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

June 17, 2016

Mr. Steven E. Sisley
Energy*Solutions* Spent Fuel Division
2105 South Bascom Ave., Suite 230
Campbell, CA 95008

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE CERTIFICATE OF COMPLIANCE NO. 9320, FOR THE MODEL NO. MIDUS PACKAGING (CAC NO. L25103)

Dear Mr. Sisley:

By application dated March 30, 2016, Energy*Solutions* (the applicant), requested a revision to Certificate of Compliance (CoC) for the Model No. MIDUS packaging. The applicant proposes the following regarding the Model No. MIDUS CoC:

1. adding solid molybdenum-99 (^{99}Mo) as authorized contents;
2. reducing the previously approved fracture toughness for the depleted uranium shielding material; and
3. changes to licensing drawings.

In connection with our review, we need the information identified in the enclosure to this letter. To assist us in scheduling the staff's review of your response, we request that you provide this information by July 18, 2016. Inform us at your earliest convenience, but no later than July 1, 2016, if you are not able to provide the information by that date. If you are unable to provide a response by July 18, 2016, our review may be delayed.

Please reference Docket No. 71-9320 and CAC No. L25103 in future correspondence related to this request. If you have any questions regarding this matter, I may be contacted at (301) 415-6999.

Sincerely,

/RA/

Norma Garcia-Santos, Project Manager
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9320
CAC No. L25103

Enclosure: Request for Additional Information

Mr. Steven E. Sisley
Energy*Solutions* Spent Fuel Division
2105 South Bascom Ave., Suite 230
Campbell, CA 95008

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE CERTIFICATE OF COMPLIANCE NO. 9320, FOR THE MODEL NO. MIDUS PACKAGING (CAC NO. L25103)

Dear Mr. Sisley:

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Docket No. 71-9320
CAC No. L25103
Enclosure: Request for Additional Information
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Request for Additional Information
Energy*Solutions*
Docket No. 71-9320
Certificate of Compliance No. 71-9320
Model No. MIDUS

By application dated March 30, 2016, Energy*Solutions* (the applicant), requested a revision to Certificate of Compliance (CoC) for the Model No. MIDUS packaging. The applicant proposes the following regarding the Model No. MIDUS CoC:

1. adding solid molybdenum-99 (^{99}Mo) as authorized contents;
2. reducing the previously approved fracture toughness for the depleted uranium shielding material; and
3. changes to licensing drawings.

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. NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material," was used by the staff in its review of the application.

Each RAI describes information needed by the staff to complete its review of the application and to determine whether the applicant has demonstrated compliance with the regulatory requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71.

GENERAL INFORMATION

G-1 Revise Section 1.2.2, "Contents," of the application to indicate that the applicant takes credit for portions of the safety analyses for content No. 1 as the licensing basis for content No. 2.

In Section 1.2.2 of the application, the applicant states the following:

> "The safety analyses presented in Chapters 2 through 8 are for Content #01."

Nevertheless, in Chapter 9 of the application, the applicant takes credit for the analysis performed for content No. 1 as the safety basis for approval of content No. 2. Therefore, the statement in Section 1.2.2 does not accurately capture the applicability of the analyses in Chapters 2 through 8 to content No. 2.

This information is needed to determine compliance with 10 CFR 71.33(b).

CONTAINMENT EVALUATION

Co-4-1 Revise the pre-shipment leakage rate test acceptance criterion in the application and on the applicable licensing drawings (e.g., No. TYC01-1605, "Closure Devices") to ensure consistency within the application and with ANSI N14.5, "American National Standard for Radioactive Materials - Leakage Tests for Packages for Shipment."

Among the requirements in 10 CFR Part 71, the applicant shall:

i) "Identify any established codes and standards proposed for use in package design, …, testing, maintenance, and use."

ii) Include "a description of the leak testing procedures."

The applicable industry standard containing criteria to perform leak testing on packages used for transporting radioactive materials is ANSI N14.5. For the pre-shipment leakage rate test, Section 7.6.4 of ANSI N14.5, "Acceptance criterion," states the following:

> "The acceptance criterion for preshipment leakage rate testing shall be either (1) a leakage rate of not more than the reference air leakage rate, L_R, or (2) no detected leakage when tested to a sensitivity of at least 10^{-3} ref-cm^3/s."

It seems that the discussions in the application are not consistent in terms of the leakage rate test acceptance criterion used prior to shipping the authorized content(s) in the Model No. MIDUS package. For example:

- Sections 4.4.4, "Pre-shipment leakage rate test," 7.4, "Other Operations," and 7.4.1, "Pre-Shipment Leak Detection Equipment," of the application, in addition to note No. 3 on licensing drawing No. TYC01-1605, "Closure Devices," Revision 0, sheet 1 of 2, refer to the pre-shipment leakage rate test acceptance criterion as 10^{-3} reference cubic centimeter per second (ref-cm^3/s).

- Section 7.4.2 of the application, "Pre-Shipment Leak Testing Procedures," step No. 5, states the following:

  > "The test passes if there is no indicated leakage (at the pressure measurement sensitivity, ΔP)."

Note that the sections mentioned in this question are examples and the applicant should ensure that statements are consistent throughout the application.

This information is needed to determine compliance with 10 CFR 71.31(c), 71.37(b), and 71.51.

MATERIALS EVALUATION

M-1 For the payload internals of the Model No. MIDUS:

a) Provide the material specifications and the types of materials used as materials of construction, and

b) Explain how the applicant evaluated the possibility of significant chemical, or other reaction(s) between the authorized (Content No. 1) and/or proposed (Content No. 2) contents and stainless steel (SS).

Table 1 of drawing No. TYC01-1601, "MIDUS Transportation Package general Arrangement of Packaging and Content," identifies the type, form, and user-supplied payload internals, as follows:

i) molybdenum-99 (^{99}Mo) chemical composition containing sodium hydroxide (NaOH), in liquid form, and

ii) SS flasks, with SS caps, with or without elastomeric seals.

Literature suggests that selection of SS for handling sodium hydroxide (NaOH), a strong base, is important to resist adverse chemical reactions. SS Types 304 and 316 can be resistant to stress corrosion cracking (SCC) at temperatures below 80 degrees Celsius (ºC). In order to decrease the risk of SCC (common to Types 304 and 316) at higher temperatures, the service temperatures should not exceed 95ºC.

This information is needed to determine compliance with 10 CFR 71.33 (a)(5) and 71.43(d).

M-2 For drawing No. TYC01-1602, "General Arrangement of Cask Assembly":

a) *Sheet 1 of 4* - Verify whether note No. 4 is a resistance "Seam Weld" as identified in the American Welding Society (AWS) standard weld symbols or simply "jargon" used to describe a "groove weld." Revise the drawing, if appropriate.

ANSI/AWS defines a seam weld as a continuous weld made between or upon overlapping members. A groove weld is defined as a weld made in a groove between the work pieces.

b) *Sheet 4 of 4* - Explain the process of welding the casing plate to the shield lid and how the root of the weld will be free from contamination due to melting of depleted uranium (DU) directly and/or capillary attraction of melted DU through the gap between the casing plate and shield lid.

Section E-E weld symbol shows a single bevel groove weld, all around, for welding the casing plate to the shield lid. Provide in discussion whether the shield lid is stepped (dimension of step (run), depth of bevel, and depth of weld).

This information is needed to determine compliance with 10 CFR 71.33(a)(5).

M-3 Explain the rationale for using generic weld symbols (e.g., joint welds) on drawing No. TYC01-1602, sheet 2 of 4 and sheet 3 of 4, and not identifying the specific joint design

For example, the applicant uses specific welding symbols in drawing No. TYC01-1602, sheet 4 of 4, and in drawing No. TYC01-1603. Nevertheless, drawing No. TYC01-1602, sheet 2 of 4, Section C-C, show a weld all around symbol, with two parallel lines of unequal length above the reference line. The staff does not recognize these weld symbols and cannot locate these within the ANSI/AWS standard.

This information is needed to determine compliance with 10 CFR 71.33(a)(5) and 71.111.

M-4 Discuss welding of the pour-hole covers on drawing No. TYC01-1603 as follows:

a) *Sheets 2 and 3 of 3* - Explain if melting of polyurethane foam on the backside of these welds will contaminate the welds (e.g., density).

b) *Sheet 2 of 3* - Justify that the stepped configuration is sufficient to preclude contamination of the root from melting of polyurethane foam.

c) *Sheet 3 of 3* (overpack assembly) - Provide the dimensions, weld joint configuration, and whether the design is sufficient to preclude contamination of the root from melting of polyurethane foam.

Weld symbol shows a single bevel groove weld, all around, welded flush for welding the pour hole covers to the outer shell of the bottom overpack assembly.

This information is needed to determine compliance with 10 CFR 71.33(a)(5).

M-5 Provide the properties and specifications of the lubricant specified on note No. 2, drawing No. TYC01-1605, sheet 1 of 2, as it may cause possible detrimental effects to the function and/or operation of the O-rings and associated sealing surfaces.

Lubricants should not:

i) cause shrinkage, excessive swelling, excessively soften;
ii) solidify over the anticipated temperature range; or
iii) break-down and produce gummy or gritty deposits.

Lubricants should be:

i) capable of forming thin, strong films over the metal being lubricated that the O-ring cannot wipe away, and
ii) compatible with the fluid being sealed if used inside the system.

This information is needed to determine compliance with 10 CFR 71.39 and 71.43(d).

M-6 Provide the properties and specifications of the “ANTI-SIEZE” coating. In addition, verify the spelling of the word “ANTI-SIEZE” and clarify if it is a trademark name.

The applicant mentions the “ANTI-SIEZE” coating on note Nos. 1 and 4 of drawing No. TYC01-1605, sheet 1 of 2. The staff needs additional information of this coating materials to determine if it may cause detrimental effects to the function and/or operation of thread and associated contact surfaces.

Lubricants should meet several essential needs for threaded connections:

i) *control friction for obtaining true torque values* - Correct lubrication and tightening of critical connections ensures proper assembly seating.

ii) Lubricants should reduce the destructive contact between dissimilar metals and withstand greater temperature stresses.

iii) allow for non-destructive disassembly.

This information is needed to determine compliance with 10 CFR 71.43(d).

M-7 For drawing No. TYC01-1607, provide the following information:

a) *Criteria for Visual Inspection* – Either identify the inspection criteria or provide the applicable industry standard for the visual inspection related to note No. 2, drawing No. TYC01-1607, sheet 1 of 2. As part of your response include the qualified process or procedure that a qualified inspector will use to qualify and to determine the “adequate” flow of brazing material.

Note 2 states to visually examine all accessible surfaces for adequate flow of brazing metal through joint. However, the applicant does not cite an industry code or inspection criteria as the basis for this non-destructive evaluation.

b) *Impacts on the Installation Process of Polyurethane Foam* - Explain how furnace brazing inside surfaces of the overpack will affect installation of polyurethane foam.

Note No. 2, drawing No TYC01-1607, sheet 1 of 2, directs that “to furnace braze using Bag-8 brazing metal at ring and end of legs.” Furnace brazing will subject the surfaces to oxidation resulting in a tightly adhering scale which may adversely impact the installation of the polyurethane foam.

c) *Lack of brazing symbols* - Explain the lack of brazing symbols, brazing location, number of brazed joints, and brazing filler material

identification to ASME Section IX. Also, explain how the CoC holder ensures that the spider is secured in order to fulfill its safety function.

In note No. 2, drawing No. TYC01-1607, sheet 1 of 2, the applicant notes the following:

(1) furnace braze using Bag-8 brazing metal at ring and end of legs.

(2) the thermal spider will be either torched or furnace brazed, the material is SB-162 Copper, also listed in Table 2-11 of the application, as Copper B152.

In Section 2.3.1 of the application, the applicant notes the following:

> …for plate and shell type Class 2 supports, the fabrication of non-containment structural components of the package will follow applicable requirements of ASME Code, Subsection NF.

In Section 3.1.1, "Design Features," of the application, the applicant states the following:

> "…The spider is seized to enhance the transfer of the payload's decay heat load from the interior of the package during NCT conditions, while limiting the transfer of heat into the package under HAC conditions."

This information is needed to determine compliance with 10 CFR 71.119.

M-8 Provide an evaluation to justify the reduction of the previously approved fracture toughness, a minimum Charpy V-notch impact energy of 10 ft-lb at 70 °F to 6 ft-lb at 70 °F, considering the calculations and inspections remained unchanged.

The applicant proposes using depleted uranium (DU) alloyed with 2% by weight of molybdenum (U-2% Mo) for fabricating the shielding components of the package. The applicant revised fracture toughness evaluation (the Charpy V-notch impact energy of 10 ft-lb at 70 °F to 6 ft-lb at 70 °F) in Section 2.1.2.5 of the application without evaluating the adequacy of the new material specification for the design of the Model No. MIDUS package in order to ensure compliance with 10 CFR Part 71.

This information is needed to determine compliance with 10 CFR 71.43(d).