



Department of Energy
Washington, DC 20585

May 5, 2021

MEMORANDUM FOR MICHAEL D. BUDNEY
MANAGER

SAVANNAH RIVER OPERATIONS OFFICE

FROM:

JULIA C. SHENK

Julia C. Shenk Digitally signed by Julia C. Shenk
Date: 2021.05.05 08:56:29 -04'00'

HEADQUARTERS CERTIFYING OFFICIAL
DIRECTOR

OFFICE OF PACKAGING AND TRANSPORTATION

SUBJECT:

Renewal and Amendment of Department of Energy Certificate of
Compliance Number 9979

In response to the email request from Maxcine Maxted dated October 30, 2018, as supplemented, to Dr. James M. Shuler of my staff, Department of Energy (DOE) Certificate of Compliance (CoC) Number 9979, Revision 16, for the Model 9979 package is issued with its attached Safety Evaluation Report. Changes to the CoC are indicated by vertical bars in the right page margin.

This CoC is issued by DOE under the authority of 49 CFR 173.7(d) and is conditional upon fulfilling the applicable Operational and Quality requirements of 49 CFR Parts 100-199 and 10 CFR Part 71 and the conditions specified in Item 5 of the CoC.

The expiration date of the certificate is September 30, 2025.

If you have any questions, please contact me or Dr. Shuler at (301) 903-5513.

Attachments

cc: Maxcine Maxted, SR
Glenn Abramczyk, SRNL
Yung Liu, ANL
James Shuler, EM-4.24



CERTIFICATE OF COMPLIANCE For Radioactive Materials Package

Table with 5 columns: 1a. Certificate Number (9979), 1b. Revision No. (16), 1c. Package Identification No. (USA/9979/AF-96 (DOE)), 1d. Page No. (1), 1e. Total No. Pages (12)

2. PREAMBLE

- 2a. This certificate is issued under the authority of 49 CFR Part 173.7(d).
2b. The packaging and contents described in Item 5 below meet the safety standards set forth in subpart E, "Package Approval Standards" and subpart F, "Package, Special Form, and LSA III Tests" Title 10, Code of Federal Regulations, Part 71.
2c. 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.

Table with 3 columns: (1) Prepared by (Name and Address): U.S. Department of Energy, Savannah River Operations Office, P.O. Box A, Aiken, SC 29808; (2) Title and identification of report or application: Safety Analysis Report for Packaging Model 9979 Type AF-96, S-SARP-G-00006, Revision 7, December 2020, as supplemented [see 5(e)]; (3) Date: December 2020

4. CONDITIONS

This certificate is conditional upon fulfilling of the applicable Operational and Quality Assurance requirements of 49CFR parts 100 – 199 and 10CFR Part 71, and the conditions specified in Item 5 below.

5. Description of Packaging and Authorized Contents, Model Number, Transport Index, other Conditions, and References:

(a) Packaging

(1) Model Number: 9979

(2) Description:

The Model No. 9979 packaging is composed of one 55-gallon drum overpack and one 30-gallon inner drum. The packaging configuration is shown in Figure 1 below.

The 55-gallon drum and its lid, fabricated from 16-gauge carbon steel, include a welded steel liner containing a polyurethane foam for thermal insulation and structural support. When installed, the lid assembly extends into the drum body liner. An ethylene propylene diene M-class (EPDM) gasket seals the overpack closure. The 30-gallon inner drum, fabricated from 16-gauge carbon steel, is positioned centrally, both radially and axially, within the 55-gallon drum overpack steel liner. The inner drum, which secures the radioactive contents payload, is the containment boundary for the package. A silicon gasket seals the 30-gallon containment drum closure.

Table with 2 columns: 6a. Date of Issuance: May 5, 2021; 6b. Expiration Date: September 30, 2025

FOR THE U.S. DEPARTMENT OF ENERGY

Table with 2 columns: 7a. Address (of DOE Issuing Office): U.S. Department of Energy, Office of Packaging and Transportation (EM-4.24), 1000 Independence Avenue, SW, Washington, DC 20585; 7b. Signature, Name, and Title (of DOE Approving Official): Julia C. Shenk, Digitally signed by Julia C. Shenk, Date: 2021.05.05 09:05:15 -04'00', Julia C. Shenk, Headquarters Certifying Official, Director, Office of Packaging and Transportation

Certificate Number	Revision No.	Package Identification No.	Page No.	Total No. Pages
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Reinforced split-ring devices, fabricated from 12-gauge carbon steel, provide secure closures for both the 30-and 55-gallon drums. Tamper Indicating Devices (TID) can be inserted through the lugs welded at each end of the two split-rings for both the 55-and 30-gallon drums.

Two thermal insulation components, made of a ceramic fiber mat sandwiched and sewn between flexible fiberglass woven cloth, are added to the packaging: a quilted insulation cover, 21 ½ inches in diameter by ½ inch thick is positioned between the 30-gallon and 55-gallon drum closure lid and an insulation bag is installed in the 30-gallon drum.

The 55-gallon drum is nominally 23 inches in diameter and 34 ½ inches in height. The nominal weight of the overpack (body, closure lid and split-ring closure device) is 174.5 lb. The 30-gallon drum is nominally 18.6 inches in diameter and 29 inches in height. The 30-gallon drum with its lid and the split-ring closure weighs approximately 50 lbs.

The gross weight of a fully loaded package shall not exceed 415 lb.

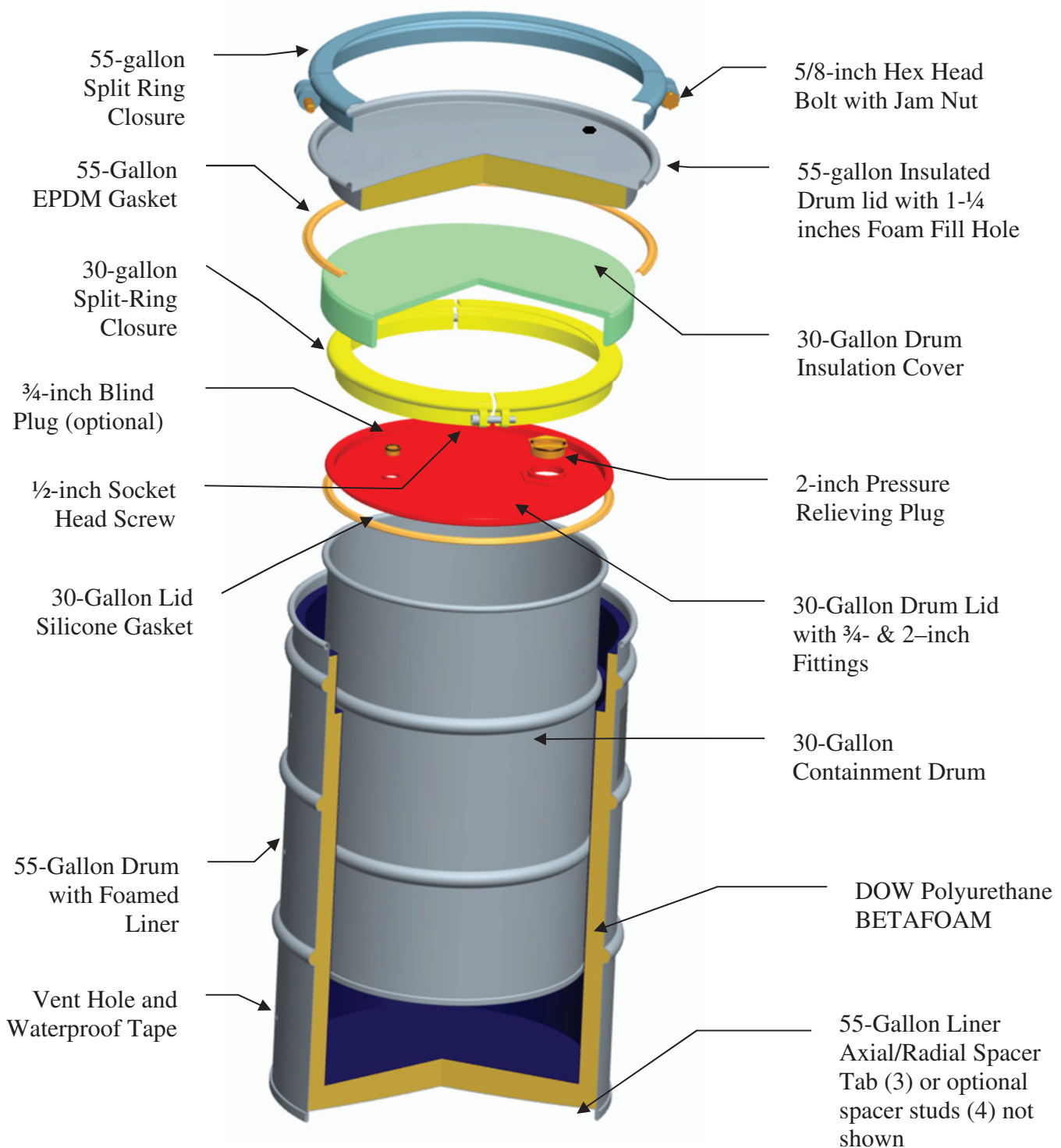


Figure 1 – 9979 Packaging Configuration

(3) Drawings:

The 9979 packaging design is defined by the following drawings.

Drawing Number	Revision Number	Title
R-R5-G-00006	4	9979 Type AF Package Tree (U)
R-R1-G-00026	8	9979 Type AF 30-Gallon Container Split Ring Assembly (U)
R-R1-G-00027	7	9979 Type AF 55-Gallon Drum Lid Split Ring Assembly (U)
R-R1-G-00028	7	9979 Type AF 30-Gallon Drum Assembly (U)
R-R1-G-00029	5	9979 Type AF 55-Gallon Drum Assembly (U)
R-R1-G-00030	4	9979 Type AF Packaging Assembly (U)
R-R2-G-00057	11	9979 Type AF 55-Gallon Drum Sub-Assembly and Weldment (U)
R-R2-G-00058	6	9979 Type AF 30-Gallon Drum (U)
R-R2-G-00059	7	9979 Type AF 55-Gallon Drum Lid Sub-Assembly and Weldment (U)
R-R2-G-00060	6	9979 Type AF 30-Gallon Drum Lid with Dual Bung Closures (U)
R-R4-G-00062	4	9979 Type AF 30-Gallon Drum Lid Gasket (U)
R-R4-G-00064	3	9979 Type AF Insulation Bag
R-R4-G-00065	3	9979 Type AF Insulation Cover Assembly for 30-Gallon Drum (U)
R-R4-G-00066	2	9979 Type AF Package Identification Plate (U)

Note: U is unclassified

Special Form capsule designs authorized for transport in the package are defined by the following drawings or certificate.

Drawing Number	Revision Number	Title
157Y701711-900	B	Vogan Assembly with Tungsten
157Y701720-000	A	Plutonium Oxide Pod (P.O.P.) Assembly
CZ/1009/S-96	2	Am1.N02 Special Form Radioactive Material

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(b) Contents

(1) Type and Form of Radioactive Material:

The contents (payload) for the 9979 package includes all radioactive (fissile and non-fissile) and non-radioactive materials confined within the 30-gallon containment drum. The radioactive contents for the 9979 package are grouped broadly into two payload categories as listed in Table 1: non-combustible materials, and combustibles materials. A general description of the content payload is listed in Table 1.

Low enriched uranium (LEU) is limited to two forms. The first form, under Table 1, Material Form "Sources and Standards" is a 10 cm cube assembly of steel encapsulated metal plates, or up to four individual plates, approximately 10 cm square by 2 cm thick each, per package. The cube assembly or plates may be packed in a 3-quart stainless steel convenience can. The second form, under Table 1, Material Form "Solid Compounds" is LEU metal waste.

Tri-Structural Isotropic (TRISO) fuel and process materials are limited to the physical and chemical forms of Highly Enriched Uranium and Thorium defined in Tables 2-1 through 2-6 of N-NCS-G-00174, Revision 1 (SARP Appendix 6.5). TRISO fuel and process materials will be placed in convenience containers such as steel cans (carbon or stainless) with slip top or press fit lids; miscellaneous small glass vials, less than 1/2 pint; or poly-bottles with screw top lids. Convenience containers may be placed in plastic bags, which are taped closed for contamination control.

Special Form Pu metal or oxide in Vogan or Plutonium Oxide Pods (POP) Assemblies, Special Form Am-241 with Beryllium (Am-Be) in the Am1.N02 Assemblies, and Normal Form Cesium-137 & Thorium-232 solid samples. The Pu may contain up to 4.5% Gallium as an alloying metal. The Am-241 is Am₂O₃ mixed with a maximum of 20 mg of Beryllium.

Table 1 - Radioactive Content Description

Payload Categories	Material Form	General Description
COMBUSTIBLE	Filters	Roughing, sock, demister, HEPA, and other uranium filters
	Rubber, Plastics, Cellulose Products	Clothing, gaskets, bottles, filter frames, paper, wood, mop heads, etc.
	Floor Sweepings	Miscellaneous materials collected from cleaning activities
	Process Solids	Furnace residues. (pan filter cloth and scrapings, wipes/sponges, etc.)
NON-COMBUSTIBLE	Graphite/Carbon	Carbon and graphite scrap molds
	Slag and Liner	Residue that contains magnesium oxide, calcium fluoride, and/or lithium fluoride
	Ceramics/Glass	Crucibles, glassware and borosilicate rings
	Borax Pellets	From analytical x-ray operations.
	Reduction Sand	Granular magnesium oxide (MgO)
	Asbestos/Firebrick	Insulation, floor tiles, etc.
	Solid Compounds and Metal	Uranyl Fluoride, UO ₄ , ammonium diuranate and residues and solid mixtures; scraped unirradiated fuel rods and pellets [e.g., size-reduced light-water breeder reactor (LWBR) fuel rods]; TRISO fuel and process materials; LEU metal waste forms; Special Form Vogan Assemblies, Plutonium Oxide Pods (POP) Assemblies, and Am ¹ .N02 Assemblies, and normal form Cesium & Thorium samples.
Standards and Sources	Encapsulated calibration standards, LEU cube assembly or up to four individual plates per package.	

Table Note 1 Non-radioactive contents include all secondary containers, wrapping, shoring, convenience cans, plastic bagging, polyurethane foam and other dunnage material.

Table Note 2 The Payload Category "Combustible", may also include "Non-Combustible" Material Forms.

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(2) Maximum Quantity of Radioactive Material per Package:

The package contents including radioactive material, dunnage, packing, and thermal insulating bag (if used) shall not exceed to 200 lb. (90 kg).

Type A quantity of radioactive material, per package.

The radioactive material and payload mass limits for the 9979 package are defined in Tables 2, 3, 4, and 5:

Table 2 defines the limits for Highly Enriched Uranium (HEU) including TRISO fuel and process materials,

Tables 3 and 4 define the limits for both forms of LEU (cubes/plates and metal waste), and

Table 5 defines the limits for Pu and Am-241 in Special Form and Cesium-137 & Thorium-232 samples in Normal Form. One package may be used to ship eight Vogan or POP Assemblies, or combination of eight thereof, with ten Am1.N02 Assemblies, and Cs-137 and Th-232 samples in accordance with Table 5.

Table 2 – Content Envelope Limits for HEU, TRISO Fuel and Process Materials

Feature	Material	Mass (g)			
Radioisotopes	Sr-90 ^g	3.09E-04			
	Tc-99	1,428			
	Cs-137 ^g	2.30E-05			
	Eu-155 ^g	1.10E-03			
	Th-228 ^g	7.15E-07			
	Th-229 ^g	3.17E-02			
	Th-230 ^g	5.42E-01			
	Th-232	90,000			
	U-232	5.00E-05			
	U-233	16.6			
	U-234	26.1			
	U-235	350			
	U-236	2,500			
	U-238	90,000			
	Np-237	76.9			
	Pu-238	1.58E-03			
	Pu-239	0.435			
	Pu-240	0.119			
	Pu-241	1.58E-02			
	Am-241	7.69E-03			
Cm-243 ^g	5.19E-04				
Impurities	Carbon	1,000 ^d	unlimited ^{b, e}	1,000 ^d	90,000 ^{c, e}
	Beryllium		0		0
	Hydrocarbons ^f	1,000	1,000	unlimited ^e	1,000
Total Mass ^a	Fissile Material [U-235 (eq)]* Radioactive Material	350	350	300	150
	Package Payload	90,000			
		90,000			

Note: Except for Sr-90, Cs-137, Eu-155, Th-228, Th-229, Th-230, U-232, U-235, Cm-243, the mass limit for each isotope listed is based on a single A₂ or 90,000 grams.

a Package contents are limited to specified mass of U-235 (eq) and to a maximum composite A₂ activity of ≤ 1.

$$* \text{U-235}(\text{eq}) = \text{U-235} + [4.1 \times \text{U-233}] + [4.1 \times \text{Pu}]$$

[The sum of U-233 and Pu must be ≤ 5 wt.% of the total fissile mass.] All other fissile isotopes are only allowed in trace quantities (i.e., <0.015 grams)]

b Fissile material must be fixed on graphite pieces.

c Fissile material is not fixed on graphite pieces.

d This limit applies to sum of beryllium and carbon in the payload.

e Subject to payload limit.

f Materials predominantly containing hydrogen and carbon (i.e., molecular formula involving C_xH_y...) such as plastics, polyethylene, and oil.

g In addition to the requirements of note a) above, the sum of mass fractions for Sr-90, Cs-137, Eu-155, Th-228, Th-229, Th-230, & Cm-243 are limited to ≤ 1, to control dose rate. Mass fraction is m_x/M_x, Where, "m_x" = mass of isotope x from Table 2 offered for shipment and "M_x" = mass limit of isotope x from Table 2.

Table 3 – Content Envelope Limits for LEU Cube or Plates

Feature	Material	Weight Fraction	Mass (kg)
Radioisotopes	U-235	0.199	3.819
	U-238	0.801	15.373
Total Mass	Radioactive Material	-	19.192
	Package Payload	-	90

Low Enriched Uranium less than or equal to 19.9 weight percent U-235 and 80.1 weight percent U-238. Limits are based on U-235 enrichment: weight fraction and mass of U-238 may be higher when U-235 weight fraction and mass is lower than shown in the Table.

Table 4 – Content Envelope Limits for LEU Metal Waste

Feature	Material	Mass (g)
Radioisotopes	Tc-99	4.00E+00
	Th-228	6.72E-09
	Th-230	3.84E-03
	Th-232	1.76E+00
	U-232	6.13E-08
	U-234	2.20E+01
	U-235 ^a	2.00E+03
	U-236	1.72E+02
	U-238 ^b	9.0E+04
	Np-237	6.15E-02
	Pu-238	1.22E-06
	Pu-239	5.63E-03
	Pu-241	3.41E-05
	Am-241	9.97E-07
Total Mass	Radioactive Material	9.0E+04
	Package Payload	9.0E+04

a Low Enriched Uranium (LEU) Content Envelope \leq 1.25 weight % U-235

b Includes contributions from daughter products, e.g., Th-234, etc.

Table 5 – Content Envelope Limits for Vogan/POP, Am1.N02, Cs-137, & Th-232

Radioactive Materials				
Form	Description	Material	Mass/Assembly (g)	Mass/package (g)
Special	Vogan Assembly ^a	Pu-239	16.3625	1.309E+02
		Pu-240	1.05	8.400E+00
		Pu-241	0.0875	7.000E-01
	POP Assembly ^a	Pu-239	16.83	1.3464E+02
		Pu-240	1.08	8.640E+00
		Pu-241	0.09	7.200E-01
	Am1.N02 ^b	Am-241	1.60E-02 ^c	1.600E-01
Normal	Cesium	Cs-137	-	1.300E-06
	Thorium	Th-232	-	3.000E+02
Radioactive Material ^d				4.4416E+02
Package Payload				9.0E+04
Total Mass per Special Form Assembly				
Assembly		Mass (g)		
Vogan		7.95E+01		
POP		5.34E+01		
Am1.N02		6.84E+00		

- a Up to eight Vogan or POP Assemblies, or a mixture of eight per package. Pu may include up to 4.5% gallium as an alloying metal.
- b Up to ten Am1.N02 Assemblies per package.
- c Am₂O₃ mixed with a maximum of 20 mg of Beryllium.
- d Total radioactive material per package is based on eight POP Assemblies, ten Am1.N02 Assemblies, and max mass for Cs-137 and Th-232.

(3) Maximum Decay Heat:

The maximum decay heat for the package thermal design is 3.5 watts.

The maximum calculated decay heat for Content:

Table 2 is 9.12E-3 watts

Table 3 is 3.64E-04 watts

Table 4 is 5.18E-03 watts, and

Table 5 is 3.42E-01 watts

(4) Maximum Moisture Content:

The contents shall not exceed one weight percent moisture.

(c) Criticality Safety Index

The Criticality Safety Index (CSI) is 1.0, i.e., CSI = 1.0 for Table 2 contents

CSI = 0.1 for Table 3 and Table 5 contents

CSI = 0.0 for Table 4 contents

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(d) Conditions

- (1) Pyrophoric materials, cryogenic liquids, compressed gasses, visible liquids, and chemically reactive substances are prohibited as content in the 9979 package.
- (2) Transport of fissile material by air in the 9979 package is not authorized.
- (3) In addition to the requirements of Subparts G and H of 10 CFR Part 71:
 - (a) The package must be prepared for shipment and operated in accordance with the Operating Procedures in Chapter 7 of the SARP, as supplemented by 5.(e) of this certificate,
 - (b) Each packaging must meet the Acceptance Tests and Maintenance Program of Chapter 8 of the SARP, and
 - (c) Each entity must comply with the Quality Assurance requirements of Chapter 9 of the SARP
- (4) All contents shall be packaged in the 30-gallon containment drum. Contents defined in Table 1 as “Combustible”, including combustible non-radioactive dunnage, must be packed in the Thermal Insulation Bag (Drawing R-R4-G-00064) by the procedure described in SARP Section 1.2.4. This bag is optional dunnage for non-combustible contents.
- (5) The following are requirements for content packing configurations:
 - Sharp edges and corners must be padded.
 - Liquid waste and waste containing free liquids must be processed to a solid form or be collected on sorbent material sufficient to retain twice the volume of the liquid. Sorbents must be non-biodegradable in accordance with 40 CFR 265.314(e).
 - Handling containers must be packed with closures upright.
- (6) The shipping period and minimum package void volume in the 30-gallon drum apply for each content Table as follows (Note – Shipping period begins when the 30-gallon drum is closed):
 - Tables 2 and 4 – shipping period is 180 days, with a minimum void volume of 8.9% for Table 2 contents and 4.6% for Table 4 contents.
 - Tables 3 and 5 – shipping period is unlimited and with no minimum void volume.

The shipping period for packages loaded with Tables 2 and 4 contents may be reset to 180 days by:

 - Diffusion or purging methods described in the operations procedures in Section 7.4.3 of the SARP, as supplemented. For the purging method, use of the 100 µm sintered metal filter of 0.092 inch thickness is required for contamination control.
 - The detection or sampling methods described in the operations procedures in Section 7.4.4 of the SARP, as supplemented.
- (7) Fuel pellets from scrap unirradiated LWBR fuel rods must be either be confined within sized-reduced fuel rods [e.g., the cut end(s) of the fuel rod shall be covered with metal tape] or placed in a stainless steel convenience container, prior to loading in the 30-gallon containment drum. Loose fuel pellets are prohibited in the containment drum.
- (8) The calculated external radiation for the package with Table 5 contents exceeds the limits in §71.47(a), so the package with Table 5 contents must be transported by exclusive use shipment only, in accordance with §71.47(b).
- (9) Packaging serial numbers 11-100 through 11-599 must be modified in accordance with Appendix 8.2 of the SARP, prior to authorized use under this certificate.
- (10) Revision 15 of this CoC may be used until September 30, 2021.

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- (11) This certificate authorizes use of two hundred (200) silicone gaskets from Batch No.0057022890, Lot # S0059225 produced by Parker Hannifin Corporation in accordance with the Drawing R-R4-G-00062, Rev. 3.
- (12) Only DOE or persons working under contract to DOE shall consign the package for shipment.
- (13) NRC or Agreement State licensees shall not consign a DOE certified package for shipment but can transfer the material on-site to DOE or persons working under contract to DOE, for consignment of the package.

(e) Supplements

None