



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

December 1, 2017

Mr. Gerard Van Noordennen
Vice President Regulatory Affairs
EnergySolutions
2105 South Bascom Ave., Suite 230
Campbell, CA 95008

SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9168, REVISION NO. 24, FOR THE
MODEL NO. 8-120B PACKAGE

Dear Mr. Van Noordennen:

As requested by your letter dated April 5, 2017, as supplemented on September 12 and November 14, 2017, enclosed is the Certificate of Compliance No. 9168, Revision No. 24, for the Model No. 8-120B package. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's safety evaluation report is also enclosed.

The approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of Part 173.471 of the Title 49 of the *Code of Federal Regulations*. If you have any questions regarding this certificate, please contact Pierre Saverot of my staff at (301) 415-7505.

Sincerely,

/RA/

Meraj Rahimi, Acting Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9168
EPID No. L-2017-LLA-0054 (Previously
CAC No. L25213)

Enclosures:

1. Certificate of Compliance
No. 9168, Rev. No. 24
2. Safety Evaluation Report
3. Registered Users

Upon removal of
Enclosure 3, this
document is uncontrolled.

cc w/encl 1 & 2: R. Boyle, Department of Transportation
J. Shuler, Department of Energy, c/o L. Gelder
Registered Users

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SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9168, REVISION NO. 24, FOR THE
MODEL NO. 8-120B PACKAGE, DOCUMENT DATE: December 1, 2017

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ADAMS PKG: ML17338A827

ADAMS P8 Letter No.: ML17338AA829

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| OFC: | SFM | E | SFM | E | SFM | | SFM | | SFM | | SFM | |
| NAME: | PSaverot | | JWise | | JIreland | | MRahimi | | YDiaz-Sanabria | | WWheatley | |
| DATE: | 11/6/2017 | | 10/26/2017 | | 10/26/2017 | | 11/7/2017 | | 11/22/2017 | | 11/28/2017 | |
| OFC: | SFM | E | SFM | E | SFM | | SFM | | SFM | | SFM | |
| NAME: | MRahimi | | | | | | | | | | | |
| DATE: | 12/01/2017 | | | | | | | | | | | |

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SAFETY EVALUATION REPORT
Docket No. 71-9168
Model No. 8-120B
Certificate of Compliance No. 9168
Revision No. 24

SUMMARY

By letter dated April 5, 2017, EnergySolutions (ES) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to (i) commit to the latest version of the leak testing standard ANSI N14.5 2014, (ii) upgrade leak testing of the package to a leaktight criterion per ANSI N14.5, (iii) clarify requirements for the pre-shipment leak test for better alignment with ANSI N14.5, (iv) provide specifications for the seals, impact limiter foams, and (v) make a few editorial and clarification changes to the licensing drawings and the application. In addition, ES also submitted a timely renewal request for the certificate of compliance (CoC). On September 12, 2017, ES provided responses to the request for additional information (RAI) letter dated August 8, 2017. ES submitted a consolidated revision of the application, Revision 14, dated November 14, 2017.

NRC staff reviewed the applicant's request and finds that the package meets the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71.

1.0 GENERAL INFORMATION

Changes proposed by the application include:

- Updated references and licensing drawings to include a detailed description and specification requirements for the cask seals. Specifically, the licensing drawings re-directed to ES Specification ES-C-038 for detailed requirements; however, the specification was not part of the application. As stated by 10 CFR 71.33(a)(4), the application must include a detailed description and identification of the containment system, therefore the change will specify the seal specifications in the application.
- Updated references and licensing drawings to include a detailed description and specification requirements for the impact limiter foam. Specifically, the licensing drawings re-directed to ES Specification ES-M-175 for detailed requirements, however; the specification was not part of the application. As stated by 10 CFR 71.33(a)(5), the application must include a detailed description and identification of specific materials of construction, weights, dimensions, and fabrication methods of various components.
- Added references, updated drawings and general editorial and format changes.

The staff reviewed ES Drawing Nos. C-110-E-0007, Sheets 1-6, Revision No. 24, and Drawing No. DWG-CSK-12CV01-EG-0001-01, Revision No. 4, and confirmed that the applicant inserted the appropriate notations on the licensing drawings.

The staff concludes that the information presented in this section of the application provides an adequate basis for the evaluation of the Model No. 8-120B package against 10 CFR Part 71 requirements for each technical discipline.

2.0 STRUCTURAL AND MATERIALS EVALUATION

The applicant revised the application to provide specifications for the impact limiter foam and containment seals, which previously were contained in separate specification documents referenced by the application. The staff evaluated whether the new information in the application provides adequate control of the impact limiter and seal material properties.

2.1 Impact Limiter Foam

The applicant removed from the previous application and drawing references the ES specification ES-M-175, "Specification for Rigid Polyurethane Foam for Impact Limiters for 8-120B Casks." This specification contained the testing and performance requirements of the foam. In place of this specification, the applicant revised the application and drawings to include similar information.

The staff evaluated the additional detail provided in Section 8.2.5 of the application and drawing C-110-E-0007 to determine whether the impact limiter foam properties and test methods are sufficiently defined. The staff notes that each of the critical foam characteristics previously defined in the discontinued specification document are described in the revised application and corresponding drawing. This includes requirements on material density, specific crush strengths at various degrees of strain, the capability of the foam to resist sustaining a flame, and the reference to the specific types of foam that were previously allowed in the ES-M-175 specification. The staff finds the application and drawing specifications for the impact limiter foam to be acceptable because the critical foam characteristics of density, crush strength, and flammability are specifically defined in the application and the specific material options are identical to those previously approved by the NRC.

2.2 Seals

The applicant removed from the previous application and drawing references the ES specification ES-C-038, "Seal Specification for the 8-120B Cask." This specification contained the testing and performance requirements of the vent port seal and the primary and secondary closure lid O-rings, such as the hardness, low-temperature brittleness, and performance under elevated temperatures and pressures. In place of this specification, the applicant revised the application and drawings to include similar requirements. The staff evaluated the additional detail provided in the application and drawings to determine whether the seal properties and test methods are sufficiently defined, as was previously done. The staff notes that some aspects of the seal specifications that were previously in the ES-C-038 document were transferred unchanged to the application and drawings, and the following evaluation addresses new or revised materials test specifications.

The applicant revised drawing C-110-E-0007 to identify a specific vent port seal from Parker Hannifin Corporation. The applicant stated in Section 8.2.5 that the seal's acceptable performance in the 8-120B package is demonstrated by the manufacturer's service temperature range for this material and the fact that this seal material is qualified to National Aerospace Standard NAS1613, "Packing, Preformed, Ethylene Propylene Rubber." The staff evaluated the NAS1613 test standard against the requirements in the previously approved ES-C-038 seal specification. The staff notes that the NAS test standard includes requirements for hardness, tensile strength, elongation, cold temperature retraction, compression set, allowable property changes under high temperature air aging, and leakage performance at high and low temperatures. The staff notes that the NAS1613 air aging and leakage test temperatures bound

the normal conditions of transport (NCT) and hypothetical accident conditions (HAC) for the 8-120B package. The staff finds the application description of the vent port seal to be acceptable because qualifying to the NAS1613 standard is considered capable of ensuring that the vent port seal can maintain containment under NCT and HAC.

The applicant revised the application Section 8.2.5 description of the closure lid O-rings to specify a low temperature brittleness test method that is different from the previously approved method. For the brittleness testing, the applicant changed the test method from ASTM D2137, "Standard Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics," Method A to ASTM D2137 Method C. The staff notes that Methods A and C perform essentially the same brittleness test; however, Method C is performed only at single temperature of interest to confirm no failure, while Method A is performed at several temperatures to identify the temperature at which no failures occur. The staff finds the revision to Method C acceptable because testing the O-ring material at its lowest service temperature is capable of ensuring the containment seal's low temperature brittleness performance for the 8-120B package.

The discontinued ES-C-038 specification contained a requirement for permeability testing of the O-rings that was not added to the application. The staff notes that the application requires leakage testing of the containment boundary to American National Standards Institute (ANSI) standard ANSI N14.5, "American National Standard for Leakage Tests on Packages for Shipment of Radioactive Materials," to demonstrate leak tightness of the package in the year prior to shipment. Because this leakage testing is capable of verifying the containment performance of the closure lid O-rings, the staff finds the removal of the separate permeability test requirement to be acceptable.

Based on review of the statements and representations in the application, the staff concludes that the materials design has been adequately described and evaluated, and that the structural performance of the package meets the thermal requirements of 10 CFR Part 71.

4.0 CONTAINMENT EVALUATION

This amendment request is to: 1) commit to the ANSI N14.5-2014 standard, 2) perform the leakage rate testing to the ANSI N14.5 leaktight acceptance criterion, 3) clarify the pre-shipment leakage rate test requirements, and 4) provide more detailed specifications for the containment seals. Therefore, the purpose of the containment review is to evaluate that these changes satisfy the containment requirements of 10 CFR Part 71 under NCT and HAC.

4.1 Description of Containment System

The Model No. 8-120B package has the containment boundary defined as the cask inner vessel inner shell, the bolting flange and seal ring, inner bottom plate, all structural and pressure retaining welds on the containment boundary, cask primary lid outer plate and attached seal ring, primary lid containment (innermost) seal, vent port cap screw and seal, cask secondary lid outer plate, and secondary lid containment (innermost) seal. The staff reviewed Chapter 4 of the application and confirmed that there is no change in the containment system and components in this amendment request.

Instead of including the seal specifications on a separate document, the seal specifications have been specifically included and detailed on the application licensing drawings. The staff confirmed the elastomeric seal material temperature limits specified on the licensing drawings

are able to exceed the containment boundary seals predicted temperatures in Tables 3-1 and 3-2 of the application based on the descriptions in Chapter 8 of the application. Section 8.2.5.2.2, "Primary and secondary lid containment seals," of the application describes that the elastomeric compounds will be tested to demonstrate low temperature performance using ASTM D1237 Method C, and high temperature performance for NCT and HAC conditions using ASTM E1069. Published test literature and/or seal data will be used to demonstrate the performance of the remaining material requirements on the licensing drawings and in Section 8.2.5.2.1, "All seals," of the application. Section 8.2.5.2.3, "Vent port containment seal," describes that the vent port seal will be a specific Parker product that has been qualified to exceed the low temperature and high temperature NCT and HAC limits and is tested per National Aerospace Standard NAS1613. Additional discussion on the elastomeric seals can be found in Chapter 2 of this SER. The staff also confirmed that silicone was not specified as a seal material option due to its high helium permeability during helium leakage rate testing. The staff confirmed the primary and secondary lid bolts and vent port torque values were included in Chapter 7 of the application. The application included a discussion of the radiation exposure to the elastomeric seals and showed that there was no significant loss of elastomeric properties. Chapter 4 of the application also described that all containment boundary materials are procured to ITS Category A in accordance with NUREG-6407.

4.2 Containment Under Normal Conditions of Transport

Section 4.2 of the application describes that the Model No. 8-120B package is designed, constructed, and prepared for shipment so that, under the tests specified in 10 CFR 71.71, the package meets the containment requirements of 10 CFR 71.51(a)(1). Section 4.2.2 of the application describes that the 8-120B package is designed to the leaktight containment criterion, 1×10^{-7} ref-cm³/s of air, per ANSI N14.5-2014. The MNOP is 35 psig and it has not changed in this amendment request. Section 4.2.3 of the application describes that Section 2.6 of the application shows that there would be no loss or dispersal of radioactive contents and that the containment boundary, seal region, and closure bolts do not undergo any inelastic deformation when subjected to the conditions of 10 CFR 71.71. Section 4.2.3 of the application also describes that Table 3-1 of the application shows that the seals, and containment boundary components do not exceed their allowable temperature limits when subjected to the conditions of 10 CFR 71.71. The staff confirmed that Section 2.6 and Table 3-1 remain unchanged in this amendment request.

4.3 Containment Under Hypothetical Accident Conditions

Section 4.3 of the application describes that the Model No. 8-120B package is designed, constructed, and prepared for shipment so that, under the tests specified in 10 CFR 71.73, the package meets the containment requirements of 10 CFR 71.51(a)(2). Section 4.3.2 of the application also describes that the Model No. 8-120B package is designed to the leaktight containment criterion, 1×10^{-7} ref-cm³/s of air, per ANSI N14.5-2014. The maximum internal pressure is 155 psig and it has not changed in this amendment request. Section 4.3.3 of the application describes that Section 2.7 of the application shows that there would be no loss or dispersal of radioactive contents and that the containment boundary, seal region, and closure bolts do not undergo any inelastic deformation when subjected to the conditions of 10 CFR 71.73. Section 4.3.3 of the application also describes that Table 3-2 of the application shows that the seals, and containment boundary components do not exceed their allowable temperature limits when subjected to the conditions of 10 CFR 71.73. The staff confirmed that Section 2.7 and Table 3-2 of the application remain unchanged in this amendment request.

4.4 Leakage Rate Tests

The fabrication leakage rate testing for the as-built cask body assemblies built before April 1, 1999, is described in Section 8.1.3 of the application to the leaktight acceptance criterion. Section 8.1.3.1 of the application describes the fabrication leakage rate testing that was performed on configurations 1 and 2 built before April 1, 1999, when leakage rate testing was not performed to the leaktight acceptance criterion. In Section 8.1.3.1 of the application, details of the previously performed halogen fabrication leakage rate testing method have been removed for clarity.

Section 8.1.3.2 of the application describes the confirmatory leak test performed after fabrication on the as-built configurations 1 and 2 body assemblies to demonstrate its ability to meet the leaktight acceptance criterion and sensitivity requirements in ANSI N14.5-2014. These as-built configurations have multiple layer construction that includes the welded stainless steel inner liner, lead shielding, and carbon steel outer vessel that is in addition to the carbon steel containment shell; therefore, it is not possible to directly access the containment shell. Section 8.1.3.2 of the application describes that the leakage rate test performed is the helium mass spectrometer test, which is a gas filled envelope technique where helium in a hood bag surrounds the evacuated as-built configurations 1 and 2 body assemblies. The staff verified that this type of leakage rate testing has the capability to detect leakage to the leaktight acceptance criteria. Section 8.1.3.2 of the application describes that the leakage rate testing may occur with or without the associated primary and secondary lids. This is because all lids are configuration 3 and fabricated after April 1, 1999, therefore the lids are leakage rate testing in accordance with Section 8.2 of the application. Section 8.1.3.2 of the application described that the leakage rate test is performed in accordance with written procedures approved by an ASNT NDT Level III in leakage testing. Section 8.1.3.2 of the application also described the testing is performed by personnel that are qualified and certified in accordance with ASNT Recommended Practice No. SNT-TC-1A.

The fabrication leakage rate testing for the inner containment shell and lids for packages in configuration 3 fabricated after April 1, 1999, is described in Section 8.2.4 of the application to the leaktight acceptance criteria and sensitivity requirements in ANSI N14.5-2014. The leakage rate testing method described is the gas filled envelope. Section 8.2.4 of the application describes that the leakage rate testing written procedures shall be approved by personnel whose qualifications and certification on the nondestructive method of leakage rate testing includes certification by a nationally recognized society at a level appropriate to the writing and/or review of leakage rate testing procedures, such as an ASNT NDT Level III in leak testing. Section 8.2.4 of the application also describes that the leakage rate testing procedures shall be qualified and the qualification shall be documented. In addition, Section 8.2.4 of the application describes that leakage rate testing shall be performed by personnel who are qualified and certified in accordance with ASNT Recommended Practice No. SNT-TC-1A.

The periodic and maintenance leakage rate testing for each Model No. 8-120B package is described in Section 8.3.2.1 of the application to the leaktight acceptance criteria and sensitivity requirements in ANSI N14.5-2014. The leakage rate testing method described is the gas filled envelope. Section 8.3.2.1 of the application describes that the leakage rate testing written procedures shall be approved by personnel whose qualifications and certification on the nondestructive method of leakage rate testing includes certification by a nationally recognized society at a level appropriate to the writing and/or review of leakage rate testing procedures, such as an ASNT NDT Level III in leak testing. Section 8.3.2.1 of the application also describes that the leakage rate testing procedures shall be qualified and the qualification shall be

documented. In addition, Section 8.3.2.1 describes that leakage rate testing shall be performed by personnel that are qualified and certified in accordance with ASNT Recommended Practice No. SNT-TC-1A. The staff confirmed that Section 8.3.2.1 of the application describes that each Type B radioactive material shipment shall be made with containment seals that have been replaced and have had periodic leakage rate testing performed within the preceding 12 month period.

The pre-shipment leakage rate testing of all containment closures is described for each 8-120B loaded package before each shipment in Section 8.3.2.2 of the application. The acceptance criteria of no detected leakage when tested to a sensitivity that shall be equal to or more than 1×10^{-3} ref-cm³/s is described in Section 8.3.2.2 of the application. The leakage rate testing method described is the gas pressure rise or gas pressure drop. The staff verified that this type of leakage rate test is capable to detect leakage at the required sensitivity. Section 8.3.2.2 of the application describes that the leakage rate testing written procedures shall be approved by personnel whose qualifications and certification on the nondestructive method of leakage rate testing includes certification by a nationally recognized society at a level appropriate to the writing and/or review of leakage rate testing procedures, such as an ASNT NDT Level III in leak testing. Section 8.3.2.2 of the application also describes that the leakage rate testing procedures shall be qualified and the qualification shall be documented. In addition, Section 8.3.2.2 of the application describes that leakage rate testing shall be performed by personnel that are qualified and certified in accordance with ASNT Recommended Practice No. SNT-TC-1A. The staff confirmed that pre-shipment leakage rate testing of the primary lid and secondary lid O-rings and vent port is described in Section 7.1.14 of the application, which also references Section 8.3.2.2 of the application.

The staff concludes that the leakage rate testing description, methods, qualification and approval of written leakage rate testing procedures, and qualification and certification of leakage rate testing personnel description demonstrates the commitment to ANSI N14.5-2014. The staff also concludes the application describes that the leakage rate testing is performed to the leaktight acceptance criteria for packages fabricated before and after April 1, 1999. The staff confirmed that the pre-shipment leakage rate testing has been clarified in Section 8.3.2.2 of the application to describe that there is no detectable leakage when tested to a sensitivity that shall be equal to or more sensitive than 1×10^{-3} ref-cm³/s.

The staff reviewed the changes in Chapters 4, 7, and 8 of the application, as well as the licensing drawings, and finds that the operating procedures and the acceptance tests and maintenance program, described in Chapters 7 and 8, and licensing drawings incorporated by reference into the CoC are appropriate for the changes requested in this amendment.

Based on review of the statements and representations in the application, the staff concludes that the containment design and leakage rate testing have been adequately described and evaluated, and that the package design meets the containment requirements of 10 CFR Part 71.

7.0 PACKAGE OPERATIONS

The package operating procedures describe the general procedures for loading and unloading of the package. Changes were made to this Section to reflect the correction of editorial errors, updates to licensing drawings and revision numbers, and also clarification of procedure terminology.

Based on these findings, the staff concludes that the operating procedures both meet the requirements of 10 CFR Part 71 and are adequate to assure the package will be operated in a manner consistent with its evaluation for approval.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

Consistent with 10 CFR 71.31(c), the proposed changes described in Section 1 of this document were implemented, as appropriate, to the Acceptance Tests and Maintenance Program. Specifically, the changes to this section include:

- Perform the periodic and maintenance leak testing to the more stringent “leaktight” criterion, in lieu of the halogen leak testing. The basis for the change is that halogen leak testing is not suitable for leaktight systems and is not currently used for the 8-120B package testing. Also, the applicant committed to perform a confirmatory leak rate test of the as-built cask body assemblies for 8-120B units built pre-1999. The lids for these units were recently replaced with lids that have been tested to the leaktight criterion during fabrication, therefore including the lids in the test is optional. Post-1999 units are leak tested to “leaktight” during fabrication. In addition, the licensee also committed to perform the leak test procedures against the current industry standards code, ANSI-N14.5-2014.
- A clarification of the pre-shipment leak test requirements. The change will eliminate specification of nonessential variables since procedures will be approved by a level III per ANSI N14.5 2014.

Major changes made in Section 8.1.3.1; 8.1.3.2; 8.2.4; 8.3.2.1; and 8.3.2.2 of the application were described in detail in Section 4.4 of this SER. Based on these findings, the staff concludes that the acceptance tests and maintenance requirements both meet the requirements of 10 CFR Part 71 and are adequate to assure the package will be tested and maintained in a manner consistent with its evaluation for approval.

CONDITIONS

The conditions specified in the CoC have been revised to incorporate several changes as indicated below:

Item No. 3.b and the references section have been revised to identify *EnergySolutions*’ consolidated application, Revision No. 14, dated November 2017.

Condition No. 5(a)(3) has been revised to include *EnergySolutions*’ Drawing No. C-110-E-0007, Sheets 1-6, Revision No. 24.

Condition No. 10 was modified to authorize continued use of the previous revision for up to 1 year.

Condition No. 11 has been updated to reflect the new expiration date of December 31, 2022.

CONCLUSION

Based on the statements and representations in the application, as supplemented, and the conditions listed above, the staff concludes that the Model No. 8-120B package design has been adequately described and evaluated and that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9168, Revision No. 24, on December 1, 2017.