



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

July 5, 2016



NVY 16-022

Mr. Steven Sisley
Cask Licensing Manager
EnergySolutions
2105 South Bascom Ave., Suite 230
Campbell, CA 95008

SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9168, REVISION NO.23, FOR THE
MODEL NO. 8-120B PACKAGE

Dear Mr. Sisley:

As requested by your letter dated January 28, 2016, supplemented May 12, 2016, enclosed is Certificate of Compliance No. 9168, Revision No. 23, 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 49 CFR 173.471.

If you have any questions regarding this certificate, please contact Pierre Saverot of my staff at (301) 415-7505.

Sincerely,

A handwritten signature in black ink that reads "John McKirgan".

John McKirgan, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9168
CAC No. L25082

Upon removal of
Enclosure 3, this
document is uncontrolled.

Enclosures: 1. Certificate of Compliance
No. 9168, Rev. No. 23
2. Safety Evaluation Report
3. Registered Users

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

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGE
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2. PREAMBLE

- a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."
- b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

- a. ISSUED TO (*Name and Address*)
EnergySolutions
Suite 100, Center Point II
100 Center Point Circle
Columbia, SC 29210
- b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
EnergySolutions application, Revision No. 11, dated
May 2016.

4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.

(a) Packaging

- (1) Model No.: 8-120B
- (2) Description

A cylindrical carbon steel, lead shielded, packaging designed for the transport of radioactive waste materials. The packaging has four tie-down and two removable lifting devices and is transported in the upright position with cylindrical foam-filled impact limiters, 102 inches outside diameter (OD), installed at each end of the packaging. The overall height of the package with the impact limiters attached is 132 ¼ inches. The maximum gross weight of the package is approximately 74,000 pounds (lbs), as follows:

Packaging Body	42,220 lbs
Lid	7,080 lbs
Payload	14,150 lbs
Impact Limiters	4,860 lbs (each)
Miscellaneous	830 lbs
Package	74,000 lbs

The cavity of the packaging is a right circular cylinder with an internal diameter of 61 13/16 inches and a height of 74 7/8 inches. The package body consists of two shells, both fabricated of ASTM A516, Grade 70 steel. The annular space between the 1½ inch thick external shell and the ¾ inch thick internal shell is filled with 3.35 inch thick lead. The primary lid is attached to the packaging body with twenty equally spaced 2-inch diameter bolts. A supplemental 14 gauge stainless steel sheet is welded to the inside surface of the primary lid.

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5(a)(2) Packaging Description (Continued)

The centered secondary lid is attached to the primary lid with twelve equally spaced 2-inch diameter bolts. A thermal shield, consisting of two polished stainless-steel plates separated by a thin air gap, is attached to the secondary lid lifting lugs with hitch-pins. A ½ inch thick steel plate covers the central hollow region of the lower impact limiter. A 12 gauge stainless steel liner is welded to the cavity of the package and the lid surface to protect all accessible areas from contamination.

The containment boundary consists of the inner shell, the upper baseplate, the bolting ring, the inner O-rings of the lids, and the lids. Test ports for leak testing of the package are located between the twin O-ring seals for both the primary and secondary lids.

There are three configurations of the packaging: Configuration 1 includes a drain port, sealed with the insertion and welding of a rod in the drain port; Configuration 2 does not have a drain port; Configuration 3 does not have a drain port and the packaging's base plate is fabricated differently than for Configurations 1 and 2. Fabrication of Configurations 1 and 2 is not authorized.

(3) Drawings

The packaging is constructed and assembled in accordance with *EnergySolutions* Drawing No. C-110-E-0007, 8-120B Shipping Cask, sheets 1-6, Revision No. 22.

The secondary lid thermal shield is constructed in accordance with *EnergySolutions* Drawing No. DWG-CSK-12CV01-EG-0001-01, 8-120B Cask Secondary Lid Thermal Shield Details, Rev. 3.

(b) Contents

(1) Type and form of material

- (i) Byproduct, source, or special nuclear material in the form of dewatered or grossly dewatered resins, solids, including powdered or dispersible solids, or solidified material, contained within secondary containers; or
- (ii) Radioactive material in the form of activated metals, or metal oxides in solid form, contained within secondary containers.

(2) Maximum quantity of material per package

- (i) Activity not to exceed 3,000 times a Type A quantity along with the following limits:

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- (1) The limit determined per the procedure in Attachment 1 to Chapter No. 7 of the application for beta and gamma emitting radionuclides.
- (2) The mass limits for fissile materials as prescribed by 10 CFR 71.15 for exempting materials from classification as fissile material.
- (3) A maximum total package neutron source of 1×10^5 neutrons/second for materials that produce neutrons (other than fissile materials) through any means, including spontaneous fission, alpha-neutron reactions, and gamma-neutron reactions.

- (ii) Maximum decay heat: 200 Watts.
- (iii) Maximum weight of contents: 14,150 lbs including shoring and secondary containers.
- (iv) Powdered or dispersible solid materials must have a mass of at least 60 grams or a specific activity of 50 A_2/g or less.
- (v) Explosives, corrosives, and non-radioactive pyrophorics are prohibited. Pyrophoric radionuclides may be present only in residual amounts below 1 weight per cent.
- (vi) Materials that may auto-ignite or change phase at temperatures below 350°F, not including water, shall not be included in the contents. Also, contents shall not include any materials that may cause any significant chemical, galvanic, or any other reaction.
- (vii) Powdered radioactive materials shall not include radioactive forms of combustible metal hydrides or combustible element metals, i.e., magnesium, titanium, sodium, potassium, lithium, zirconium, hafnium, calcium, zinc, plutonium, uranium, and thorium, or combustible non-metals, e.g., phosphorus.
- (viii) Contents may only include quantities of boron, lithium, or beryllium such that these materials do not constitute quantities sufficient to be considered as a bulk material for a payload item or a portion of that payload item.

6. In addition to the requirements of Subpart G of 10 CFR Part 71:

- (i) The package must be prepared for shipment and operated in accordance with the Operating Procedures of Chapter 7 of the application,
- (ii) The packaging must be tested and maintained in accordance with the acceptance tests and maintenance program described in Chapter 8 of the application.

7. Except for close fitting contents, shoring must be placed between the secondary containers, or activated components, and the package cavity's walls to prevent both radial and axial movements during transport.

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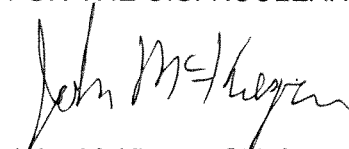
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8. Flammable gas (hydrogen) concentration is limited to less than 5% in volume. Compliance with this concentration limit is determined by the methodology used in NUREG/CR-6673.
9. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.
10. Expiration date: August 31, 2017.

REFERENCES

EnergySolutions application, Revision No. 11, May 2016.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION



John McKirgan, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: July 5, 2016



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SAFETY EVALUATION REPORT
Docket No. 71-9168
Model No. 8-120B
Certificate of Compliance No. 9168
Revision No. 23

SUMMARY

By letter dated January 28, 2016, *EnergySolutions* (ES) submitted an application to the U.S. Nuclear Regulatory Commission to add grossly dewatered resins to the authorized contents of the Model No. 8-120B package. On May 12, 2016, ES provided responses to the request for additional information (RAI) letter dated March 9, 2016, and submitted a consolidated revision of the application, Revision 11, dated May 2016.

NRC staff reviewed the applicant's request and found that the package meets the requirements of 10 CFR Part 71.

1.0 GENERAL INFORMATION

The staff reviewed *EnergySolutions* Drawing Nos. C-110-E-0007, Sheets 1-6, Revision No. 22, which cover all three potential configurations of the package, and *EnergySolutions* Drawing No. DWG-CSK-12CV01-EG-0001-01, Rev. 3, of the thermal shield. The applicant inserted the appropriate notations on the licensing drawings.

The amendment request expanded the description of the "dewatered" resin contents to include "grossly dewatered resins". The term "dewatered" means that the water used to sluice resins has been removed from the waste, whereas the term "grossly dewatered" refers to the first step in the dewatering process, i.e., when resins have not yet been processed to reduce the water content further than that which can be obtained by pumping water out the liner until the pump loses suction.

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 EVALUATION

No changes were made to the structural evaluation of the package other than adding, in this chapter, the evaluation of differential thermal expansion between grossly dewatered resins and the secondary container for (i) the normal conditions of transport (NCT) heat and cold conditions and (ii) for the hypothetical accident conditions (HAC) fire.

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

3.0 THERMAL EVALUATION

This amendment request is to add grossly dewatered resins, which the applicant defined in Section 1.2.2.1 of the application as an industry term applied to resins that have not been processed to reduce the water content further than that which can be obtained by pumping water out of the liner until the pump loses suction.

Certificate of Compliance condition No. 5(b)(2)(ii) states the maximum decay heat of the content is 200 Watts which is consistent with the thermal analysis. Certificate of Compliance condition No. 5(b)(1)(i) states the contents are contained within a secondary container; the staff ensured there was adequate ullage within the secondary container to meet 10 CFR Part 71.87(d) considering the grossly dewatered contents. Certificate of Compliance condition No. 8 also states that the hydrogen gas generation is limited to less than 5% by volume which is consistent with the NCT and HAC pressure calculations.

The staff reviewed the NCT and HAC pressure calculations in Sections 3.3.2 and 3.4.3 of the application respectively, and finds that the calculations which address the gas temperature increase, water vapor pressure, and hydrogen generation are adequate for the grossly dewatered contents.

The staff also reviewed the thermal expansion calculations during NCT hot conditions, NCT cold conditions, and HAC conditions in Sections 2.6.1.2, 2.6.2, and 2.7.4.2 of the application respectively due to the partial water content of the grossly dewatered contents. The staff found that the calculations addressed the expansion of a bounding quantity of water over the content temperature range, this resulted in the need for 10% ullage within the secondary container based on a bounding NCT cold conditions analysis.

The staff also confirmed that Section 7.1.21.3 of the application operating procedures addressed that there is at least 10% available free volume in the form of ullage for expansion of the liquid portion of the content within the secondary container.

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

4.0 CONTAINMENT EVALUATION

The containment review is performed to evaluate the impact of grossly dewatered resins on flammable gas concentrations and the containment analysis, and verify that the package design satisfies the containment requirements of 10 CFR Part 71 under NCT and HAC.

4.1 Containment Design

The Model No. 8-120B package has the containment boundary defined as the inner shell of the shielded transport cask together with the associated lid, O-ring seals and lid closure bolts. The Model No. 8-120B package has three penetrations of the containment vessel: (1) the primary lid with the lid's inner O-ring, (2) the secondary lid with the secondary lid's inner O-ring, and (3) the vent port located in the primary lid. The vent port is sealed with a Parker Stat-O-ring. The primary and secondary lids are sealed with elastomeric O-rings.

The staff reviewed SAR Section 4.0 and confirmed that there is no change in the containment system and components in this amendment request.

4.2 Leakage Rate Testing

The fabrication leakage tests are performed on the entire containment boundary including the closure lid, the vent port, the cask inner shell and base plate, and the associated welds. The maintenance and periodic leakage tests are performed on the closure lid and the vent port. The pre-shipment leak test is performed on the lid and the vent port. All leak tests need to demonstrate that the requirements of ANSI N14.5-1997 are met.

The applicant specified in the RAI response that a planned amendment will address the upgrades to the containment and require that the leakage rate testing procedures are developed and approved by personnel certified by the ASNT, as a Level III examiner, in compliance with ANSI N14.5-2014.

The staff reviewed the RAI response, and Sections 7 and 8 of the application, and finds that the operating procedure and the acceptance tests and maintenance program, described in Sections 7 and 8, respectively, are appropriate for this amendment request.

4.3 Hydrogen Gas Generation

The applicant stated in Section 1.2.2.3 that (1) explosives, non-radioactive pyrophorics and corrosives are prohibited, (2) materials that may auto-ignite or change phase at temperatures less than 350°F, not including water, shall not be included in the contents, (3) contents shall not include any materials that may cause any significant chemical, galvanic or other reactions as required by 10 CFR 71.43(d), and (4) the hydrogen generated must be limited to less than 5% by volume of the free gas volume if present at standard conditions for temperature and pressure (STP).

The staff reviewed Section 1.2.2.3 and confirmed that the four requirements mentioned above remain unchanged for 8-120B package loaded with the grossly dewatered resins.

The applicant performed sample hydrogen calculations with the resins fully flooded, grossly dewatered (20%), and dewatered (1%), as described in Attachment A "Hydrogen Calculation Details" of RAI response (ES/NRC 16-011, Enclosure 1). Based on the sample calculations, the applicant revised Attachment 2 "Determination of Hydrogen Concentration", in Section 7.0, for the determination of hydrogen generated by the grossly dewatered resins and concluded that (a) it is neither necessary nor desirable to define a limit in the water content of the grossly dewatered resins, and (b) the 10-day LSA rule is only applicable for dry and dewatered contents, but not for grossly dewatered materials, and (c) the hydrogen evaluations always need to be performed, using the methodology of NUREG/CR-6673, for shipment of the grossly dewatered resins in 8-120B.

The staff reviewed the sample calculations of the resins fully flooded, grossly dewatered (20%), and dewatered (1%) shown in Attachment A and the revised instructions in Attachment 2. The staff determined that the analyses of hydrogen gas generation provided in Attachment A are acceptable and the instructions in Attachment 2 of Chapter 7 are appropriate for the determination of hydrogen concentration generated by grossly dewatered resins.

The applicant stated in its RAI response (ES/NRC 16-011, Enclosure 1) that the grossly dewatered resin shipments in the 8-120B must meet the 5% hydrogen concentration limit. The applicant noted that the shippers are required by the guidelines of Attachment 2 of Chapter 7 to ensure the hydrogen concentration of grossly dewatered resins remains below a 5% concentration limit.

Based on the sample calculations in Attachment A and the revised instructions in Attachment 2, the staff determined that the amendment request for adding grossly dewatered resins as contents has no significant impact on the flammable gas concentrations and has no adverse effect on the containment function of the Model No. 8-120B package.

4.4 Evaluation Findings

Based on review of the statements and representations in the application, the staff concludes that the containment system and the flammable gas (hydrogen) generation have been adequately described and evaluated, and that the package meets the containment requirements of 10 CFR Part 71.

5.0 SHIELDING

The shielding evaluation was not modified.

In order to account for the possibility that the package dose rates could potentially exceed regulatory limits if a maximum resin load were to experience water migration, or leaching, to the extent that the top part of the payload would locally exceed the γ /s.g limit, the applicant changed the operating procedures, i.e., the "qualification procedure" delineated in Attachment 1 to Chapter 7 of the application, to require that the mass of free standing water be excluded in the calculations of the source strength density for shipments of grossly dewatered resins. Free standing water is defined as the quantity of water that would escape if the bottom of the secondary container were to be punctured.

Based on its review of the statements and representations in the application, the staff finds reasonable assurance that the shielding design has been adequately described and evaluated and that the package meets the external radiation requirements of 10 CFR Part 71.

6.0 CRITICALITY EVALUATION

Not applicable.

7.0 PACKAGE OPERATIONS

Changes were made to Section 7.1, Attachment 1, "Determination of Acceptable Beta and Gamma Source Strength", and Attachment 2, "Determination of Hydrogen Concentration."

For shipments of grossly dewatered resins, a step was added, in Section 7.1.21.3 of the loading procedures, to require verification of the adequate sealing of the secondary container and confirmation of a minimum of 10% of available free volume in the form of ullage and/or interstitial void space for expansion of the liquid portion of the contents within the secondary container.

Step 3 of the "qualification procedure", in Attachment 1, has been revised to note that the weight of free standing interstitial water shall be excluded when calculating the source strength density for shipments of grossly dewatered resins. This modification allows the applicant not to place a limit on the amount of free standing water in grossly dewatered resins

Attachment 2, "Determination of Hydrogen Contents", Step 1, was revised to allow a ten-day LSA exemption only for dry or dewatered contents. This exemption does not apply to shipments of grossly dewatered resins.

Step 2 was revised to clarify the requirements for the void space inside the secondary container for resin shipments, depending upon the adequate characterization of the interstitial void volume.

Step 3 was also revised to require that the permeability of the vent path be considered in the determination of hydrogen concentration. Step 5 was revised to include guidance on the calculation of the effective G-value for resins. The hydrogen evaluations always need to be performed, using the methodology of NUREG/CR-6673, for shipment of grossly dewatered resins.

The containment design and features remain unchanged and therefore there is no significant impact to the operating procedure for 8-120B loaded with grossly dewatered resins.

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

The containment design and features remain unchanged and therefore there is no significant impact to the acceptance tests and maintenance programs for 8-120B loaded with grossly dewatered resins.

The acceptance tests and maintenance program were not modified.

CONDITIONS

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

Item No. 3.b has been revised to identify *EnergySolutions'* application, Revision No. 11, dated May 2016.

Condition No. 5(a)(3) has been revised to include *EnergySolutions* Drawing No. C-110-E-0007, Sheets 1-6, Revision No. 22 for the three configurations of the packaging and *EnergySolutions* Drawing No. DWG-CSK-12CV01-EG-0001-01, Rev. 3, for the thermal shield.

Condition No. 5(b)(1)(i) has been revised to add grossly dewatered resins to the authorized contents.

Condition No. 10 has been removed. This condition was added in Revision No. 22 of the certificate to allow the use of the package with the drawings authorized in Revision No. 21 of

this certificate. Since all lids have been retrofitted with the vent port tubes, this condition is no longer necessary.

Condition No. 11 has been renumbered Condition No. 10, as a result of the removal of the previous Condition No. 10. The expiration date of the certificate has not changed.

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. 23,
on July 5, 2016.