ENERGYSOLUTIONS

November 24, 2014
ES/NRC 14-022
Docket No. 71-9321

ATTN: Document Control Desk
Director, Division of Spent Fuel Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: **Response to Second Request for Additional Information for the Model No. 3-60B Package, Docket No. 71-9321 (TAC No. L24883)**

References: Letter from W. Allen (NRC) to S. Sisley, "Application for Certificate of Compliance No. 9321 for the Model No. 3-60B Package – Second Request for Additional Information," November 6, 2014, ADAMS Accession Number ML14311A976.

In the referenced second Request for Additional Information (RAI), NRC identified the need for additional information to assist with the staff's review of the application to amend Certificate of Compliance (CoC) No. 9321 for the Model No. 3-60B Package. ES hereby provides the response to the second RAI, along with Revision 7 of the Safety Analysis Report (SAR) for the Model 3-60B Type B Shipping Cask. Enclosure 1 contains the response to the second RAI and provides a summary of changes to the 3-60B SAR. Enclosure 2 contains one (1) paper copy of the non-public version of the revised 3-60B SAR, which contains security-related sensitive information that should be withheld under 10 CFR 2.390. Enclosure 3 contains one (1) paper copy of the public version of the revised 3-60B SAR.

Should you or any member of your staff have questions, please contact the undersigned at (408) 558-3509.

Sincerely,

Steven E. Sisley
Cask Licensing Manager
Energy*Solutions*

Enclosures:
1) Responses to Request for Additional Information (7 pages),
2) Safety Analysis Report for Model 3-60B Type B Shipping Cask, Rev. 7, November 2014, Non-Public Version (1 paper copy), **(Security-Related Information – Withhold Under 10 CFR 2.390)**,
3) Safety Analysis Report for Model 3-60B Type B Shipping Cask, Rev. 7, November 2014, Public Version (1 paper copy),

cc w/ enclosure
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Enclosure 1

Responses to Second Request for Additional Information

(7 pages)

The responses to the NRC's second Request for Additional Information (RAI) associated with the Energy*Solutions* (ES) request to amend the Certificate of Compliance (CoC) for the Model No. 3-60B Type B Shipping Cask are provided below. The RAI questions, which are shown in *italics*, are followed by the ES response and a summary of the resulting changes to the 3-60B Safety Analysis Report (SAR).

Drawing Review

1.1 Clarify if silicone will be used as an O-ring material.

In Section 8.1.5.2 of the application, silicone has been removed as an example seal material and only EPDM has been included in its place. However, Licensing Drawing No. C-002-165024-001, Rev. 2, sheet 1 of 10, note 13, indicates that EPDM and silicone are acceptable containment boundary O-ring materials.

This information is necessary to satisfy the requirements in 10 CFR 71.33(a)(5).

Response:

As indicated on SAR Drawing No. C-002-165024-001, Rev. 2, Sheet 1 of 10, Note 13, both silicone rubber and EPDM are acceptable elastomeric compounds for the containment boundary seals. It is noted that the material callout in Section 8.1.5.2 is "for example" (e.g.).

Summary of SAR changes:

- None.

1.2 Justify the thermal shield and spacer wire quality categories (Items 8 and 9 on Licensing Drawing No. C-002-165024-001, Rev. 2, sheet 1 of 10), or revise the licensing drawings to change the thermal shield and spacer wire quality categories.

*The thermal shield and spacer wire prevent excessive heat from the regulatory fire accident from reaching the internal packaging components. Section 2.3 of the application states that, "*Energy*Solutions will apply its USNRC approved 10 CFR Part 71 Subpart H Quality Assurance Program, which implements a graded approach to quality based on a component's or material's importance to safety consistent with the guidance provided in NUREG/CR-6407." NUREG/CR-6407, "Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According to Importance to Safety," provides guidance that the temperature control components should be Category A items (equivalent to QL-I). In the original application, both the thermal shield and spacer wire were QL-II. In your response to the first request for additional information, the quality level for the spacer wire changed to QL-III while the thermal shield quality level remained unchanged. However, justification for the quality categories assigned to the thermal shield and spacer wire has not been provided either in the original application or in the response to the first request for additional information.*

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

Response:

As noted in the RAI above, in response to the first RAI, the quality category of the spacer wire was changed to QL-III. The quality category for the spacer wires was determined in accordance with the Energy*Solutions* (ES) Quality Assurance Program (QAP) based on the guidance provided in NUREG/CR-6407 and Appendix A of Regulatory Guide 7.10. Although Section 5.3 of NUREG/CR-6407identifies temperature control components of a Type B (Normal Form) package as Category A items (equivalent to the ES QL-I), the section discusses "considerations for assigning classifications...". Further, Section 3 of NUREG/CR-6407 permits assignment of a category different from those indicated in the table with justification. Thus, the quality level designation for the spacer wire was determined to be QL-III, as discussed below.

The spacer wires on the cask outer shell are used to position the thermal shield away from the cask outer shell during fabrication to form the air layer between thermal shield and cask outer shell. The spacer wires are also used as backing for the thermal shield seal welds. Once fabricated, the spacer wires serve only as dunnage between the cask outer shell and thermal shield. As such, the quality level of the spacer wire was identified as QL-III in response to the first RAI because the failure or malfunction of the wire would not significantly reduce the package effectiveness and would be unlikely to create a condition that would adversely affect public health and safety. It is also noted that NUREG/CR-6407 defines dunnage (see Section 5.3.3) as Category C (equivalent to QL-III). Therefore, based on the specific criteria defined, and guidance provided in NUREG/CR-6407, QL-III is an appropriate category for the cask spacer wires.

Similarly, spacer wires are used on the impact limiters only provide for spacing to create an air gap between the impact limiter inner end plate and the ends of the cask, and similarly once the impact limiters are installed the wires are simply dunnage. Therefore, the quality level for the impact limiter spacer wires, are also QL-III.

As the thermal shield does provide the thermal protection as described in NUREG/CR-6407, the category is changed to QL-I consistent with the guidance in the NUREG.

Summary of SAR changes:

- SAR Drawing No. C-002-165024-001, Sheet 1 of 10: Change the quality level (QL) designation for the thermal shield (Item 8) to I.

1.3 Clarify how the closure lid test ports which are part of the Configuration B containment boundary will be identified considering the inner and outer test ports are not labeled on the package.

In the Configuration B containment boundary, the two closure lid inner test ports are part of the containment boundary and require leakage rate testing; however, the two outer test ports are not part of the containment boundary and do not require leakage rate testing. The safety analysis report drawings do not identify visual cues which would clearly indicate the test ports to be leak tested, and although the inner test port plugs are centered on a 38 5/8" diameter and the outer test port plugs are centered on a 39 7/8" diameter, the difference may not allow for clear visual identification of which test ports are part of the Configuration B containment

boundary. In addition, it is not immediately apparent to staff if leakage rate testing procedures would assist a leak tester to identify the inner and outer test ports independent of visual cues.

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

Response:

SAR Drawing No. C-002-165024-001 has been revised to require marking on the top surface of the closure lid to identify the inner test ports.

Summary of SAR changes:

- Revised SAR Drawing No. C-002-165024-001, Rev. 3, to add Note 39 on Sheet 1 of 10 and Note 39 call-outs adjacent to the test port call-outs in ITEM A6 – TOP VIEW on Sheet 6 of 10.

Materials Review

2.1 Provide the American Society of Testing Materials standard used to verify the proposed seal material properties identified in note 13 on Revision 3 of Drawing No. C-002-165024-001, and in Tables 3.1 and 3.2 of the application.

Neither the Final Safety Analysis Report drawing note nor the Chapter 8 text identifies the American Society of Testing Materials standard used to verify the critical characteristics of the O-ring seal material.

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

Response:

Section 8.1.5.2 of the 3-60B SAR has been revised to clarify that the elastomeric compounds used for the containment O-ring seals are tested in accordance with applicable nationally recognized testing standards (e.g., ASTM D2240, ASTM D2137, and ASTM E1069.)

Summary of SAR changes:

- Section 8.1.5.2: Revised as noted above.

Containment Review:

4.1 If silicone is still planned to be used as an O-ring material:

a. explain how the leakage rate test can be performed based on physical testing before the silicone saturates with helium, and

b. explain how a leak tester can accurately and repeatedly differentiate permeation from leakage at the leaktight criterion when using helium as a tracer gas on this containment design.

As the staff noted in RAI 4-1 from the first information request (ML14184A673), silicone seals are highly permeable to helium, and because of this, it is known that performing a helium leakage rate test on silicone seals to the leaktight criterion requires a short leakage rate test time. In addition, permeation of helium through silicone increases with temperature. Therefore, performing leakage rate tests to the leaktight criterion on a loaded package would further shorten the leakage rate test time. It is also known that distinguishing helium permeation from leakage to the leaktight criterion for silicone seals is very difficult.

In the response to RAI 4.1 from the first information request, the applicant stated: "The 3-60B cask includes design features that allow the helium leakage rate testing to be completed prior to the seals becoming saturated. Therefore, silicone rubber elastomeric compound is believed to be a suitable material for the containment seals." However, evidence (e.g. helium leakage rate testing of full size silicone seals to the leaktight criterion of the 3-60B containment designs at the maximum temperature expected during loading, resulting in a leakage rate test duration that includes an appropriate factor of safety) has not been provided to indicate that the helium leakage rate test for the 3-60B containment designs can be completed successfully before silicone seals saturate with helium gas on a repeatable basis. It is also not clear how permeation will be accurately differentiated from leakage when leak testing silicone seals with helium to the leaktight criterion on a repeatable basis for the 3-60B containment designs.

This information is needed to determine compliance with 10 CFR 71.43(d), 71.51(a), 71.85(a), and 71.87(c).

Response:

As discussed in the response to RAI 1.1, both silicone rubber and EPDM are acceptable elastomeric compounds for the containment seals. It is noted that silicone rubber O-ring seals were included in SAR Revision 3, which was found by staff to be acceptable as documented in the SER and evidenced by issuance of CoC 71-9321.

Nonetheless, to be responsive to this staff request for more information on how such testing can be performed, the following information is provided:

a. Leakage rate tests of Type B packages with silicone rubber O-rings using helium gas have been successfully performed, even to leaktight standards, for decades. In order to perform the helium leakage rate tests of the containment O-rings before the helium gas permeates through the elastomeric material, the test duration must be limited. The amount of time available to complete the leakage rate testing depends upon the permeability of the elastomeric compound. Operating experience shows that silicone rubber O-rings with the same cross-section used for the 3-60B cask lid containment O-ring will be permeated by helium gas in 15 minutes or less under ambient test conditions. The amount of time required to perform the leakage rate test depends upon the packaging design features and the leakage rate test procedures. For instance, a package that requires the entire cavity to be filled with helium gas to perform the leakage rate test may not be suitable for certain elastomeric compounds, such as silicone rubber, because the time required to fill the cask cavity with helium gas would likely exceed the time required for the helium gas to permeate through the O-ring. However, one approach successfully applied for design such

as this is the use of a sealed cavity filler placed inside the cask cavity during the leakage rate test to minimize the free volume inside the cavity, and thus minimize the time required to fill that free volume with helium gas. Other approaches are commonly used to accomplish the same objective, such as use of a temporary bag on the inside of the containment O-ring. The 3-60B package includes design features specifically intended to minimize the time required to fill the test volume with helium gas, thereby allowing the leakage rate testing to be completed before the helium gas saturates the O-ring.

b. It is not necessary to differentiate permeation from leakage when performing acceptance, maintenance, or periodic leakage rate testing of the containment seals. As discussed in SAR Section 8.2.2.1, any containment seal that does not satisfy the leakage rate test acceptance criterion for any reason (leakage around the O-ring, damage to the sealing surface, helium gas permeation, or any other cause) shall be reworked, replaced, or repaired, as required, and retested prior to returning the package to service.

Summary of SAR changes

- None.

4.2 *Clarify if the drain port socket set screw (used only in the Configuration B containment boundary) is removed during acceptance, maintenance, and periodic leakage rate testing.*

The last sentence of the first full paragraph on page 1-2 of the application states that the drain port socket set screw is removed for maintenance and periodic leakage rate testing of the drain port plug containment seal. This does not appear to be described in Section 8.2.2.1 of the application. In addition, Section 8.1.4 of the application states that the drain port socket set screw is removed for the acceptance leakage rate test. This was not described on page 1-2 of the application.

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

Response:

The drain port socket set screw (Item 54 on Drawing No. C-002-165024-001) is not included (i.e., "used") in the Configuration B containment boundary. As shown in CONTAINMENT BOUNDARY – ITEM A4 on sheet 10 of 10 of Drawing No. C-002-165024-001, the drain port socket set screw is not hatched, nor identified by its item number, indicating that it is not included in the containment boundary. The drain port socket set screw is installed in the threaded hole on the inside end of the Configuration B drain port during cask operation to protect the threads in the hole from damage and minimize contamination of the threads. The threaded hole is provided as a feature to facilitate maintenance and periodic leakage rate testing of the drain port plug fastener seals. The drain port socket set screw is removed from the drain port to allow a helium gas supply to be connected directly to the inside end of the drain port. This feature was specifically added to eliminate the need to fill the entire cask cavity volume with helium, thus minimizing the time required to complete the leakage rate testing of the drain port plug seal and the potential for leakage rate testing failures resulting from helium gas permeation of the O-ring seal material (see response to RAI 4.1).

The SAR text has been revised for consistency.

Summary of SAR changes:

- Section 1.2.1 has been revised to state that the drain port socket set screw shall not be installed for the acceptance leakage rate test of the Configuration B containment system.
- Section 8.2.2.1 has been revised to clarify that the drain port socket set screw shall be removed to perform the maintenance and periodic leakage rate tests of the drain port plug seal.

Editorial Comments

1. *Section 2.1.2 state, "The package is designed to satisfy the requirements of 10 CFR 71.71 under NCT and HAC test conditions." 10 CFR 71.71 only applies to NCT. 10 CFR 71.73 applies to HAC.*

Response:

Section 2.1.2 has been revised to clarify that the package is designed to satisfy the requirements of 10 CFR 71 for Normal Conditions of Transport (NCT) and 10 CFR 73 for Hypothetical Accident Conditions (HAC).

Summary of SAR changes:

- Revised as noted above.

2. *Section 2.1.2, page 2-3 states, "The acceptance criterion for prevention of buckling is based on the ASME Nuclear Code Case N-284. Factors of safety of 1.34 for the NCT and 2.0 for HAC have been used in the buckling evaluation of the cask." These values are reversed. Section 1400 of Code Case N-284-2 lists the factors of safety as 2.0 for Level A and B Service Limits (NCT) and 1.34 for Level D Service Limits (HAC). The calculations use the correct safety factors.*

Response:

Section 2.1.2 has been revised to clarify that the minimum required factors of safety are 2.0 for NCT and 1.34 for HAC.

Summary of SAR changes:

- Revised as noted above.

3. *Item 55 on Drawing No. C-002-165024-001, sheet 8, End View is incorrect. Item 55 is an attachment stud. The drawing is pointing to what looks to be a 1 ¾" thick plate (item 45).*

Response:

ITEM A9 – END VIEW on Sheet 8 of 10 of Drawing No. C-002-165024-001 has been revised to correct the item number called out for the impact limiter bolt ring. The correct item number for the impact limiter bolt ring is 45. Furthermore, review of Drawing No. C-002-165024-001 for other editorial errors resulted in an editorial correction to the description of Item 58 in the Bill of Materials on Sheet 1 of 10.

Summary of SAR changes:

- Section 1.3, Drawing No. C-002-165024-001, Rev. 4, Sheet 1 or 10, B.O.M.: Change Item 58 description to "SOCKET HEAD SCREW, 1/2-20 UNF THREAD, 1" LONG".
- Section 1.3, Drawing No. C-002-165024-001, Rev. 4, Sheet 8 or 10, ITEM A9 – END VIEW: Change item number call-out for bolt ring from 55 to 45.

4. *ANSI N14.23 is not a valid publication. This is identified as a draft reference, and has never been released.*

Response:

This is not a change to the SAR; the ANSI N14.23 draft standard reference was included in revision 3 of the SAR as referenced in the existing issued Certificate of Compliance.

Reference 2-16 of the SAR clearly identifies ANSI N14.23 as a draft standard. The fact that it has only been issued as a draft standard does not make it an invalid publication. However, to avoid the possibility of confusion, the SAR text has been revised to also identify the "draft" status of the standard.

Summary of SAR changes:

- Section 2.6.5.1, pg. 2-14, 1st sentence: Changed "ANSI N14.23 standard" to "ANSI N14.23 draft standard".
- Section 2.6.5.1, pg. 2-14, last sentence on page: Changed "ANSI N14.23" to "The ANSI N14.23 draft standard".
- Section 2.6.5.2, pg. 2-16, 1st sentence: Changed "ANSI N14.23 standard" to "ANSI N14.23 draft standard".