Department of Energy
Washington, DC 20585

MAY 9 2011

MEMORANDUM FOR PATRICK W. MCGUIRE
ASSISTANT MANAGER FOR NUCLEAR
MATERIALS STABLIZATION PROJECTS
SAVANNAH RIVER OPERATIONS OFFICE

FROM: STEPHEN C. O'CONNOR
HEADQUARTERS CERTIFYING OFFICIAL
DIRECTOR FOR OFFICE OF PACKAGING AND
TRANSPORTATION

SUBJECT: Revision 6 to DOE CoC USA/9975/B(M)F-96 (DOE)

Per your request, attached is Revision 6 of Department of Energy (DOE) Certificate of Compliance (CoC) USA/9975/B(M)F-96 (DOE) for the 9975-96 and the Safety Evaluation Report. This revision was issued to allow the shipment of the use of a nested and filtered convenience container configuration for the shipment of plutonium oxide in the 9975 -96 Package, using nitrogen as the inerting gas in the primary containment vessel. This new content can configuration and approach for inerting the primary containment vessel to achieve an oxygen concentration no greater than five percent (i.e., <5%) by volume is authorized.

The expiration date of Revision 6 is June 30, 2013.

If you have any questions, please call me at (301) 903-7854 or James Shuler of my staff at (301) 903-5513.

Attachment

cc w/att.:
Maxcine Maxted, SR
Brian Anderson, LLNL
Steve Bellamy, SRNS

DOE F 5822 1
(5-85)
Formerly EV-618)

U.S. DEPARTMENT OF ENERGY
CERTIFICATE OF COMPLIANCE
For Radioactive Materials Packages

OMB Approval
No 1910-2000

1a. Certificate Number	1b. Revision No.	1c. Package Identification No.	1d. Page No.	1e. Total No Pages
9975	6	USA/9975/B(M)F-96 (DOE)	1	13

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.

3. This certificate is issued on the basis of a safety analysis report of the package design or application --

(1) Prepared by *(Name and address)*.

U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29808

(2) Title and Identification of report or application:

Safety Analysis Report for Packaging
Model 9975, B(M)F-96
S-SARP-G-00003, Revision 0, January 2008' as supplemented [see 5(e)]

(3) Date.

Jan. 2008

4. CONDITIONS

This certificate is conditional upon the 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: 9975

(2) Description:

The components of the package include the drum, insulation, bearing plates, primary containment vessel (PCV), secondary containment vessel (SCV), lead shielding, and aluminum honeycomb spacers. An aluminum PCV sleeve, or 3013 top and bottom spacer, may be used, depending on the type of product can to be transported The nominal net weight of the packaging ranges from 159–168 kg (350–374 lb). The drum is fabricated as a 132-liter (35-gallon) bolted lid drum of 18-gauge Type 304L stainless steel. Four 1 3 cm (1/2 in.) diameter vent holes are drilled into the drum, approximately 90 degrees apart, 2.5 cm (1 in.) below the drum flange, and are covered with plastic Caplugs (fusible plugs). The plugging devices prevent water from entering the drum through the vent holes under normal conditions of transport. In the event a fire occurs, the plugs melt, allowing the drum to vent gases, generated from the insulation, to prevent rupture of the drum. The drum lid is bolted to a 3.2 cm (1.25 in.) wide by 0.3 cm (1/8 in.) thick angle flange welded to the top of the drum body using 24 1.3 cm (1/2 in.) high-strength bolts. The lid is recessed 1.4 cm (0.55 in.).

A 0.3 cm (1/8 in.) thick by 3.2 cm (1.25 in.) wide circular ring is welded to the outer section of the lid.

6a Date of Issuance: MAY 9 2011

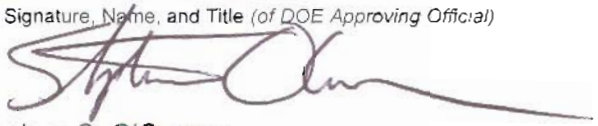
6b. Expiration Date: June 30, 2013

FOR THE U.S. DEPARTMENT OF ENERGY

7a. Address *(of DOE Issuing Office)*

U.S. Department of Energy
Office of Packaging and Transportation, EM-45
1000 Independence Avenue, SW
Washington, DC 20585

7b. Signature, Name, and Title *(of DOE Approving Official)*



Stephen C. O'Connor
Headquarters Certifying Official

The ring serves to reinforce the lid, and prevents the lid from shearing away from the bolts during a hypothetical accident condition event. Nuts are tack welded to the underside of the flange, to ease assembly operations. The bolts are tightened to 40.7 ± 6.8 N-m (30 ± 5 ft-lbs) of torque.

The insulation material that surrounds the shielding body is Celotex® cane and/or softwood fiberboard, manufactured in accordance with ASTM Specification C 208-95. The fiberboard is regular grade wall sheathing material, with a nominal density of 0.24 g/cm^3 (15 lb/ft^3). The fiberboard is fabricated in 1.3 cm (1/2 in.) thick sheets that are bonded together with a water-based carpenter's glue or equivalent into top and bottom subassemblies. The subassemblies are fitted into the drum so that the radial clearances between the Celotex®, the Lead Shielding Body, and the drum are all under 0.6 cm (1/4 in.). The radial thickness of the Celotex® is approximately 12.1 cm (4 3/4 in.). Along the axis of the drum, the thickness of the top Celotex® is 8.9 cm (3.5 in.), and the bottom thickness is 8.6 cm (3.4 in.). A stainless steel air shield is placed over, and glued to, the top of the Celotex®.

A 1.3 cm (1/2 in.) thick Firemaster® encapsulated blanket is placed between the top insulation subassembly and the drum closure lid. The blanket is manufactured from a ceramic fiber (Kaowool®), encapsulated in stainless steel foil and heat-sealed.

The radiation shielding body assembly is a lead cylinder that surrounds the PCV/SCV double containment assembly. The shielding body assembly consists of an 18.4 cm (7-1/4 in.) inside diameter, 20-gauge, 304 stainless steel cylinder, with a 20-gauge bottom, and nominal 61.2 cm (24.1 in.) interior height, surrounded by ASTM B-749 lead, that is nominally 1.3 cm (1/2 in.) thick. The lead is surrounded by a 20-gauge, 304 stainless steel exterior liner. The top of the shielding body is closed with a 1.3 cm (1/2 in.) thick ASTM B-209 1100 aluminum shielding lid that is attached with four 0.6 cm (1/4 in.) ASME SA-320 stainless steel bolts, torqued to 13 (±5) in-lb. The shielding body assembly does not employ a lead lid because the PCV and SCV stainless steel closures provide adequate shielding. The shielding body assembly has a minimum weight of 59.1 kg (130.3 lb).

Two 1.3 cm (1/2 in.) thick by 28.4 cm (11.2 in.) diameter ASTM B-209 1000 aluminum bearing plates provide load bearing surfaces, which distribute the load between the shield assembly and the Celotex® insulation.

The PCV is a stainless steel pressure vessel, designed, analyzed, fabricated, and examined in accordance with Section III, Subsection NB of the ASME Boiler & Pressure Vessel B&PV Code (the Code), with design conditions of 900 psig at 300°F. The PCV is fabricated from 12.7 cm (5 in.), Schedule 40, seamless, Type 304L stainless steel pipe [0.66 cm (0.258 in.) nominal wall] and has a standard, Schedule 40, Type 304L stainless steel, pipe cap [0.66 cm (0.258 in.) nominal wall] at the blind end. A stayed head, machined from a 15.2 cm (6 in.) diameter by 5.7 cm (2 ¼ in.) long Type 304L stainless steel (SS) bar is welded to the pipe end. The head is machined to include 5½-12UN-2B internal thread and a female cone-seal surface with a 32 μin. finish. Both vessel body joints are Category B with full penetration/complete fusion circumferential welds.

A 10.2 cm (4 in.), Schedule 40 Type 304L SS pipe is welded to the convex side of the cap to form a skirt to vertically support the PCV. The skirt has two slots on the bottom edge, 180° apart, to engage a rectangular key to prevent vessel rotation during removal and installation of the closure.

The PCV closure assembly consists of a Type 304L SS cone-seal plug, shaped as a truncated cone, and a Nitronic® 60 threaded cone-seal nut. The cone-seal nut and the containment vessel body are made from dissimilar materials to minimize the potential for galling. A leaktight PCV closure is achieved through a male-female cone joint with surfaces machined to identical angles, so that they mate with zero clearance. The cone-seal nut threads into the stayed head forcing the cone-seal plug against the female cone. A 0.24 cm (0.094 in.) diameter through-hole, located in the PCV wall just below the stayed head threads, is provided to vent any pressure in the PCV that may

have built up during transport as the cone-seal nut is unscrewed and the cone-seal plug unseats from the female cone sealing surface.

Two O-ring grooves (an outer and an inner), with a 32 μin. finish, are machined in the face of the male cone-seal plug. Viton GLT and/or GLT-S O-rings fit into these grooves to form a leaktight seal. The male-female cone surfaces are designed to mate with essentially zero clearance, with, or without, the O-rings installed. The cone-seal plug leak-test port is connected by a radial passage drilled to the annular volume between the two O-ring grooves on the sealing surface of the cone-seal plug to assist leak testing. The leak-test port is closed by the leak-test port plug and tested after closing. The containment boundary for the vessel is formed by the containment vessel body, the cone-seal plug, outer O-ring and the leak-test port plug.

A snap-ring joins the cone-seal nut to the cone-seal plug, and unseats the closure seal during disassembly. The closed PCV has an internal volume of approximately 795 cubic cm (313 cubic inches), weighs 15 kg (34 lb), and has a nominally closed length of 47.2 cm (18.6 in.). It has a usable inside cavity that is approximately 38 cm (15 in.) deep, with a minimum diameter of 12.7 cm (5 in.).

A spacer is installed in the bottom of the PCV to provide a flat surface for the contents. The spacer is made of aluminum honeycomb, and is contoured to fit the curved bottom of the PCV cavity. The spacer is fabricated from 3-mil, minimum thick foil, and is rated for an axial compressive strength of 1,500 ± 500 psi before deformation.

The PCV is fitted with an aluminum sleeve to fill the space between food-pack cans and the inner wall of the PCV. The PCV sleeve is fabricated from 6061-T6 seamless aluminum tubing. The sleeve is 36.8 cm (14.5 in.) tall, has a 12.7 cm (5 in.) OD, and an approximately 0.76 cm (0.3 in.) wall thickness. Two finger-hole cut-outs are provided near the top and bottom of the sleeve to facilitate its insertion into, and removal from, the PCV.

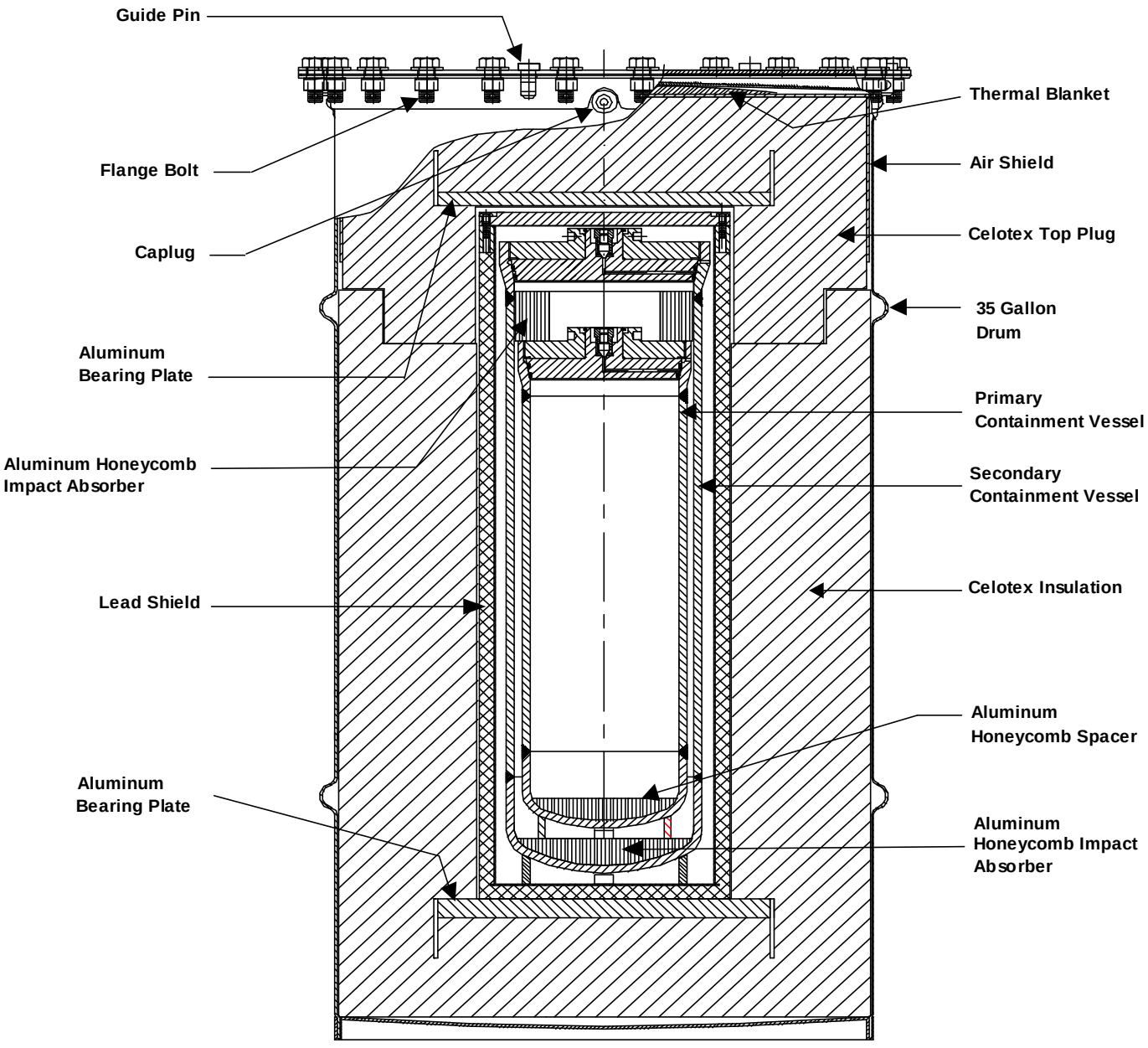
The 3013 top spacer is fabricated from 6061-T6 aluminum tubing, with a 12.5 cm (4.92 in.) OD, and is 12.85 cm (5.06 in.) tall. The spacer is placed on top of the 3013 container to take up the remaining axial space within the PCV cavity. The 3013 top spacer prevents the 3013 container from impacting the PCV cone-seal plug in the event of package mishandling or a transportation accident. Two finger-hole cut-outs are provided near both ends of the spacer to facilitate its insertion into, and removal from, the PCV.

The SCV is a stainless steel pressure vessel designed, analyzed, and fabricated in accordance with Section III, Subsection NB of the ASME Code, with design conditions of 800 psig at 300°F. The SCV is fabricated from 15.2 cm (6 in.), Schedule 40, seamless, Type 304L SS pipe [0.71 cm (0.280 in.) nominal wall], and has a standard Schedule 40 Type 304L SS pipe cap [also 0.71 cm (0.280 in.) nominal wall] at the blind end. A stayed head, machined from a 19.1 cm (7½ in.) diameter by 5.7 cm (2¼ in.) long Type 304L SS bar, is welded to the pipe top end. The head is machined to include 6½-12UNS-2B internal threads and a female cone-seal surface with a 32 μin. finish. Both vessel body joints are Category B, with full penetration/complete fusion circumferential welds. A 12.7 cm (5 in.), Schedule 40 Type 304L SS pipe is welded to the convex side of the cap to form a skirt to vertically support the SCV. The skirt has two slots on the bottom edge, 180° apart, to engage a rectangular key, to prevent vessel rotation during removal and installation of the closure.

The SCV closure is identical to that used on the PCV, except that the SCV closure is larger in height and diameter.

The assembled SCV has an internal volume of approximately 1,534 cm^3 (604 cubic inches). The nominal assembly weight is 25.4 kg (56 lb), and it has a nominally closed length of 61 cm (24 in.). It has a usable cavity approximately 54.6 cm (21.5 in.) deep, with a minimum diameter of 15.2 cm (6 in.).

Aluminum honeycomb impact absorbers are used in the SCV to reduce the impact loads transmitted between the containment vessels. The SCV bottom impact absorber is contoured to fit the curved bottom of the SCV cavity and has a flat top, providing a level surface on which the PCV stands. The SCV top impact absorber is ring-shaped, and separates the PCV cone-seal nut from the SCV cone-seal plug. The impact absorbers are fabricated from 3-mil minimum thickness foil, and are rated for an axial compressive strength of 1,500 ± 500 psi before deformation.



9975 Packaging Section View

Option to use the radiofrequency identification (RFID) system: The option to use the RFID system is justified by Addendum [See 5(e)(4)] to be within the existing safety basis. The RFID guide [See 5(e)(5)] provides procedures for installing the DOE MK-II RFID tag to the 9975 package. The DOE MK-II RFID tag is not considered a part of the package. The DOE MK-II RFID tags are equipped with a suite of sensors-seal integrity, temperature, humidity, shock, and battery status. The seal sensor is a thin flexible membrane that sits under the flange bolts of the drum cover when installed. The DOE MK-II RFID tag has a robust plastic front cover and the stainless-steel back plate which provide adequate protection of the tag against damage under normal handling and transport. The tag weighs approximately 2.4 lb (with four batteries) and is approximately 8 inches wide x 7 inches high x 1.5 inches tall. Appendix B of the RFID guide [See 5(e)(5)] provides documentation that the batteries used in the DOE MK-II RFID tag are not subject to the hazardous material regulations and also contains the Material/Product Safety Data Sheet for the batteries.

(3) Drawings:

The packaging design is defined by the following Savannah River Site drawings:

Drawing Number	Revision Number
R-R2-F-0026	Revision 4
R-R2-F-0019	Revision 7
R-R2-F-0020	Revision 10
R-R2-F-0025	Revision 4
R-R2-F-0018	Revision 9
R-R3-F-0016	Revision 12
R-R3-F-0015	Revision 5
R-R4-F-0054	Revision 13
R-R4-F-0055	Revision 4
R-R2-F-0037	Revision 1

(b) Contents:

(1) Type and Form of Material:

(i) Uranium metal or oxide, as specified in Content Envelope C.1 (see Table 1);

(ii) Plutonium-238 heat sources, as specified in Content Envelope C.2 (see Table 1);

(iii) Plutonium and/or uranium metal, as specified in Content Envelope C.3 (see Table 1) or C.10 (see Table 2);

(iv) Plutonium and/or uranium oxide, as specified in Content Envelope C.4 (see Table 1) or C.11 (see Table 2);

(v) Plutonium composites, as specified in Content Envelope C.5 (see Table 1);

(vi) Plutonium/tantalum composites, as specified in Content Envelope C.6 (see Table 1);

(vii) Plutonium-238 oxide/beryllium metal, as specified in Content Envelope C.7 (see Table 1);

(viii) Neptunium oxide, as specified in Content Envelope C.8 (see Table 1).

(2) Maximum Quantity of Material per Package (as specified in Table 1 or 2):

(i) For the contents described in 5(b)(1)(i) through 5(b)(1)(viii) [All Content Envelopes]:

(a) The maximum decay heat per package may not exceed 19 watts.

(b) The maximum weight of all material (radioactive contents, product cans, spacer, etc.) inside the PCV may not exceed 20.1 kg (44.4 lb).

(c) Except as permitted for oxides, all contents shall be dry.

(d) Pu/U content bulk density shall be no greater than 19.84 g/cc. No minimum bulk density is specified. However, low bulk densities may require dilution of the local atmosphere within the content container by a specific gas (helium or nitrogen) and/or reduction in the allowable decay heat, as summarized in SARP 1.2.3.2.

(e) Except as stated in Table 1, small concentrations (<1000 ppm each) of other actinides, fission products, decay products, and neutron activation products are permitted.

(f) Except as stated in Table 1, inorganic material impurity quantities of less than 100 ppm each are permitted so long as the total mass is less than 0.1 weight percent of the total content mass.

Table 1 - Content Envelopes C.1 thru C.8 [Table notes are on the following page.]

	Material [a, b]	C.1 [c, d]	C.2	C.3 [d, e, f, g]	C.4 [e, g, h, i]	C.5 [d, f, g, j]	C.6 [d, f, k]	C.7	C.8 [l]
		U Metal/Oxide	^{238}Pu Heat Sources	Pu/U Metals	Pu/U Oxides	Pu Composites	Pu/Ta Composites	^{238}Pu Oxide/ Be Metal	Neptunium Oxide
Radioisotope [m] (Weight Percent of Radioactive Material Mass)	^{236}Pu		1×10^{-4}					1×10^{-4}	
	^{238}Pu [n]		100	2	2	0.05	0.05	80	5×10^{-2}
	^{239}Pu [o]		40	100	100	100	100	40	8.8×10^{-3}
	^{240}Pu		13	50	50	6.5	6.5	13	1.5×10^{-3}
	^{241}Pu [o, p]		1	15	15	1	1	1	1.4×10^{-4}
	^{242}Pu		1.5	5	5	0.1	0.1	1.5	7.7×10^{-4}
	^{241}Am + ^{241}Pu		1	15	15	1	1	1	2.3×10^{-4}
	^{243}Am		1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	
	^{244}Cm		1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	
	^{237}Np		0.5	5.0	5.0				100
	^{232}U	1×10^{-5}	4×10^{-6}	1×10^{-5}	1×10^{-5}				
	^{233}U [o]	0.5	0.2	0.5	0.5				2.4×10^{-3}
	^{234}U [q]	100	40	100	100				0.47
	^{235}U [o]	100	40	100	100				0.47
	^{236}U	40	16	40	40				0.19
	^{238}U	100	40	100	100				0.47
	^{232}Th		10	23 [x]	23 [x]				2.3
Impurities (grams)	Al, B, F, Li, Mg, Na			r	r				8.0
	Be			500	500	4,400		200 [s]	0.60
	V					4,400			
	Ta					4,400	6,000		
	C			1,000	1,000				20
Total Mass (kilograms)	Radioactive Materials	13.5	0.1	4.4	4.4	4.4	2	0.02	6
	Impurities			3.08 [t]	3.08 [t]	4.4	6 [u, v]	0.2	0.07
	All Contents	13.5	0.1	4.4	5	4.4	8	0.22	6.81 [w]

Table 1 - Content Envelopes C.1 thru C.8, Notes

a	Except as permitted for oxides, all contents shall be dry.
b	Pu/U content bulk density shall be no greater than 19.84 g/cc. No minimum bulk density is specified. However, low bulk densities require dilution of the local atmosphere within the content container by a specific gas (helium or nitrogen) and/or reduction in the allowable decay heat as summarized in SARP Table 3.4.
c	Up to 1 gram of plutonium contamination is permitted.
d	Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches) and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013. A minimum 50-gram mass per metal piece conservatively meets these criteria.
e	Mass limit due to shielding.
f	Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.1. [8]
g	Plutonium plus uranium mass shall not be less than 30 weight percent of the total content mass.
h	Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.2. [8]
i	The moisture content of the oxide shall be less than 0.5 weight percent of the total content mass.
j	Depleted Uranium or Enriched Uranium may be substituted for any amount of plutonium on a gram-for-gram basis.
k	The Be, V, and Ta each form a composite with the radionuclide content and, as such, are not homogeneously mixed with the Pu. A maximum of 50 pieces of composite material is permitted.
l	Material to be prepared in accordance with WSRC-TR-2003-00388[11] which limits the moisture content of the material.
m	Maximum amounts by constituent.
n	^{238}Pu decays to ^{234}U, which will result in significant concentrations of ^{234}U over time. ^{234}U growth will not adversely impact package performance.
o	Nuclide classified as “fissile” per DOE Good Practices Guide, Criticality Safety Good Practices Program, Guide For DOE Nonreactor Nuclear Facilities, DOE G 421.1-1, 3.79 *Fissile Nuclide*, 8-25-99.
p	^{241}Pu must be less than ^{240}Pu.
q	Applies to ^{234}U other than ^{234}U resulting from ^{238}Pu decay.
r	The listed light element impurities have a combined mass limit of 3080 grams minus the mass of Be and C present.
s	The beryllium is assumed to be physically separated from the plutonium oxide. The 200 grams of beryllium can be in any configuration with up to 275 cm^2 in direct contact with plutonium contents. The surface area restriction is based on shielding.
t	Total impurity limit is based on the minimum 30% Pu + U mass within DOE-STD-3013. The limit was calculated from the maximum radioactive material mass (4.4 kg). [4.4 kg × 70% = 3.08 kg]
u	Plutonium mass is assumed bonded to the tantalum (as an outer/inner reflector) and is not readily separable.
v	For analytical purposes there are no mixing assumptions for the Ta with the radionuclide content.
w	Up to 250 ppm sulfur and 3000 ppm silicon impurities permitted.
x	Not to exceed 1000 grams total ^{232}Th.

Table 2 - Content Envelopes C.10 and C.11

		Content Envelopes	
	Material [a, b]	**C.10** [d, e, f, g] **Pu/U Metals grams**	**C.11** [e, g, h, i] **Pu/U Oxides grams**
Radioisotope [m] (the amount of material in the container.)	^{236}Pu [z]		
	^{238}Pu [n]	34	34
	^{239}Pu [o]	4400	4400
	^{240}Pu	1450 [y]	2200
	^{241}Pu [o, p]	188.9	188.9
	^{242}Pu	400 [y]	2200
	$^{241}Am + ^{241}Pu$	188.9	188.9
	^{243}Am	1.00	1.00
	^{244}Cm	0.0044	0.0044
	^{237}Np	220	220
	^{232}U	0.00044	0.00044
	^{233}U [o]	427	427
	^{234}U [q]	4400	4400
	^{235}U [o]	4400	4400
	^{236}U	2640	2640
	^{238}U	4400	4400
	^{232}Th	4400	4400
Impurities (grams)	Al, B, F, Li, Mg, Na	r	r
	Be	500	500
	C	1,000	1,000
Total Mass (kilograms)	Radioactive Materials	4.4	4.4
	Impurities	3.08 [t]	3.08 [t]
	All Contents	4.4	5

Table 2 - Content Envelopes C.10 and C.11, Notes

a	Except as permitted for oxides, all contents shall be dry.
b	Pu/U content bulk density shall be no greater than 19.84 g/cc. No minimum bulk density is specified. However, low bulk densities require dilution of the local atmosphere within the content container by a specific gas (helium or nitrogen) and/or reduction in the allowable decay heat as summarized in SARP Table 3.4.
c	Not applicable.
d	Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches) and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013. A minimum 50-gram mass per metal piece conservatively meets these criteria.
e	Mass limit due to shielding. The heat loading of each mixture needs to be determined. The 188.9 gram limit is given in David Riley, "Proposed New DOE-Model 9975 C.3 and C.4 Content Envelopes", WCID-2009-0002, Revision 0, August 2009.
f	Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.1.
g	Plutonium plus uranium mass shall not be less than 30 weight percent of the total content mass.
h	Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.2.
i	The moisture content of the oxide shall be less than 0.5 weight percent of the total content mass.
j	Not applicable.
k	Not applicable.
l	Not applicable.
m	Maximum amounts by constituent in g (grams mass).
n	^{238}Pu decays to ^{234}U, which will result in significant concentrations of ^{234}U over time. ^{234}U growth will not adversely impact package performance.
o	Nuclide classified as “fissile” per DOE Good Practices Guide, Criticality Safety Good Practices Program, Guide For DOE Nonreactor Nuclear Facilities, DOE G 421.1-1, 3.79 *Fissile Nuclide*, 8-25-99.
p	^{241}Pu must be less than ^{240}Pu.
q	Applies to ^{234}U other than ^{234}U resulting from ^{238}Pu decay.
r	The listed light element impurities have a combined mass limit of 3080 grams minus the mass of Be and C present.
s	Not applicable.
t	Total impurity limit is based on the minimum 30% Pu + U mass within DOE-STD-3013. The limit was calculated from the maximum radioactive material mass (4.4 kg). [4.4 kg × 70% = 3.08 kg]
u	Not applicable.
v	Not applicable.
w	Not applicable.
x	Not applicable.
y	The ^{240}Pu and the ^{242}Pu mass limits may be adjusted per the equation: $^{242}Pu + 0.596\ ^{240}Pu < 1290$, Where ^{240}Pu and ^{242}Pu are the mass limits in grams.
z	^{236}Pu is not expected to be present in significant amounts.

(ii) For the contents described in 5(b)(1)(i) [Content Envelope C.1]:

(a) Up to 1 gram of plutonium contamination is permitted.

(b) Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches) and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013.

(iii) For the contents described in 5(b)(1)(iii) [Content Envelopes C.3 or C.10]:

(a) Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches) and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013.

(b) Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.1.

(c) Plutonium plus uranium mass may not be less than 30 weight percent of the total content mass.

(iv) For the contents described in 5(b)(1)(iv) [Content Envelopes C.4 or C.11]:

(a) Plutonium plus uranium mass may not be less than 30 weight percent of the total content mass.

(b) Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.2.

(c) The moisture content of the oxide shall be less than 0.5 weight percent of the total content mass.

(d) The PCV sleeve for food-pack can configurations is not required when the outer food-pack can diameter exceeds 4.38 inches and the PCV shall be inerted with nitrogen so that at the time of closure the oxygen content is all void spaces is no greater than 5% by volume.

(v) For the contents described in 5(b)(1)(v) [Content Envelope C.5]:

(a) Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches), and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013.

(b) Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.1.

(c) Plutonium plus uranium mass may not be less than 30 weight percent of the total content mass.

(d) Depleted uranium, or enriched uranium, may be substituted for any amount of plutonium, on a gram-for-gram basis.

(vi) For the contents described in 5(b)(1)(vi) [Content Envelope C.6]:

(a) Each metal piece shall have a minimum thickness of 1.0 mm (0.04 inches) and a specific surface area less than 100 mm^2/gram (71 in^2/lb) per DOE-STD-3013.

(b) Contents shall be stabilized in accordance with DOE-STD-3013, Section 6.1.1.

(c) A maximum of 50 pieces of composite material is permitted.

(vii) For the contents described in 5(b)(1)(vii) [Content Envelope C.7]:

(a) The 200 grams of beryllium can be in any configuration with up to 275 cm^2 in direct contact with plutonium contents.

(viii) For the contents described in 5(b)(1)(viii) [Content Envelope C.8]:

(a) Material shall be prepared in accordance with WSRC-TR-2003-00388, which limits the moisture content of the material.

(b) Up to 250 ppm sulfur and 3000 ppm silicon impurities are permitted.

(c) Minimum Transport Index for Criticality Control (Criticality Safety Index): 2.0

(d) Conditions:

(1) Content envelope loading arrangements/configurations shall comply with the applicable requirements of Sections 1.2.3.1 and 1.2.3.2 of the SARP.

(2) Food-pack cans with organic liners may not be used for any contents.

(3) All food-pack, 3013, or hex cans, must be examined for post-sealing bulging or buckling prior to placement inside the PCV. No can that has visibly bulged or buckled may be transported in the package.

(4) Inspect radioactive material outer product containers, i.e., food-pack, 3013, or hex cans, upon removal from the PCV after shipment. Any visible bulging, buckling, or evidence of corrosion on the exterior shall be reported to the Design Agency (DA). The DA shall report to the DOE Headquarters Certifying Official any condition the DA deems significant to safety.

(5) The gross weight of the package may not exceed 183 kg (404 lbs).

(6) For the contents described in 5(b)(1)(v), any package that is subjected to an impact greater than that of a four-foot drop shall be surveyed for neutron dose rate prior to contact or handling.

(7) In addition to the requirements of Subparts G and H of 10 CFR Part 71, and except as specified in section 5(d) of this certificate, each package must be fabricated, acceptance tested, operated, and maintained in accordance with the Operating Procedures requirements of Chapter 7, Acceptance Tests and Maintenance Program requirements of Chapter 8, and packaging-specific Quality Assurance requirements of Chapter 9 of the SARP as supplemented [See 5(e)].

(8) Transport by air of fissile material is not authorized.

(9) If the option is chosen to attach a DOE MK-II RFID tag to the 9975 packaging, the operating procedures must follow the additional steps per Chapter 7 in Addendum [See 5(e)(4)], and the guide to RFID monitoring system [See 5(e)(5)]. The RFID guide contains a copy of the Material/Product Safety Data Sheet for the batteries used in the DOE MK-II RFID tag, which provides guidance on the safe use of the batteries.

(10) Add the following to the Packaging Loading Preparations requirements, when the Celotex top subassembly is fitted in the drum, verify the axial distance between the top of the air shield and drum flange does not exceed 1 inch.

(11) Verification of the pre-shipment containment integrity of the containment system, on both the O-ring seal and the Leak Test Port Plug, shall be accomplished using either the pressure rise method or the pressure drop method of testing as specified in ANSI N14.5-1997.

(e) References

(1) Safety Analysis Report for Packaging Model 9975, B(M)F-96 S-SARP-G-00003, Revision 0, January 2008.

(2) Memorandum of June 2, 2009 from Jeffrey M. Allison to Dae Chung, “Clarification Wording for the 9975 Certificate of Compliance (CoC) for Corrosion Inside of a 3013 Container.”

(3) Justification for 9975 Gram Based Content Envelopes, C.10 and C.11Safety Analysis Report for Packaging Model 9975, Addendum, S-SARA-G-00007, Revision 1, August 2009.

(4) Justification for Use of the Radio Frequency Identification (RFID) System, Safety Analysis Report for Packaging Model 9975, Addendum, S-SAR-G-00008, Revision 0, November 2009.

(5) Guide to the RFID Monitoring System (Models 9975, 9977, and 9978 Packages), Argonne National Laboratory, ANL/DIS-09-5, December 3, 2009.

(6) Letter Amendment Request for the 9975-85, 9975-96, 9977, and 9978, COR-OM-11/15/2010-301010, submitted to Dr. Jim Shuler, Environmental Management, by the National Nuclear Security Administration (NNSA), Livermore Site Office (November 17, 2010).

(7) Justification for shipment of Plutonium Oxide in Large Vented Food-Pack Cans, Safety Analysis Report for Packaging Model 9975, Addendum, S-SARA-G-00013, Revision 1, May 2011.