

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1.	a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
	9355	4	71-9355	USA/9355/B(U)-96	1	OF 9

2. PREAMBLE

- 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."
- 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

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

a.	ISSUED TO (<i>Name and Address</i>)	b.	TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
	National Nuclear Security Administration P.O. Box 5400 Albuquerque, NM 87185		"435-B Transport Package, Safety Analysis Report," Revision 6.1, January 2025.

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.: 435-B
- (2) Description

The Model No. 435-B package consists of multiple configurations. The package is a Category I container. When loaded and prepared for transport, the external dimensions of the 435-B package are approximately 83 inches (in.) [210.8 centimeters (cm)] tall and 70 in. [177.8 cm] in diameter (over the lower impact limiter). The maximum weight of the package is 10,100 pounds (lb.) [4,581 kilograms (kg)].

Unless noted in the application, all elements of the 435-B package are made of Type 304 stainless steel in conformance with the American Standards for Testing Materials (ASTM) A240. The major components of the package include:

- (i) *A base*—The base consists of the lower torispherical head, lower flange, lower internal impact limiter, and external impact limiter. The volume inside the external impact limiter is filled with 15 pounds per cubic foot (lb/ft³) polyurethane foam poured in place. The inside surface of the bottom shell is covered with a ¼-inch thick layer of refractory insulation paper. A full penetration weld connects the lower torispherical head (½-inch thick plate) to the lower flange.
- (ii) *A bell*—The bell consists of the upper torispherical head, cylindrical shell, upper flange, vent and test port blocks, upper internal impact limiter, dual side thermal shield, head thermal shield, and the closure bolt access tube structure. Two, ¼-inch thick, layers of refractory insulation paper cover the area of the containment wall adjacent to the tubes. Machined blocks of 30 lb/ft³ polyurethane foam are located between the tubes.

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FOR RADIOACTIVE MATERIAL PACKAGES**

1.	a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
	9355	4	71-9355	USA/9355/B(U)-96	2	OF 9

(iii) 5.(a) Packaging (Continued)

(2) Description

- (iv) *Internal lodgments*, made of aluminum, which support the Long Term Storage Shield (LTSS), Disposal Canisters, or the IBL 437 (aka IBL 437C) Shielded Device (Type 1 or Type 2)—The lodgments and the inner container designs allow maintaining the position of the payload in the package cavity during normal conditions of transport and hypothetical accident conditions. The LTSS rests on a ½-inch thick plate covered with a ½-inch thick layer of neoprene rubber.
- (v) *LTSS*—The LTSS consists of a central steel magazine, or barrel, surrounded by thick lead encased in a steel shell. The barrel contains four longitudinal holes, each of which can accommodate one drawer assembly.
- (vi) *An inner container*, which supports shielded devices (including Hopewell Designs, Inc. Shielded Devices and Transport Shield) —The inner container holds a shielded device and provides support for the device and the blocking (dunnage) materials during transport.
- (vii) *Two internal impact limiters*—The internal impact limiters located at each end of the payload cavity include an array of 130 ASTM A249 or A269, Type TP304, stainless steel tubes. The impact limiters are curved on one side to match the inside of the torispherical head, and flat on the other. Each of the 130 tubes is tack-welded in three places to a stainless steel tube stabilizer sheet. Four stainless steel clips welded to the inner surface of the containment boundary in the lower and upper position hold the internal impact limiters in place.

The LTSS, Disposal Canisters, or shielded devices provide shielding. Shielding materials are lead, tungsten, steel, or depleted uranium. The LTSS provides the shielding for the sealed capsule content specified in Tables 1 and 2. Therefore, these sources must be packed in the LTSS drawer(s). The shielded devices, identified in Table 3, are self-shielding, and must be packed in an inner container for shipment as specified in Table 4.

(3) Drawings

The packaging is constructed in accordance with the following drawings provided in the application:

- 1) 1916-01-01-SAR, "435-B Package Assembly SAR Drawing," sheets 1-7, Revision 8
- 2) 1916-01-02-SAR, "435-B LTSS Lodgment SAR Drawing," sheets 1-2, Revision 4
- 3) 1916-01-03-SAR, "435-B Inner Container SAR Drawing," sheets 1-2, Revision 4
- 4) 1916-01-04-SAR, "435-B Disposal Canister Lodgment SAR Drawing," sheets 1-2, Revision 0; and
- 5) 1916-01-05-SAR, "435-B IBL 437 Lodgment SAR Drawing," sheets 1-2, Revision 2.

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1.	a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
	9355	4	71-9355	USA/9355/B(U)-96	3	OF 9

5.(b) Contents (Continued)

(1) Type and form of material

Radioactive sealed sources of isotopes described in Tables 1 through 5.

(2) Maximum quantity of material per package

(i) Sealed Sources for Transport in the LTSS

Table 1. Maximum Activity of LTSS Payload Source Nuclides ^{1, 2, 3, 4}

Nuclide	Maximum Activity Ci
⁶⁰ Co	12,970
¹³⁷ Cs	14,000
⁹⁰ Sr	1,000
²²⁶ Ra (no Be) ⁵	20
²²⁶ Ra Be ⁵	1.2
²⁴¹ Am (no Be) ⁶	1,000
²⁴¹ Am Be ⁶	6.6
¹⁹² Ir	200
⁷⁵ Se	80

Notes:

- Physical form of all nuclides is solid material in a sealed capsule.
- The maximum decay heat limit for the 435-B package is 200W.
- The values in the table represent the absolute maximum activities allowed in the 435-B. Individual payload activity limits depend on the configuration of the LTSS used. Payload activity limits are specified in Section 7.1.4, "Loading and Preparing the LTSS for Transport," of the application.
- The sum of the LTSS payload activities listed above is 86,732 A₂, which bounds the value for the Disposal Canister. This value exceeds the maximum number of A₂ that could be transported.
- Impurities may include oxygen, carbon, sulfur, bromine, and chlorine (hydrous and anhydrous).
- Impurities may include oxygen and chlorine.

Table 2. Maximum Mass of LTSS Payload Source Nuclides. ^{1, 2}

Nuclide	Maximum Mass grams of Pu
²³⁸ Pu (no Be)	75 g Pu
²³⁹ Pu (no Be)	15 g Pu
²³⁹ Pu Be	15 g Pu

Notes:

- Physical form of all nuclides is solid material in a sealed capsule.
- Impurities may include oxygen.

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1.	a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
	9355	4	71-9355	USA/9355/B(U)-96	4	OF 9

5.(b) Contents (Continued)

(2) Maximum quantity of material per package (Continued)

(ii) Inner Container-Shielded Devices

Table 3. Maximum Activity and Weight of Shielded Devices ¹

Model Name/Type	Maximum Activity Ci	Nominal Weight lb.	Sealed Source Device Registry No. ³
Group 1 Devices			
Gammator 50B, B, B34, G-50-B	420	1,800	NR-0880-D-802-S
Gammator M34	1,920	1,850	NR-0880-D-806-S
Gammator M38	3,840	2,250	NR-0880-D-806-S
Gammacell 1000 (GC-1000) -Models A through D -Elite A through D, Type I and Type II	3,840 (bounding value)	2,800	NR-0880-D-808-S, NR-1307-D-102-S
Gammacell 3000 (GC-3000) -Elan A through C, Type I and Type II ²	3,048	3,300	NR-1307-D-102-S
Group 3 Devices			
Gammacell-40 (GC-40 Exactor)	2,250 ⁴	2,650	NR-1307-D-101-S
Other Devices			
IBL 437 (aka IBL 437C)	5,610	4,550 ⁵	MA-0219-D-813-S

Notes:

1. Radionuclide in all cases is ¹³⁷Cs.
2. Gammacell 3000 external secondary shielding is not credited in the shielding analysis.
3. Consult NRC's Sealed Source Device Registry for design and safety features of each model.
4. GC-40 activity is given for one of the two device components that make up a complete GC-40. Only one device component may be shipped at one time.
5. Maximum weight.

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1.	a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
	9355	4	71-9355	USA/9355/B(U)-96	5	OF 9

5.(b) Contents (Continued)

(2) Maximum quantity of material per package (Continued)

(ii) Inner Container-Shielded Devices (Continued)

Table 4. Hopewell Designs, Inc. Shielded Devices and Transport Shield

	Model Name	Maximum Activity			Maximum Weight lb.
		Option a	Option b	Option c	
Shielded Devices	G10-1-360	530 Ci ¹³⁷ Cs or 2 Ci ⁶⁰ Co	---	---	≤ 1,200
	G10-2-360	530 Ci ¹³⁷ Cs and 2 Ci ⁶⁰ Co	Total 530 Ci ¹³⁷ Cs in 2 sources	Total 2 Ci ⁶⁰ Co in 2 sources	≤ 1,900
	G10-1-2600	2,800 Ci ¹³⁷ Cs or 5 Ci ⁶⁰ Co	---	---	≤ 1,600
	G10-2-2600	2,800 Ci ¹³⁷ Cs and 5 Ci ⁶⁰ Co	Total 2,800 Ci ¹³⁷ Cs in 2 sources	Total 5 Ci ⁶⁰ Co in 2 sources	≤ 2,200
	G10-2-2600-BX	2,800 Ci ¹³⁷ Cs and 5 Ci ⁶⁰ Co	Total 2,800 Ci ¹³⁷ Cs in 2 sources	Total 5 Ci ⁶⁰ Co in 2 sources	≤ 2,200
Transport Shield	SC2323-GC60	5,952 Ci ¹³⁷ Cs and 1,945 Ci ⁶⁰ Co and shall not exceed 30W decay heat	---	---	≤ 3,500

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
9355	4	71-9355	USA/9355/B(U)-96	6	OF 9

5.(b) Contents (Continued)

(2) Maximum quantity of material per package (Continued)

(iii) Sealed Sources for transport in the Disposal Canisters

Table 5. Disposal Canisters Source Nuclides.^{1, 2, 3, 4}

Nuclide	Maximum Activity Ci
⁶⁰ Co	12,970
¹³⁷ Cs	27,000
⁹⁰ Sr	1,000
²²⁶ Ra (no Be) ⁵	20
²²⁶ Ra Be ⁵	4.88
¹⁹² Ir	200
⁷⁵ Se	80

Notes:

- Physical form of all nuclides is solid material in a sealed capsule.
- The maximum decay heat limit for the 435-B package is 200 W.
- The values in the table represent the absolute maximum activities allowed in the 435-B. Individual payload activity limits depend on the specific Disposal Canister used. Payload activity limits are specified in Section 7.1.5, "Loading and Preparing the Disposal Canisters for Transport" of the application.
- The sum of the LTSS payload activities listed above is 86,732 A₂, which bounds the value for the Disposal Canister. This value exceeds the maximum number of A₂ that could be transported.
- Impurities may include oxygen, carbon, sulfur, bromine, and chlorine (hydrous and anhydrous).

- (3) The maximum weight of contents in the package is 5,160 lb. Conditions 5.(b)(3)(i) through (v) include the maximum weight of the authorized contents.

(i) LTSS

For the LTSS, the payload of isotopes other than plutonium is limited by the activity rather than their weight as depicted in Tables 1 and 2 of this certificate. The maximum weight of the LTSS contents (payload) is 4,660 lb.

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
9355	4	71-9355	USA/9355/B(U)-96	7	OF 9

5.(b)(3) Contents (Continued)

(ii) Inner Container

The maximum weight of the shielded device includes the mass of radioactive material and the source drawer.

Table 6. Maximum Weight of the Inner Container Payload

Content Type	Maximum Weight of Payload lb.
Dunnage	≤ 500
Group 1-Shielded Device	≤ 3,500
Group 3-Shielded Device	≤ 3,500
IBL 437 (aka IBL 437C)	≤ 4,550
Hopewell Designs, Inc., Shielded Devices and Transport Shield	≤ 3,500

(iii) Disposal Canisters

Table 7. Maximum Weight of Disposal Canisters Payload

ks	Maximum Weight of Payload lb.
Heavy Disposal Canister	≤ 4,610
Medium Disposal Canister	≤ 4,630
Light Disposal Canister	≤ 4,165

(iv) The total fissile mass limit for the 435-B package is 15 grams.

(4) Maximum decay heat

Table 8. Maximum Decay Heat of the Package's Authorized Contents

Content Type	Condition Describing the Authorized Content	Decay Heat W
LTSS shielded devices	5.(b)(2)(i)	≤ 200
Inner container shielded devices	5.(b)(2)(ii)	≤ 30
IBL 437 (aka IBL 437C) Shielded Device	5.(b)(2)(ii)	≤ 30
Group 1 Shielded Devices Group 3 Shielded Devices Hopewell Designs, Inc. Transport Shield	5.(b)(2)(ii)	≤ 30
Hopewell Designs, Inc. G10 Series Shielded Devices	5.(b)(2)(ii)	≤ 15
Heavy disposal canister	5.(b)(2)(iii)	≤ 200
Medium disposal canister	5.(b)(2)(iii)	≤ 159
Light disposal canister	5.(b)(2)(iii)	≤ 144

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FOR RADIOACTIVE MATERIAL PACKAGES**

1.	a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
	9355	4	71-9355	USA/9355/B(U)-96	8	OF 9

6. Plutonium sources are not permitted for transport by air.
7. Americium sources are not permitted for transport by air.
8. In addition to the requirements of Subpart G of 10 CFR Part 71:
 - (a) The package shall be prepared for shipment and operated in accordance with the Operating Procedures in Chapter 7.0 of the application; and
 - (b) The package must meet the Acceptance Tests and Maintenance Program of Chapter 8.0 of the application.
 - (c) The LTSS shall be transported using the lodgment depicted on drawing No. 1916-01-02-SAR.
 - (d) The following devices shall be transported using the using the Inner Container depicted on drawing 1916-01-03-SAR.
 - (1) Group 1 and Group 3 Devices depicted in Table 3, "Maximum Activity and Weight of Shielded Devices," of this certificate of compliance.
 - (2) All Shielded Devices and the Transport Shield depicted in Table 4, "Hopewell Designs, Inc. Shielded Devices and Transport Shield," of this certificate of compliance.
 - (e) The IBL 437 (aka IBL 437C) depicted in Table 3 of this certificate of compliance shall be transported using the lodgment depicted on drawing No.1916-01-05-SAR.
 - (f) The Disposal Canisters with the contents described in Table 5, "Disposal Canisters Source Nuclides," of this certificate of compliance shall be transported using the lodgment depicted on drawing No. 1916-01-04-SAR.
9. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.
10. For the Disposal Canisters, the package is transported in quantities of one or two in a closed conveyance as exclusive use.
11. With the exception of the Disposal Canisters, the package is designed to be transported singly, with its longitudinal axis vertical, by ground, air, or by water in non-exclusive use.
12. Revision 3 of this certificate of compliance can be used until May 31, 2026.
13. Expiration date: May 31, 2030.

NRC FORM 618 (8-2000) 10 CFR 71		U.S. NUCLEAR REGULATORY COMMISSION			
CERTIFICATE OF COMPLIANCE FOR RADIOACTIVE MATERIAL PACKAGES					
1.	a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE PAGES
	9355	4	71-9355	USA/9355/B(U)-96	9 OF 9

REFERENCES

“435-B Transport Package, Safety Analysis Report,” Revision 6.1, January 2025, submitted on February 21, 2025.

FOR THE U.S. NUCLEAR REGULATORY
COMMISSION

**YOIRA DIAZ-
SANABRIA**

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Yaira K. Diaz Sanabria, Chief
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: May 9, 2025.



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

SAFETY EVALUATION REPORT

**Docket No. 71-9355
Model No. 435-B
Certificate of Compliance No. 9355
Revision No. 4**

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TABLE OF CONTENTS

	Page
SUMMARY	1
1.0 GENERAL INFORMATION	2
1.1 Packaging.....	2
1.2 Package	2
1.3 Drawings	2
1.4 Contents	3
1.5 Evaluation Findings	4
3.0 THERMAL EVALUATION	4
3.1 Thermal Evaluation	5
3.2 Evaluation Findings	5
4.0 CONTAINMENT EVALUATION	5
4.1 Containment Evaluation	5
4.2 Evaluation Findings	6
5.0 SHIELDING EVALUATION	6
5.1 Description of the Changes	6
5.2 Shielding Evaluation	7
5.3 Evaluation Findings	7
6.0 CRITICALITY	7
7.0 MATERIALS EVALUATION	7
7.1 Corrosion Resistance and Protective Coatings	7
7.2 Content Reactions	8
7.3 Package Contents	8
7.4 Bolting Material.....	8
7.5 Evaluation Findings	8
8.0 PACKAGE OPERATIONS	9
8.1 Evaluation of Package Operations	9
8.2 Evaluation Findings	9
9.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM REVIEW	9
9.1 Acceptance Tests	9
9.2 Maintenance Program	9
9.3 Evaluation Findings	10
10.0 QUALITY ASSURANCE.....	10

CONDITIONS	10
CONCLUSIONS	12



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

**SAFETY EVALUATION REPORT
Docket No. 71-9355
Model No. 435-B
Certificate of Compliance No. 9355
Revision 4**

SUMMARY

By letter dated July 3, 2023 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML25087A035), as supplemented on July 21, 2023 (ML23220A071), January 24, 2024 (ML25087A076), March 5, 2024 (ML25087A003 and ML24072A002), December 6, 2024 (ML25086A038), and February 21, 2025 (ML25086A032 and ML25078A413), the U.S. Department of Energy, National Nuclear Security Administration (NNSA or the applicant), requested a revision to the Certificate of Compliance (CoC) for the Model No. 435-B package design. The applicant's request included the following changes (ML23220A156 and ML25086A037):

- 1) Add material option for zinc plating for the disposal canister lid closure bolts.
- 2) Clarify that sources must be sealed and may be in normal form or special form.
- 3) Change the maximum decay heat for the IBL 437 from 15 (watts) W to 30W.
- 4) Correct maximum activity of the IBL 437 from 5,160 Ci to 5,610 Ci.
- 5) Revise drawing Nos. 1916-01-01-SAR, "435-B Package Assembly SAR Drawing," and 1916-01-05-SAR, "435-B IBL 437 Lodgment SAR Drawing."
- 6) Revise section 7.1.2, "Loading of Contents," to expand paragraph describing the sections for operational steps for each payload type.
- 7) Revise section 7.1.3, "Final Preparations for All Shipments," to combine repetitive procedure steps related to the operation of the package.
- 8) Add section 7.1.6, "Recognition of Special Form," to define the requirements for the acceptance of a source as being in special form.
- 9) Clarify the process for performing pre-shipment, maintenance and periodic leakage tests.
- 10) Adding a condition in the renewed CoC No. 9355 to continue using revision 3 of CoC No. 9355 for one year to continue planned shipments (ML25115A238).

The applicant also requested a CoC renewal in the letter dated February 21, 2025, and the communication dated February 27, 2025 (ML25086A284) as well as adding a condition in the renewed CoC No. 9355 to continue using revision 3 of CoC No. 9355 for one year for planned

shipments (ML25115A238) to support national security efforts by safely removing radioactive sealed sources as part of the Off-site Source Recovery Program. Changes made to the enclosed certificate (Enclosure 1) are indicated by vertical lines in the margin. The certificate has been renewed for a five-year term.

NRC staff reviewed the safety analysis report (SAR) (also referred as “the application” in this document), including its supplements, using the guidance in NUREG-2216, “Standard Review Plan for Transportation Packages for Spent Fuel and Radioactive Material: Final Report” (NUREG-2216). Based on the statements and representations in the application, as supplemented, and the conditions listed in this safety evaluation report (SER), the staff concludes that the package meets the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71, “Packaging and Transportation of Radioactive Material.”

1.0 GENERAL INFORMATION

1.1 Packaging

Section 1.2.1 of provides a detailed description of the packaging. When loaded and prepared for transport, the 435-B package is 83 inches (in.) tall, 70 in. in diameter (over the lower impact limiter), and weighs a maximum of 10,100 pounds (lb.). The empty packaging weight is 4,940 lb. The maximum weight of the payload is 5,610 lb.

The packaging consists of a base, a bell cover (bolted to a base), an inner container (IC), internal lodgments, and two internal impact limiters. Unless noted, all elements of the packaging are made of Type 304 austenitic stainless steel in conformance with the American Society for Testing Materials (ASTM) A240. The applicant requested adding a material option for using zinc plating for the disposal canister lid closure bolts. The evaluation of this change is discussed in section 7.0, “Materials Evaluation,” of this SER.

1.2 Package

The 435-B package provides leaktight containment of the radioactive contents under normal conditions of transport (NCT) and hypothetical accident conditions (HAC). Also, the packaging does not provide shielding protection to its contents. Instead, the possible contents of the Model No. 435-B (i.e., LTSS, disposal canisters, and shielded devices) contain lead, which provides shielding to its radioactive materials.

The package can be transported singly by air, ground, or water in non-exclusive use for most of its authorized contents. For the content in disposal canisters, the package is transported in a closed conveyance as exclusive use.

1.3 Drawings

The applicant proposed changes to the following drawings:

- a. 1916–01–01–SAR, “435-B Package Assembly SAR Drawing,” sheets 1-7, Revision 8;

Added Flag Note 56 which allows the closure bolt heads to have an opening for a security tool instead of a hex shape as an option. Section 7.4 of this SER includes the evaluation of this change.

- b. 1916-01-05-SAR, "435-B IBL 437 Lodgment SAR Drawing," sheets 1-2, Revision 2.

Revised General Note 8 to add the baseplate and the rubber pad to the items which may be notched or relieved to accommodate appurtenances on the IBL 437.

The staff removed "AREVA Federal Services LLC" from and made editorial changes to Condition No. 5.(b)(3). This change should eliminate the need of submitting a revision to the CoC to change the name of the company that made the drawings. The staff also revised Condition No. 5.(a)(3), "Drawings," of the CoC to include the latest revision of the licensing drawings discussed in this section of the SER.

The staff reviewed the drawings and found them to be an adequate representation of the package.

1.4 Contents

There was a typographical error in the CoC related to the maximum activity of ^{137}Cs in the application and the CoC. The applicant also corrected the maximum activity of the IBL 437 in Table 1.2-2 of the application, which is in agreement with Table 5.5.4-5 of the application. In section 1.2.2.3, "Shielded Devices," the application noted that the maximum activity of ^{137}Cs in the IBL 437 is 5,610 Ci and not 5,160 Ci, as stated in the Revision 3 of CoC. As described in section 5.0, "Shielding Evaluation," of this SER, there was no impact on the shielding analysis. The applicant requested additional changes to correct typographical errors in the certificate and ease the use of the package's CoC. Therefore, this revision resulted on the following changes to the CoC:

- a. Condition No. 5.(b)(2)(i), changed LTSS to "Sealed Sources for Transport in the LTSS."
- b. Condition No. 5.(b)(2)(ii)
 - (1) removed footnote No. 2 from the column titled "Nominal Weight lb." because it already appears in the row corresponding to "Gammacell 3000..."
 - (2) revised typographical error of the "Maximum Activity" for the "IBL 437 (aka IBL 437C)" in Table 3, "Maximum Activity and Weight of Shielded Devices," from 5,160 Ci to 5,610 Ci.
 - (3) added footnote No. 5 "Maximum weight" to Table 3.
 - (4) added footnote No. 5 to the weight of the IBL 437.
- c. Condition No. 5.(b)(2)(iii), revised the text from "Disposal Canisters" to "Sealed Sources for transport in the Disposal Canisters."

- d. Condition No. 5.(b)(3), made editorial changes to clarify that the word “contents” means payload in the context of this certificate.
- e. Condition No. 5.(b)(3)(i), revised to reflect that the weight “4,660 lb.” corresponds to the maximum weight of the LTSS payload.
- f. Condition No. 5.(b)(3)(ii), added the weight of the “Hopewell Designs, Inc., shielded devices and transport shield” to table 6, “Maximum Weight of Inner Container Contents,” of the CoC.
- g. Condition No. 5.(b)(3)(iii), deleted the weight of the lodgment in Table 7, “Maximum Weight of Disposal Canisters Payload,” of the CoC since this condition is focused only on the weight of each payload without the lodgment.
- h. Condition No. 5.(b)(3)(iv), removed this condition to fix a typographical error and also because the payload related to the “Hopewell Devices” was included in Table 6 of the CoC.
- i. Condition No. 5.(b)(3)(v), renumbered as Condition No. 5.(b)(3)(iv).
- j. Condition No. 5.(b)(3), “Maximum Weight of Contents,” was revised to reflect the current weight of the package, the LTSS, IBL 437 (aka IBL 437C), Disposal Canisters, and Honeywell Inc. Shielded Devices (Type 1 and Type 2) that are allowed to be shipped in the Model No. 435-B.

The applicant provided clarification in section 1.2.2 that all radioactive materials transported must be sealed sources in normal form or special form. The staff notes that this is consistent with the previously approved description of the contents in Chapter 1 of the application. Section 3.1, “Thermal Evaluation,” of this SER evaluated changes related to the decay heat of the contents of the package.

Per the above discussion, the staff finds the applicant’s description of the chemical and physical form of the package contents to be acceptable.

1.5 Evaluation Findings

The staff reviewed documentation provided by the applicant including package and packaging descriptions as well as design drawings to verify that statements presented by the applicant are acceptable for the review and approval of the revision of the CoC for the Model No. 435-B, as required by 10 CFR 71.33. Based on the review of the statements and representations provided by the applicant, the staff concludes that the package, packaging, and contents have been adequately described to meet the requirements of 10 CFR Part 71.

3.0 THERMAL EVALUATION

The purpose of this thermal evaluation is to verify that the applicant’s proposed changes to the Model No. 435-B package design continues to:

- 1) provide reasonable assurance of adequate protection against the thermal tests specified in 10 CFR Part 71 under NCT and HAC, and
- 2) meet the thermal performance requirements of 10 CFR Part 71.

Regulations applicable to the thermal review include 10 CFR 71.31, 71.33, 71.35, 71.43, 71.71, and 71.73. The following sections summarize the staff's thermal evaluation.

3.1 Thermal Evaluation

The staff reviewed the changes described in the applicant provided road maps (ML23220A156 and ML25086A037). The applicant corrected a typo for the decay heat for the IBL 437, which is a large shielded device transported in a lodgment, in section 1.2.2.3, "Shielded Devices," of the application and the staff verified that the bounding decay heat for the IBL 437 was 30 W, as described in Appendix 3.5.5 of the application.

3.2 Evaluation Findings

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.

The staff revised Table 8, "Maximum Decay Heat of the Package's Authorized Contents," under Condition No. 5(b)(4), "Maximum decay heat," of the CoC to add Group 1 Shielded Devices, Group 3 Shielded Devices, and Hopewell Designs, Inc. G10 Series Shielded Devices. Also, the staff added a column titled, "Condition Describing the Authorized Content," to facilitate the use of the certificate, as requested by the applicant (ML21340A249). The staff also revised the decay heat for the IBL 437 depicted in Table 8 from ≤ 15 W to ≤ 30 W.

4.0 CONTAINMENT EVALUATION

The purpose of this evaluation is to verify that the proposed changes to the Model No. 435-B transport package provide adequate protection against radiation and to verify that the package design meets the requirements of 10 CFR Part 71 under NCT and HAC.

4.1 Containment Evaluation

The staff reviewed the changes described in the applicant provided road maps (ML23220A156 and ML25086A037). The applicant consolidated repetitive operating procedures from portions of sections 7.1.2.1, 7.1.2.2, 7.1.2.3, and 7.1.2.4.2 of the application and relocated them to be within section 7.1.3 of the application.

The staff reviewed the relocated steps in section 7.1.3 of the application and verified that the changes were reflected in Revision 6.1 of the application (ML25086A032). The pre-shipment leakage testing described in section 7.4, "Preshipment Leakage Rate Test," of the application (or periodic leakage testing described in section 8.2.2 of the application, as appropriate) for the containment boundary main O-ring and vent port plug O-ring had been described in section 7.1.3.1, step 10, item c. Consistent with the American National Standards Institute (ANSI) N14.5, "American National Standard for Radioactive Materials – Leakage Tests on Packages for Shipment," pre-shipment leakage rate testing should be performed on

containment boundary seals that have been opened, unless an ANSI N14.5 maintenance / periodic leakage rate test has been performed before each shipment, after the contents are loaded, and the containment system is assembled, in lieu of a pre-shipment leakage rate test. This is especially important for Type B contents in normal form. The applicant also described in section 7.1.3 of the application, the maintenance leakage rate testing, if necessary, by referring to section 8.2.2 of the application.

The staff also verified that the torque values of the vent port plug bolts (8) and the containment boundary main O-ring closure bolts (24) were described in section 7.1.3 of the application. The staff verified that the relocated steps were essentially the same as those that had been located within sections 7.1.2.1, 7.1.2.2, 7.1.2.3, and 7.1.2.4.2, or included improvements, such as consistently describing a visual surface inspection of the O-ring grooves, or noting that if all of the radioactive material is in sealed sources qualified as special form in accordance to the requirements in section 7.1.6 of the application that no leakage rate testing is required, which is consistent with ANSI N14.5-2014 example B.15.18, NUREG-2216, section A.8.3, and the 10 CFR 71.4 definition of special form, because containment is provided primarily by the special form source.

4.2 *Evaluation Findings*

Based on review of the statements and representations in the application, the staff finds that the applicant adequately described and evaluated the containment design and that the package design meets the containment requirements of 10 CFR Part 71.

5.0 SHIELDING EVALUATION

The purpose of this evaluation is to verify that the proposed changes to the shielding features of the Model No. 435-B transport package provide adequate protection against direct radiation from its contents and to verify that the package design meets the external radiation requirements of 10 CFR Part 71 under NCT and HAC.

5.1 *Description of the Changes*

The applicant submitted changes to the Model No. 435-B transport package. Those changes affecting the shielding design and contents are as follows:

- a. Adding a sentence to section 1.2.2 and delete a phrase from section 1.2.2.1 of the application relating to the sealed sources. The applicant is adding this sentence to clarify that sources must be sealed and may be in normal form or special form.
- b. Correcting the maximum activity of the IBL 437 from 5,160 Ci to 5,610 Ci. This correction is made due to a typographical error in the CoC. The activity is stated correctly in section 1.2.2.3, and the shielding evaluation of the IBL 437 uses the correct activity of 5,610 Ci in Table 5.5.4-5. Therefore, no revision to the shielding evaluation is necessary.
- c. Inclusion of a reference to the requirements of section 7.1.6 of the application, "Recognition of Special Form." This reference will allow the shipper to take

advantage of special form under the conditions specified in section 7.1.6 of the application.

5.2 *Shielding Evaluation*

The applicant revised section 1.2.2, “Contents,” of the application to specify that all radioactive material transported in the Model No. 435-B must be in sealed sources in normal form or special form. The staff reviewed this proposed change by the applicant and found it acceptable because it provides sufficient detail to evaluate the contents of the transportation package to demonstrate compliance with the requirements specified in 10 CFR Part 71.

As described in section 1.3 of this SER, the applicant identified a typographical error in the CoC related to the maximum activity of ¹³⁷Cs. Since section 1.2.2.3, “*Shielded Devices*,” of the application and the shielding evaluation of the IBL 437 uses the correct activity of 5,610 Ci in Table 5.5.4-5 for the Device Sources of the application, no revision to the shielding evaluation is necessary.

The applicant added section 7.1.6 of the application to include the process for recognizing a special form source. The staff found that the additional requirements are in accordance with 10 CFR 71.71 regulations.

5.3 *Evaluation Findings*

Based on its review of the information and representations provided in the application and the staff’s evaluation, the staff has reasonable assurance that the proposed changes to the package design and contents satisfy the shielding requirements. Therefore, the staff found that the shielding design of the Model No. 435-B transport package continues to provide adequate protection against direct radiation from its contents and that the package design meets the external radiation requirements of 10 CFR Part 71 under NCT and HAC.

6.0 CRITICALITY

The changes requested by the applicant did not impact the previous criticality review findings. Therefore, the staff did not perform a criticality review.

7.0 MATERIALS EVALUATION

The staff reviewed Revision 6.1 of the application to verify that the material performance meets the requirements of 10 CFR Part 71. As discussed in the letter dated July 3, 2023 from the applicant, minor changes, corrections, and clarifications were made to the application to improve security and operational efficiency. Only the sections of the materials evaluation that changed from the previous application are discussed below.

7.1 *Corrosion Resistance and Protective Coatings*

As described in section 1.2.1.6.2 of the application, the applicant proposed adding zinc plating as an optional material treatment of the disposal canister lid bolts, which is an alternative to the previously approved method of galvanization. The staff notes that the lid bolts are fabricated from alloy steel and are susceptible to general corrosion. The staff finds the applicant’s use of

zinc coating (or galvanization) acceptable to prevent corrosion. This approach is consistent with the guidance in section 7.4.8.2, "Carbon and low-alloy steels," of NUREG-2216, which states that coatings may be used to prevent atmospheric corrosion.

As described in section 8.2.3.1 of the application, the alloy bolts should be inspected at each use for the presence of corrosion. The staff reviewed the applicant's maintenance and inspection program and finds it acceptable to prevent corrosion of the disposal canister lid bolts.

Based on the above discussion, the staff finds that the applicant's identification of materials and package components where corrosion should be considered, assessment of the effects of corrosion, and selection of coatings to prevent corrosion are acceptable.

7.2 Content Reactions

As described in section 7.1 of this SER, the applicant proposed adding zinc plating as an optional material treatment of the disposal canister lid bolts. The staff notes that both zinc plating and the previously evaluated galvanization process are zinc-based material treatments. As a result, the staff finds that this amendment does not introduce any adverse corrosive or other reactions considered in the previous approval of the CoC for the Model No. 435-B package. The materials of construction and the service environments are bounded by those that were previously evaluated in the CoC. Therefore, the staff finds the applicant's evaluation of corrosion resistance and potential adverse reactions to be acceptable.

7.3 Package Contents

Sections 1.3, 3.1, and 5.0 of this SER includes evaluations of the changes related to the contents of the Model No. 435-B package. The staffs finds these changes to be acceptable.

7.4 Bolting Material

In Drawing No. 1916-01-01 of the SAR, the applicant added a note to allow the head of the closure bolts to be shaped to support operation via a security tool in addition to the previously approved hexagonal shape. The staff notes that this change does not alter the bolting material or material properties previously evaluated by the staff. Therefore, the staff finds the applicant's bolting material to be acceptable.

7.5 Evaluation Findings

F7.1 The applicant has met the requirements of 10 CFR 71.33. The applicant described the materials used in the transportation package in sufficient detail to support the staff's evaluation.

F7.2 The applicant has met the requirements of 10 CFR 71.43(d) and 10 CFR 71.87(b). The applicant has demonstrated that there will be no significant corrosion, chemical reactions, or radiation effects that could impair the effectiveness of the packaging.

The staff concludes that the Model No. 435-B transport packaging adequately considers material properties and material quality controls such that the design is in compliance with 10 CFR Part 71. This finding is reached on the basis of a review that considered the regulation itself, appropriate regulatory guides, applicable codes and standards, and accepted engineering practices.

8.0 PACKAGE OPERATIONS

The purpose of this evaluation is to verify that the operating controls and procedures of the Model No. 435-B transport package meet the requirements of 10 CFR Part 71.

8.1 *Evaluation of Package Operations*

The staff reviewed the changes to the application as described in the applicant's provided road map, ADAMS Accession No. ML23220A156, as it relates to the operating procedures for the package. The staff determined that the revisions in section 7.1.2 of the application do not alter the scope or types of operations previously authorized for loading the package. Instead, repetitive operational steps were consolidated and organized appropriately into another section, section 7.1.3, and new language was added to clarify specific operational steps for packages containing sealed sources in special form. Additionally, section 7.1.6, was introduced to outline the criteria for accepting a source as being in special form.

The applicant proposed changes to the CoC (ML21340A251) that resulted on the following conditions to the CoC No. 9355:

- a. Condition No. 8, added condition Nos. 8(c) to (f) related to the operations of the package based on changes proposed by the applicant.
- b. Added Condition Nos. 10) and 11) to specify the conditions for non-exclusive and exclusive shipments of the package. These conditions are based on changes proposed by the applicant to ease use of the CoC of the package.

8.2 *Evaluation Findings*

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

9.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM REVIEW

9.1 *Acceptance Tests*

The purpose of this evaluation is to verify that the prescribed inspections and tests of the Model No. 435-B packaging meet the requirements of 10 CFR Part 71. The staff determined that this revision does not introduce any changes relevant to the acceptance testing of the package.

9.2 *Maintenance Program*

The purpose of this evaluation is to verify that the maintenance program for the Model No. 435-B package is adequate to ensure its continued safe operation. The staff determined that this revision does not introduce any changes relevant to the maintenance of the package.

9.3 Evaluation Findings

The staff concludes that the acceptance tests for the packaging meet the requirements of 10 CFR Part 71, and that the maintenance program is adequate to ensure packaging performance during its service life.

10.0 QUALITY ASSURANCE

There were no changes proposed that would impact the staff's quality assurance evaluation from the previous SER for CoC No.9355 for the 435-B transport package. The changes described in section 7.0 of this SER do not affect the requirements to perform package operations according to established procedures. As a result, the staff determined that a new evaluation was not required.

CONDITIONS

Besides the technical changes to the CoC, the applicant proposed changes to ease use of the CoC of the package. The revised certificate of compliance includes the following condition(s) of approval and changes:

- 1) Increased the revision No. to 4.
- 2) Condition No. 3.b., "Title and Identification of Report or Application," includes the title and date of the consolidated application.
- 3) Condition No. 5.(a)(2), "Description," correct the conversion from pounds (lb) to kilograms (kg) to 4,581 kg.
- 4) Condition No. 5.(a)(3), "Drawings," contains the latest revision of the licensing drawings that the package must be fabricated to. Condition No. 5.(a)(3)(i), removed "AREVA Federal Services LLC" and made editorial changes.
- 5) Condition No. 5.(b)(2)(i), changed LTSS to "Sealed Sources for Transport in the LTSS."
- 6) Condition No. 5.(b)(2)(ii)
 - a. removed footnote No. 2 from the column titled "Nominal Weight lb." because it already appears in the row corresponding to "Gammacell 3000..."
 - b. revised typographical error of the "Maximum Activity" for the "IBL 437 (aka IBL 437C)" in Table 3, "Maximum Activity and Weight of Shielded Devices," from 5,160 Ci to 5,610 Ci.
 - c. added footnote No. 5 "Maximum weight" to Table 3.
 - d. added footnote No. 5 to the weight of the IBL 437.

- 7) Condition No. 5.(b)(2)(iii), revised the text from “Disposal Canisters” to “Sealed Sources for transport in the Disposal Canisters.”
- 8) Condition No. 5.(b)(3), made editorial changes to clarify that the word “contents” means payload in the context of this certificate.
- 9) Condition No. 5.(b)(3)(i), revised to reflect that the weight “4,660 lb.” corresponds to the maximum weight of the LTSS payload.
- 10) Condition No. 5.(b)(3)(ii), added the weight of the “Hopewell Designs, Inc., shielded devices and transport shield” to table 6, “Maximum Weight of Inner Container Contents,” of the CoC.
- 11) Condition No. 5.(b)(3)(iii), deleted the weight of the lodgment in Table 7, “Maximum Weight of Disposal Canisters Payload,” of the CoC since this condition is focused only on the weight of each payload without the lodgment.
- 12) Condition No. 5.(b)(3)(iv), removed this condition to fix a typographical error and also because the payload related to the “Hopewell Devices” was included in Table 6 of the CoC.
- 13) Condition No. 5.(b)(3)(v), renumbered as Condition No. 5.(b)(3)(iv).
- 14) Condition No. 5.(b)(3), “Maximum Weight of Contents,” was revised to reflect the current the weight of the package, the LTSS, IBL 437 (aka IBL 437C), Disposal Canisters, and Honeywell Inc. Shielded Devices (Type 1 and Type 2) that are allowed to be shipped in the Model No. 435-B.
- 15) Condition No. 5(b)(4),
 - a. revised Table 8, “Maximum Decay Heat of the Package’s Authorized Contents,” to add Group 1 Shielded Devices, Group 3 Shielded Devices, and Hopewell Designs, Inc. G10 Series Shielded Devices
 - b. added a column titled, “Condition Describing the Authorized Content,” to facilitate using the certificate
 - c. revised the decay heat for the IBL Shielded Device to 30W as described in Appendix 3.5.5 of the application
- 17) Condition No. 8, added condition Nos. 8.(c) to (f) related to the operations of the package based on changes proposed by the applicant.
- 18) Added Condition Nos. 10. and 11. to specify the requirements for exclusive and non-exclusive shipments, respectively, of the package.
- 19) Renumbered Condition No. 10 to Condition No. 13 and changed the expiration date to renew the CoC for 5 years (i.e., May 31, 2030).

The renewal of Model No. 435-B was submitted under timely renewal (i.e., 30 days prior to its expiration date). Even though Revision 3 of CoC No. 9355 expired on March 31, 2025, Revision 3, can be used to ship materials under timely renewal. The applicant requested adding a condition to continue using Revision 3 of CoC No. 9355 for a year to continue supporting planned shipments. These shipments are part of the Off-Site Source Recovery Program, which focuses on safely removing radioactive sealed sources to ensure national security.

As additional justification for using Revision 3 of CoC. No. 93555, the applicant noted that they have eight shipments planned for this fiscal year (FY) (i.e., until September 2025) and approximately 12 more shipments in FY 26 (from October 2025 to September 2026) (ML25115A238). Considering the information provided by the applicant and the following reasons, a condition for using CoC No. 9355, Revision 3, until May 31, 2026, has been granted for the following reasons:

- 1) The proposed condition allows continuous support to the Off-site Source Recovery Program, protecting national security, and allowing the safe removal of sealed sources.
- 2) There were no major changes to the authorized contents of the package.

The “References” section includes the consolidated application provided as part of the review process as well as supplements containing regulatory bases. The staff also made some editorial changes to the certificate.

CONCLUSIONS

Based on the statements and representations contained in the application, as supplemented, and the conditions listed above, the staff concludes that the design has been adequately described and evaluated, and the Model No. 435-B package meets the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 435-B, Revision 4,
on May 9, 2025.