# CERTIFICATE OF COMPLIANCE
## FOR RADIOACTIVE MATERIAL PACKAGES

| 1. a. CERTIFICATE NUMBER | b. REVISION NUMBER | c. DOCKET NUMBER | d. PACKAGE IDENTIFICATION NUMBER | PAGE | | PAGES |
|---|---|---|---|---|---|---|
| 9315 | 0 | 71-9315 | USA/9315/B(U)F-96 | 1 | OF | 6 |

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. A, "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. B, "Manufacturing Process Specification for Casting Kaolite 1600™ into the ES-3100 Shipping Package."

(vi) Equipment Specification JS-YMN3-801580-A005, Rev. C, "Casting Catalog No. 277-4 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 cans, 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.

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 |
| Np-237 | 0.003 g/gU |

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

5.(b) Contents (continued)

(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. M2E801580A026 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)

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

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

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

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 | |
| Spheres | # 100 | 0.0 | 10.979 | 32.938 | 16.946 |
| Cylinders | # 100 | 0.0 | 6.000 | 18.000 | 12.000 |
| Sq. Bars | # 100 | 0.0 | 10.000 | 30.000 | 18.000 |
| Slugs | > 80 | 0.0 | 5.447 | 16.342 | Spacer req'd |
| Slugs | # 80 | 0.0 | 8.738 | 26.213 | Spacer req'd |

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

(ii) For metal or 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 $cm^2/g$ or must have a mass not less than 50 g, whichever is most restrictive. Powders, foils, turnings, wires, and incidental small particles are not permitted, unless they are restricted to not more than 1 percent by weight of the content per convenience can, and they are either in a sealed, inerted container or are stabilized to an oxide prior to shipment.

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)[a] | | No Spacers Maximum Mass U-235 Per Package (kg)[a] |
|---|---|---|---|---|
| | | Per Convenience Can | Per Package | |
| > 95 and # 100 | 0.0 | 0.925 | 2.774 | Spacer req'd |
| | 0.4 | 1.849 | 5.548 | Spacer req'd |
| | 0.8 | 2.774 | 8.323 | Spacer req'd |
| | 2.0 | 3.699 | 11.097 | Spacer req'd |
| > 90 and # 95 | 0.0 | 0.879 | 2.637 | Spacer req'd |
| | 0.4 | 1.758 | 5.274 | Spacer req'd |
| | 0.8 | 3.516 | 10.549 | Spacer req'd |
| | 2.0 | 5.568 | 16.703 | Spacer req'd |
| > 80 and # 90 | 0.0 | 0.833 | 2.500 | Spacer req'd |
| | 0.4 | 2.500 | 7.500 | Spacer req'd |
| | 0.8 | 3.333 | 10.000 | Spacer req'd |
| | 2.0 | 5.278 | 15.834 | Spacer req'd |
| > 70 and # 80 | 0.0 | 0.742 | 2.225 | 2.225 |
| | 0.4 | 2.967 | 8.900 | 4.450 |
| | 0.8 | 6.181 | 18.542 | 14.092 |
| | 2.0 | 7.911 | 23.734 | 18.542 |

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] |
|---|---|---|---|---|
| | | Per Convenience Can | Per Package | |
| > 60 and # 70 | 0.0 | 1.949 | 5.848 | 1.949 |
| | 0.4 | 4.115 | 12.346 | 7.797 |
| | 0.8 | 6.931 | 20.793 | 16.245 |
| | 2.0 | 8.231 | 24.692 | 24.692 |
| # 60 | 0.0 | 3.718 kgU | 11.153 kgU | 5.576 kgU |
| | 0.4 | 9.914 kgU | 29.743 kgU | 17.660 kgU |
| | 0.8 | 11.773 kgU | 35.320 kgU | 35.320 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.

(2) Uranium as oxide, which may include $UO_2$, $UO_3$, and $U_3O_8$, packaged in stainless-steel or tin-plated carbon steel convenience cans. The physical form of all contents is dense, loose powder which may contain clumps and pellets. Moisture content in oxide is limited to 3 weight percent water. 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. No spacers are required in the containment vessel.

(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 Teflon or polyethylene bottle). The mass limit shall be 24.0 kg of uranyl nitrate crystals, with a maximum mass of 11.303 kg U-235, with a CSI of 0.0. No spacers are required in the containment vessel.

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.

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. 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, and March 20, 2006.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

**/RA/**

Robert A. Nelson, Chief
Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Date: April 7, 2006