Department of Energy
Washington, DC 20585

MAR 11 2008

Attn: Document Control Desk
Director, Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

This is in response to the request for a markup draft of Revision 8 to Certificate of Compliance No. 9315, for the Model ES-3100 Package, Docket No. 71-9315, USA/9315/B(U)F-96. In a letter dated October 11, 2007, the Department of Energy reiterated remaining items to be reviewed under the current amendment in process at the Nuclear Regulatory Commission (NRC). In that letter, the following items were identified:

- Revised criticality safety calculations and fissile loadings for all the authorized contents of the ES-3100,
- Revised Criticality Safety Index (CSI) for the ES-3100,
- Revised quantity of off-gassing material that can be transported as packing material within the ES-3100 containment vessel, including a Teflon bottle as a convenience container for the uranyl nitrate crystal,
- Revised concentration of carbon in uranium oxide shipped in the ES-3100,
- Revised concentration of the neptunium-237 in uranium shipped in the ES-3100,
- Specification of uranium alloyed with aluminum and molybdenum as contents of the ES-3100,
- Revision of the manufacturing specification for the neutron absorber material (277-4).

In a letter dated January 30, 2008, the NRC issued Revision 7 of the ES3100 CoC that approved the last bullet on the above list. The other six items remain to be completed. The attached CoC markup shows the required changes to the CoC corresponding to these six items.

The original of this letter, with attachment is being sent to the Document Control Desk. In addition, one copy of this letter with attachment is being delivered to Kimberly J. Hardin, Project Manager, Licensing Branch, Division of Spent Fuel Storage and Transportation, Office of Nuclear Material Safety and Safeguards.

Printed with soy ink on recycled paper

NMSS01

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

Sincerely,

James Shuler
Manager, Packaging Certification Program
Office of Packaging and Transportation
Office of Environmental Management

Enclosure

cc:
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NRC FORM 618
(9-2000)
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
9315	~~7~~ 8	71-9315	USA/9315/B(U)F-96	1	OF	7

2. PREAMBLE

a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

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

a. ISSUED TO *(Name and Address)*
U.S. Department of Energy
Washington, DC 20585

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
BWXT Y-12, L.L.C., application dated February 25, 2005, as supplemented

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.: ES-3100

(2) Description

The ES-3100 package is a cylindrical container that is approximately 110 cm (43 in) in overall height and 49 cm (19 in) in overall diameter and is composed of an outer drum assembly and an inner containment vessel. The containment vessel is placed inside the drum and surrounded by a cement based borated neutron absorber, Catalog 277-4. The purpose of the ES-3100 is to transport bulk high enriched uranium in oxide form, uranium metal and alloy, and uranyl nitrate crystals.

The outer drum assembly consists of a reinforced stainless steel, standard mil spec 30-gal drum with an increased length. The volume formed between the drum and the attached inner liner is filled with an inorganic, castable refractory material, Kaolite 1600™, which is comprised of concrete and vermiculite. The Kaolite 1600™ acts as both a thermal insulating and an impact limiting material.

The containment vessel is approximately 82 cm (32 in) in overall height and 13 cm (5 in) in overall diameter and is constructed of 304L stainless steel. The containment boundary consists of the 0.1 in thick containment vessel body and the lid assembly. The lid assembly consists of a sealing lid, a closure nut, and external retaining ring, which holds both the assembly and closure nut together. The double ethylene-propylene elastomer O-rings in the top flange of the containment vessel permit leak testing of the containment vessel. The maximum gross weight of the package, including contents, is 190.5 kg (420 lb).

5.(a) Packaging (continued)

(3) Drawings

The Model No. ES-3100 package is constructed and assembled in accordance with:

(i) BWXT Y-12, L.L.C., Drawing No. M2E801580A037, Sheets 1 through 6, Rev. B, "Consolidated Assembly Drawing."

(ii) BWXT Y-12, L.L.C., Drawing No. M2E801580A026, Rev. C, "Heavy Can Spacer Assembly."

(iii) Equipment Specification JS-YMN3-801580-A001, Rev. E, "ES-3100 Containment Vessel."

(iv) Equipment Specification JS-YMN3-801580-A002, Rev. D, "ES-3100 Drum Assembly."

(v) Equipment Specification JS-YMN3-801580-A003, Rev. C, "Manufacturing Process Specification for Casting Kaolite 1600™ Into the ES-3100 Shipping Package."

(vi) Equipment Specification JS-YMN3-801580-A005, Rev. F, "Casting Catalog No. 272-4 Neutron Absorber for the ES-3100 Shipping Package."

5.(b) Contents (Type and form of material, maximum quantity of material per package, and Criticality Safety Index (CSI))

The weight of the radioactive contents, convenience containers, can lift attachments, polyethylene bags, spacers, and other material in the containment vessel shall not exceed 90 lb. The maximum mass of hydrogenous packaging materials in the containment vessel (e.g., polyethylene containers or bagging, silicone rubber pads, etc.) shall ~~not exceed 500 grams~~. The maximum content decay heat load shall not exceed 0.4 watts.

Teflon containers,

be based on the convenience container used (metal-500g; polyethylene-845g; Teflon-1490g). If metal cans are used with a diameter greater than 4.25 in, no hydrogenous packing material is allowed.

5.(b) Contents (continued)

The concentration limits of uranium and transuranic constituents shall be the following:

Isotope	Maximum Concentration
U-232	0.040 μg/gU[a]
U-233	0.006 g/gU[b]
U-234	0.02 g/gU
U-235	1.00 g/gU
U-236	0.40 g/gU
Transuranics (except Np)	40.0 μg/gU[a]
Np-237	0.025 ~~0.035~~ g/gU

[a] μg/gU = 10^{-6} grams per gram of total uranium
[b] g/gU = grams per gram of total uranium

(1) Uranium as solid metal or alloy, packaged in stainless steel or tin-plated carbon steel convenience cans.

The maximum uranium enrichment is 100 weight percent U-235.

For contents that must be shipped with spacers, the spacers must be in accordance with BWXT Y-12, L.L.C., Drawing No. M2E-801580A026 and Equipment Specification JS-YMN3-801580-A005, as specified in Condition No. 5.(a)(3). The quantity of fissile material in any convenience can shall not exceed one-third of the mass loading limit per package for that content. Spacers must be positioned between every two convenience cans.

(i) For metal and alloy in the form of solid geometric shapes, meeting the following restrictions, mass limits are listed in Table 1. Contents not meeting the following restrictions must be shipped as broken metal (see Condition No. 5.(b)(1)(ii)).

~~(A) Spheres having a diameter no larger than 3.24 in (maximum of two spheres per convenience can)~~

A (B) Cylinders having a diameter no larger than ~~3.24~~ 4.25 in (maximum of one cylinder per convenience can)

B (C) Square bars having a cross section no larger than 2.29 in × 2.29 in (maximum of one bar per convenience can)

C (D) Slugs having dimensions of 1.5 in diameter × 2 in tall (maximum of 10 slugs per convenience can)

5.(b)(1) Contents (continued)

Table 1: Loading Limits for Metal and Alloy in Solid Geometric Shapes

Solid uranium metal or alloy (specified geometric shapes)	Uranium Enrichment (weight percent U-235)	CSI	With Spacers Maximum Mass U-235 (kg)		No Spacers Maximum Mass U-235 Per Package (kg)
			Per Convenience Can	Per Package	
(A) Cylinders ~~Spheres~~	≤ 100	0.0	~~0.000~~ 8.333	~~0.0~~ 25.000	~~0.0~~ 15.000
(B) Cylinders	≤ 100	0.0	~~6.000~~ 10.000	~~18.000~~ 30.000	~~12.000~~ 18.000
Sq. Bars	≤ 100	0.0	10.000	30.000	18.000
Slugs	> 80	0.0	~~5.447~~ 8.534	~~16.342~~ 25.601	18.286 ~~Spacer req'd~~
Slugs	≤ 80	0.0	~~8.735~~ 9.778	~~26.243~~ 29.333	18.286 ~~Spacer req'd~~
Slugs	> 95 ≤ 95	0.4	11.589	34.766	Spacer req'd

(ii) For metal and alloy defined as broken metal, mass limits are specified in Table 2. Uranium metal and alloy pieces must have a surface-area-to-mass ratio of not greater than 1.00 cm²/g or must not pass freely through a 3/8 inch (0.0095m) mesh sieve. Particles and small shapes that do not pass this size restriction, as well as powders, foils, turnings, and wires, are not permitted unless they are in a sealed container under an inert cover gas. Uranium material or alloy which has been stored in or come in contact with water is not authorized to be shipped in this package.

Table 2: Loading Limits for Solid Metal or Alloy in the Form Defined as Broken Metal

Uranium Enrichment (weight percent U-235)	CSI	With Spacers Maximum Mass U-235 (kg)*		No Spacers Maximum Mass U-235 Per Package (kg)*
		Per Convenience Can	Per Package	
> 95 and ≤ 100	0.0	0.925	2.774	Spacer req'd
	0.4	1.8~~19~~ 50	5.54~~8~~ 9	Spacer req'd
	0.8	~~2.774~~ 3.083	~~8.323~~ 9.249	Spacer req'd
	2.0	~~3.699~~ 4.624	~~11.097~~ 13.872	Spacer req'd
	3.2	8.323	24.969	Spacer req'd

5.(b)(1) Contents (continued)

Table 2: Loading Limits for Solid Metal or Alloy in the Form Defined as Broken Metal (Continued)

Uranium Enrichment (weight percent U-235)	CSI	With Spacers Maximum Mass U-235 (kg)[a]		No Spacers Maximum Mass U-235 Per Package (kg)[a] Spacer req'd
		Per Convenience Can	Per Package	
> 90 and ≤ 95	0.0	~~0.879~~ 1.172	~~2.637~~ 3.516	Spacer req'd
	0.4	~~1.758~~ 2.051	~~5.274~~ 6.154	Spacer req'd
	0.8	~~3.516~~	10.549	Spacer req'd
	2.0	~~5.588~~ 6.154	~~16.763~~ 18.461	Spacer req'd
> 80 and ≤ 90	0.0	~~0.833~~ 1.111	~~2.500~~ 3.333	Spacer req'd
	0.4	2.500	7.500	Spacer req'd
	0.8	~~3.333~~ 4.167	~~10.000~~ 12.500	Spacer req'd
	2.0	~~6.278~~ 6.667	~~15.834~~ 20.000	Spacer req'd
> 70 and ≤ 80	0.0	~~0.742~~ 1.483	~~2.225~~ 4.450	~~Spacer req'd~~ 2.967
	0.4	2.967	8.900	~~Spacer req'd~~ 5.192
	0.8	~~4.000~~ 5.439	~~0.0~~ 16.317	~~Spacer req'd~~ 8.900
	2.0	~~7.911~~ 8.406	~~23.734~~ 25.218	~~Spacer req'd~~ 17.059
> 60 and ≤ 70	0.0	~~0.866~~ 1.733	~~0.0~~ 5.198	~~1.949~~ 3.249
	0.4	~~4.115~~ 4.332	~~12.346~~ 12.996	~~0.0~~ 5.848
	0.8	6.931	20.793	~~16.245~~ 13.646
	2.0	8.231	24.692	~~24.692~~ 21.444
≤ 60	0.0	3.718 kgU	11.157 kgU	5.576 kgU
	0.4	~~0.0~~ 9.684 kgU	~~0.0~~ 28.813 kgU	~~0.0~~ 14.872 kgU
	0.8	11.773 kgU	35.320 kgU	~~0.0~~ 28.814 kgU
	2.0	11.773 kgU	35.320 kgU	35.320 kgU

[a] All limits are expressed in kg U-235 unless specified as kgU, which means kilograms of total uranium.

5.(b) Contents (continued)

(2) Uranium as oxide, which may include UO_2, UO_3, and U_3O_8, packaged in stainless-steel, tin-plated carbon steel, or nickel-alloy convenience cans, or polyethylene bottles or Teflon bottles. The physical form of all contents is dense, loose powder which may contain clumps and pellets. Moisture content in oxide is limited to 8 weight percent water. Carbide compounds are not authorized. The mass limit shall be 24.0 kg of oxide, with a maximum mass of 21.124 kg U-235, with a CSI of 0.0. The maximum uranium enrichment is 100 weight percent U-235. No spacers are required in the containment vessel. H

(3) Solid uranyl nitrate in the form of uranyl nitrate crystals, $[UO_2(NO_3)_2 \cdot xH_2O$, where x is ≤ 6]. Uranyl nitrate crystals must be contained in a non-metallic convenience container (such as polyethylene or Teflon bottles). The mass limit shall be [illegible] kg of uranyl nitrate crystals, with a maximum mass of ~~[illegible]~~ 24.0 kg U-235, with a CSI of 0.~~[illegible]~~ 0. The maximum uranium enrichment is 100 weight percent U-235. No spacers are required in the containment vessel. I

(4) Unirradiated TRIGA fuel elements and pellets (sections). The fuel is composed of uranium zirconium hydride (UZrH). The uranium concentration in the fuel is a nominal 8.5 weight percent, and the maximum H to Zr ratio in the fuel is 2.0. The maximum uranium enrichment is 70 weight percent U-235. The fuel sections may be from any of three types of fuel elements: standard fuel elements, instrumented standard fuel elements, and fuel follower control rods. The U-235 mass for standard and instrumented fuel elements is a nominal 136 grams per element, and the U-235 mass for fuel follower control rods is a nominal 112 grams per element. Each fuel element contains three fuel sections, either stainless steel or aluminum clad or unclad. The fuel elements are approximately 15 inches in length, with sections approximately 5 inches in length. The approximate diameter of the fuel is 1.44 inches for the standard and instrumented fuel elements, and 1.31 inches for the fuel follower control rods. The fuel elements and sections are packaged within stainless steel or tin-plated carbon steel convenience cans. Disassembled fuel elements are to be packaged with a maximum of three fuel sections or three fuel elements, per convenience can. Fuel sections from different fuel elements may not be mixed within a single convenience can. A maximum of three convenience cans with disassembled fuel elements may be loaded into a single package. Three stainless steel or aluminum clad elements with crimped ends are to be packaged in a single convenience can with a maximum of one can per package. No spacers are required. The maximum quantity of fissile material per package is 408 grams U-235. The CSI is 0.0.

6. The vent holes on the outer steel drum shall be capped closed during transport and storage to preclude entry of rain water into the insulation cavity of the drum.

7. Content forms may not be mixed in a single ES-3100 containment vessel.

8. Any combination of convenience can sizes is allowed in a single package, as long as the total height of the can stack (including silicone rubber pads and spacers, if required) does not exceed the inside working height of the containment vessel (31 in). Any closure on the convenience can is allowed.

9. Empty convenience cans, spacers, silicone rubber pads, and/or stainless-steel scrubbers (i.e., stainless steel trimmings that act as dunnage) may be used to fill the void space in the containment vessel. Empty convenience cans must have a minimum 0.125 in diameter hole through the lid.

10. The contents and the convenience cans may be bagged or wrapped in polyethylene for contamination control provided the limits of Condition No. 5.(b) are met.

11. Transport by air is not authorized, except for shipment of unirradiated TRIGA fuel pellets, as described and limited in Condition No. 5(b)(4).

12. 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 Package Operations in Section 7 of the application, as supplemented.

    (b) Each package must meet the Acceptance Tests and Maintenance Program of Section 8 of the application, as supplemented.

13. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

14. Revision 6 of this certificate may be used until January 31, 2009.

15. Expiration date: April 30, 2011.

REFERENCES

BWXT Y-12, L.L.C., application dated February 25, 2005, as supplemented.

BWXT Y-12, L.L.C., supplements dated April 27, May 26, August 15, 2005, and January 9, February 6, March 20, May 8, June 6, July 18, August 21 and 24, and October 26, 2006, and January 19, January 31, February 22, April 11, April 26, May 30, June 27 (2 supplements on this date), August 8, 28, 30, October 11, and November 5, 2007.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Robert A. Nelson, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: January 30, 2008

MARK-UP INSERTS FOR USA/9315/B(U)F-96 CoC REVISION 8

A

(3.24 in < diameter ≤ 4.25 in)

B

(diameter ≤ 3.24 in)

C

>90 and ≤ 95	3.2	8.791	26.373	Spacer req'd

D

>80 and ≤ 90	3.2	9.445	28.334	Spacer req'd

E

>70 and ≤ 80	3.2	9.395	28.184	27.692

F

>60 and ≤ 70	3.2	8.231	24.692	24.692

G

≤ 60	3.2	11.773 kgU	35.320 kgU	35.320 kgU

H

For oxides with measureable carbon (such as skull oxides), the mass limit shall be 17.8 kg of oxide and 921 g carbon, with a maximum mass of 15.675 kg U-235, with a CSI of 0.0.

I

Also, a mass limit of 8.0 kg of uranyl nitrate crystals is allowed, with a maximum mass of 3.768 kg U-235 and a CSI of 0.0.