between the two tables, and thus it is not clear which values are considered the “reference case” for this application or why there is a difference between values in the two tables.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 651.

4. Provide a description of how damage from the package drop testing was captured in the thermal analysis models.

   Section 4.3.2 of “Thermal Performance of the R7016 Transport Container” states that the analysis model included damage from the mechanical tests of the R7016 package; however, a description of how the damage was incorporated into the analysis model(s) is not provided.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraphs 655 and 728.

5. Provide a description of how the value for the representative contact resistance was derived and where perfect thermal contact was assumed.

   Section 3 of Report R31-05/2.0, “Thermal Sensitivity Analysis of the R7016 Transport Container,” page 5, “Modelling,” states that the value of 3787 W/m^2K was used for contact resistance in the analysis model between certain surfaces. There is no description on how this value was calculated, neither is there a description of where perfect thermal contact is assumed.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraphs 651 and 728.

6. Provide a description of how heat flux was applied to the cavity wall, and state the specific values of heat flux applied. Relate this value to the overall heat load for the contents.

   Section 3 of Report R31-05/2.0, “Thermal Sensitivity Analysis of the R7016 Transport Container,” page 5, “Modelling,” states that the internal heat load was modeled as a heat flux to the cavity wall. No description of how the heat flux was applied in the model nor the actual value of the applied heat flux is provided.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraphs 651 and 728.

7. Describe the nature of interaction between the R7016 package and the floor in the thermal analysis model (if any exists).

   Section 3 of Report R31-05/2.0, “Thermal Sensitivity Analysis of the R7016 Transport Container,” page 5, “Normal conditions analysis,” states that the crate was modeled resting on a solid floor. There is no discussion of any interaction (such as radiative or conductive heat transfer) that was modeled between the crate and the floor. This could have an impact on the analysis results.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 651.

8. Provide a justification for the gas velocities of 4 m/s, in the accident condition fire environment, mentioned in the Sensitivity Analysis report.

   Section 3 of Report R31-05/2.0, “Thermal Sensitivity Analysis of the R7016 Transport Container,” page 6, “Accident conditions analysis,” states that gas velocities of up to 4 m/s were generated around the crate in the analysis model. Note that IAEA TS-G-1.1, paragraph 728.30 states that typical gas velocities in a fire environment are in the range of 5-10 m/s. If “forced” convection is not accounted for properly in the analysis model, the analysis results for accident conditions could be non-conservative.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 728.

9. Provide an explanation of why the cavity wall and contents model was not run for accident conditions.

   Section 3 of Report R31-05/2.0, “Thermal Sensitivity Analysis of the R7016 Transport Container,” page 6, “Accident conditions analysis,” states that the cavity wall and contents model was not run for accident conditions. Affects of accident conditions on package contents is of primary concern to overall package performance.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 728.

10. Provide a discussion of the effect of package orientation during the accident condition analysis.

    It is possible that the package could end up in a “tipped over” condition following an accident, and could be subjected to a fire in the horizontal position. If the external vents on the crate are open or damaged, there is the possibility of greater exposure of the “flask” (internal to the crate) to hot gasses from the fire. Orientation of the package during the accident condition should be considered.

    This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 728.

11. Provide a discussion of the condition of the depleted uranium (DU) shielding, used for the inner vessel (flask) assembly, after the drop test. Describe any damage that could expose the DU to the environment during the subsequent fire exposure.

    Oxidation of DU shielding is of concern if the DU is exposed to the environment during the accident fire test. The staff requires assurance that oxidation of the DU shielding cannot occur under any circumstances.

    This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 656.

CONTAINMENT

Revise the application to include a determination of maximum allowable leakage rate for non-special form contents.

Section 4.3 of the "Justification of the R7016 Containment System" section in the application cites a maximum allowable testing leakage rate of 5×10^{-4} cm^3/s of helium at a pressure differential of 1.0 bar. The applicant should revise the containment analysis to include a maximum allowable leakage rate determination consistent with ANSI N14.5-1997, "Radioactive Materials - Leakage Tests on Packages for Shipment," or ISO 12807, "Safe Transport of Radioactive Materials - Leakage Testing on Packages." The calculated maximum allowable leakage rate should either be used as the basis for the leakage rate testing criteria of the package, or shown to be bounded by the current leakage rate testing criteria in the application.

This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 657.

STRUCTURAL

Evaluate the ability of the package to withstand the stacking test or alternately provide adequate justification for not performing this test.

The shape of the package is such that it will not prevent stacking.

This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 723.

SHIELDING

1. Clarify which drawing is the correct drawing for the R7016 flask body, R7016/201 or R7016/221.

   Drawing R7016/201 has the title “R7016 Flask Body,” but has tungsten as one of the shield materials. Tungsten is not evaluated in shielding evaluation for the R7016. Drawing R7016/221 is titled “SV35 Flask Body,” and lists depleted uranium with 8% molybdenum and lead with 4% antimony as the shielding materials which are evaluated in the shielding evaluation. There is no mention of the SV34 Flask Body in the application other than on Drawing R7016/221.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraph 802.

2. Provide further information on the distances used in the section of the application entitled “Shielding Performance of the R7016 Transport Container.”

   In “Shielding Performance of the R7016 Transport Container,” Section 4.5, “Distances,” and Section 5, “Measurements,” there are tables with radial, up and down measurement distances. It is unclear how the distances in these tables were determined since they do not seem to correspond to the dimensions of the flask and crate.

   This information is required as specified in IAEA Safety Series No. TS-R-1, paragraphs 531 and 532.

MATERIALS

Revise the application to include an assessment of the shielding effectiveness under hypothetical accident conditions, considering the possible brittle fracture of the depleted uranium shielding.

The dose rates from the package could increase due to the resulting crack in the shield material. The application should be revised to include an assessment of the effects of potential brittle failure of the DU. The assessment may consider either providing assurance that there would be no brittle failure under free drop condition or showing that any brittle failure would not result in a dose rate increase. To show that there would be no brittle failure, including at cold conditions, supplemental information is necessary. This additional information would include, but is not limited to, temperature-dependent materials properties and critical flaw size analyses or an analysis that shows displacement of the shield material could not occur due to geometric constraints from other portions of the package.

This information is required as specified in IAEA Safety Series no. TS-R-1, paragraphs 615 and 657.